Appendix A

OEHI Environmental Documents

Appendix A-1

OEHI CO2 Enhanced Oil Recovery Project Supplemental Environmental Information

Supplemental Environmental Information

Occidental of Elk Hills, Inc.
CO_2 Enhanced Oil Recovery Project

Prepared For:

Occidental of Elk Hills, Inc.

Prepared By:

Stantec Consulting Corporation

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APPENDIX A AIR EMISSIONS DATA
APPENDIX B NOISE MODELS

ACRONYM LIST

Acronym	Definition
^{0}C	Degrees Celsius
^{0}F	Degrees Fahrenheit
A	Exclusive Agriculture
A-1	Limited Agriculture
AADT	Annual Average Daily Traffic
AB	Assembly Bill
ACEC	Area of Critical Environmental Concern
ALUCP	Airport Land Use Compatibility Plan
API	American Petroleum Institute
APCO	Air Pollution Control Officer
ARB	Air Resources Board
ARPA	Archaeological Resources Protection Act
ASCE	American Society of Civil Engineers
BA	biological assessment
BACT	Best Available Control Technology
BARCT	Best available retrofit control technology
BAU	Business-as-usual
BHP	Brake horsepower
BLM	Bureau of Land Management
BMP	Best management practice
BNLL	Blunt-nosed leopard lizard
BO	Biological Opinion
BPS	Best Performance Standards
Btu	British thermal units
bwpd	Barrels of water per day
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAL FIRE	California Department of Forestry and Fire Protection
Cal/OSHA	California Occupation Safety and Health Administration
CalARP	California Accidental Release Prevention Program
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CAT	Climate Act Team
CBC	California Building Code

ACRONYM LIST

Acronym	Definition
CCAP	Climate Change Action Plan
CCAR	California Climate Action Registry
CCR	California Code of Regulations
CCS	Carbon Capture Storage
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFCs	Chlorofluorocarbons
CFR	Code of Federal Regulations
CH4	Methane
CHL	California Historical Landmark
CHP	California Highway Patrol
CHRIS	California Historic Resources Information System
CLEP	Coles Levee Ecological Preserve
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNLM	Center for Natural Lands Management
CNPS	California Native Plant Society
CO	Carbon monoxide
CO2	Carbon dioxide
COG	Council of Governments
COOP	Cooperative Observers Program
CRHR	California Register of Historical Resources
CRP	CO2 Recovery Plant
CSA	County Service Area
CSUB	California State University, Bakersfield
CTB	Central Tank Battery
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted decibel
DI	Drilling Island
DMA	Disaster Mitigation Act

ACRONYM LIST

Acronym	Definition
DME	Dimethyl ether
DOD	Department of Defense
DOE	Department of Energy
DOF	Department of Finance
DOGGR	State Department of Conservation, Division of Oil, Gas, and Geothermal Resources
DOSH	California Division of Occupational Safety and Health
DTSC	Department of Toxic Substances Control
EAFB	Edwards Air Force Base
EHOF	Elk Hills Oil Field
EIR	Environmental Impact Report
EMS	Emergency Medical Services Department
EOA	Exclusive operating area
EOR	Enhanced Oil Recovery
EPA	U.S. Environmental Protection Agency
ERC	Emission reduction credit
EIS	Environmental impact statement
Federal EPA	Federal Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FIRMs	FEMA Insurance Rate Maps
FMMP	Farmland Mapping and Monitoring Program
GCR	General Conformity Rule
GHG	Greenhouse gas
H2S	Hydrogen Sulfide
HAPs	hazardous air pollutants
HAZID	Hazards Identification
HCD	Housing and Community Development Department
HCP	Habitat Conservation Plan
HDD	Heavy-Duty Diesel Truck
HECA	Hydrogen Energy of California
HMGP	Hazard Mitigation Grant Programs
HMPC	Hazard Mitigation Planning Committee
HCS	Hazard Communication Standard
HSGs	Hydrological Soil Groups
HWCL	Hazardous Waste Control Law

ACRONYM LIST

Acronym	Definition
Hz	Hertz
IBC	International Building Code
IDLH	Immediately Dangerous to Life or Health
IGCC	Integrated Gasification Combined Cycle
IPCC	Intergovernmental Panel on Climate Change
IRAA	Indoor Radon Abatement Act
K-12	Kindergarten through 12th grade
KCAPCD	Kern County Air Pollution Control District
KCEHSD	Kern County Environmental Health Services Department
KCFD	Kern County Fire Department
KCWA	Kern County Water Agency
KCWMD	Kern County Waste Management Department
KOP	Key Observation Point
lbs/day	pounds per day
LCA	California Land Conservation Act
LDA	Light duty autos
LDAR	Leak detection and repair
Ldn	Day-night sound level
Leq	Equivalent sound level
LORS	Laws, ordinances regulations, and standards
LOS	Level of service
MBTA	Migratory Bird Treaty Act
MCE	Maximum Credible Earthquake
MD	Millidarcy
MDAB	Mojave Desert Air Basin
MDB&M	Mount Diablo Base and Meridian
mmscfd	Million standard cubic feet per day
mph	Miles per hour
MRZ	Mineral Resource Zones
MSDS	Material Safety Data Sheets
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NASA	National Aeronautics and Space Administration
NAWS	Naval Air Weapons Station
N2O	Nitrous oxide
NEPA	National Environmental Policy Act

ACRONYM LIST

Acronym	Definition
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NO2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NORM	Natural occurring radioactive material
NOX	Nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPR-1	Naval Petroleum Reserve 1
NPR-2	Naval Petroleum Reserve 2
NR	Natural Resource
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NSR	New Source Review
O3	Ozone
OADP	Ozone Attainment Demonstration Plan
OEHI	Occidental of Elk Hills, Inc.
OES	Office of Emergency Services
OPEC	Organization of Petroleum Exporting Countries
OPR	Office of Planning and Research
OPS	Office of Pipeline Safety
OSHA	Occupational Safety and Health Administration
pCi/L	Picocurie per liter
PDM	Pre-Disaster Mitigation
PE	Petroleum Extraction
PEL	Permissible Exposure Limit
PG&E	Pacific Gas & Electric Company
PHMSA	Pipeline and Hazardous Material Safety Administration
PM10	Particulate matter with a diameter of 10 microns or less
PM2.5	Particulate matter with a diameter of 2.5 microns or less
ppm	Parts per million
PSD	Prevention of Significant Deterioration
PUC	California Public Utilities Commission
PVC	Polyvinyl Chloride
RCF	Reinjection Compression Facility

ACRONYM LIST

Acronym	Definition
RCRA	Resource Conservation and Recovery Act
ROGs	Reactive organic gases
ROW	Right of way
RWQCB	Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SEI	Supplemental Environmental Information
SH	Shale
SHPO	State Historic Preservation Officer
Si	Silica
SIP	State Implementation Plan
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SMARA	Surface Mining and Reclamation Act
SMGB	California State Mining and Geology Board
SNR	State Natural Reserve
SO2	sulfur dioxide
SOX	Sulfur oxides
SOZ	Shallow Oil Zone
SR	State Route
SRA	State Responsibility Area
SSC	Species of Special Concern
STEL	Short Term Exposure Limit
SVL	Snout to vent length
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminants
TQ	Toxic Quantity
TS	Total facility score
TWA	Time weighted average
TWSC	Two-way stop controlled intersection
U.S. DOT	U.S. Department of Transportation
UBC	Uniform Building Code
UIC	Underground Injection Control
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	Unusually Sensitive Area
USACE	U.S. Army Corps of Engineers

ACRONYM LIST

Acronym	Definition
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Services
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV-B	Ultraviolet-type B
VMT	Vehicle miles traveled
VOCs	Volatile organic compounds
WAG	Water alternating gas
WEGs	Wind Erodibility Groups
WKWD	West Kern Water District
WMO	World Meteorological Organization
WUI	Wildland-urban interface

1.0 EXECUTIVE SUMMARY

1.0 Executive Summary

1.1 Introduction

This Executive Summary identifies the purpose of the Supplemental Environmental Information (SEI), provides an overview of the proposed Project and alternatives, and summarizes the potential impacts and mitigation measures associated with the proposed Project.

1.2 Project Summary

Occidental of Elk Hills, Inc. (OEHI) is proposing to extend the life of the Enhanced Oil Recovery (EOR) operations by utilizing carbon dioxide (CO2) to facilitate oil production from its Elk Hills Unit operations. This is known as the OEHI CO2 EOR Project. The carbon dioxide used by OEHI will be sourced from proposed Hydrogen Energy California (HECA) project. The HECA Project will be located approximately four miles north of the Elk Hills Unit and will generate CO2 from an Integrated Gasification Combined Cycle (IGCC) power plant. The alignment of the CO2 supply line used to convey CO2 from the HECA facility to OEHI that is shown in figures included in this SEI has been modified. Potential environmental consequences of the modified CO2 supply line are addressed within a Data Gap Analysis prepared by Stantec (Stantec, 2011).

According to the HECA Project siting application, the HECA project will utilize technology capable of capturing over 90 percent of the CO2 produced during HECA facility operations. This CO2 will be compressed and delivered via pipeline to OEHI's EOR Processing Facility. The OEHI CO2 EOR Project is expected to receive an annual average rate of 107 million standard cubic feet per day (mmscfd) of CO2 (approximately 2 million tonnes per year). The planned injection process will be reviewed as a part of the OEHI permitting process with Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR). During all phases of this project, OEHI will comply with Underground Injection Control (UIC) Class II regulations enforced by DOGGR.

Use of high volume CO2 injection for EOR, in volumes similar to that anticipated for the OEHI CO2 EOR Project was successfully used in Texas in the early 1970s and has been proven to increase oil production and extend the life of mature oil fields. CO2 injection in the targeted zones of the Stevens Reservoirs at Elk Hills is expected to significantly increase recoverable oil reserves and extend the productive life of the Elk Hills Unit. The CO2 EOR process involves the injection of CO2 to enable trapped oil to flow more readily through the reservoir, thereby improving recovery. During the EOR process, injected CO2 becomes trapped in the reservoir.

As with oil and gas, CO2 has been naturally trapped in geologic formations for millions of years. The injection of CO2 into such formations has been safely practiced on an industrial scale for decades, mostly in conjunction with hydrocarbon production. Further, the U.S. Environmental Protection Agency (U.S. EPA) has recognized that oil and gas reservoirs will play a valuable role in the geologic

1.0 EXECUTIVE SUMMARY

trapping of CO2 from industrial processes such as energy production. Two of the reasons cited by U.S. EPA are: (1) oil and gas reservoirs are natural storage containers that have trapped fluid (both liquid and gaseous) for millions of years; and (2) oil and gas exploration and production activities have created a wealth of knowledge and geologic data that can support the site characterization process for geologic trapping. (See U.S. EPA's Proposed Rule: Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells, 73 Fed. Reg. 43492 541, July 25, 2008). In addition, a Department of Energy (DOE) report (DOE NETL, 2008) states that oil and gas reservoirs can be ideal candidates for trapping CO2 since oil and gas reservoirs have proven capable of storing fluids and gases for millions of years, and replacing the extracted oil and hydrocarbon gas with CO2 is an excellent use of such natural reservoirs.

In 2005, the Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), released a report entitled "Carbon Dioxide Capture and Sequestration" (the "IPCC Report"). The IPCC is charged with providing relevant advice to policymakers on all aspects of climate change. The IPCC Report was written by 125 contributing authors, and was extensively reviewed by over 200 others, including technical experts and government representatives from around the world. The IPCC Report carefully weighs the technologies and the potential risk of carbon capture and sequestration (CCS) and concludes that, with appropriately selected and managed sites, CO2 may be sequestered by injection into suitable geologic formations including oil and gas reservoirs. The IPCC Report notes that early commercial scale CCS projects will probably employ CO2 sequestration with EOR as their basis of design, which will extensively inform the technical development and safe deployment of CCS projects in other types of geologic formations.[1] The OEHI CO2 EOR Project uses, as its name suggests, CO2 for EOR. An inevitable consequence of CO2 EOR is that CO2 becomes permanently trapped underground.

The Elk Hills Oil Field (EHOF) reservoirs have the advantage of being well studied and provide a uniquely suited setting for large-scale geologic sequestration of CO2, building on 100 years of oil and gas field operating experience in the EHOF and the oil industry's more than 35 years of CO2 EOR operations. The appropriateness of using CO2 EOR in any given oil field or reservoir cannot be determined until the geologic setting is evaluated to enable informed decisions in terms of reservoir management, safety, and carbon sequestration potential. As a result of the thousands of wells installed over the operational history of the EHOF, a significant database has been developed and utilized to model the proposed OEHI CO2 EOR Project. This extensive database was transferred to OEHI when the EHOF was acquired from the federal government in 1998 and has been expanded upon by subsequent drilling operations by OEHI. As a result, OEHI is in the unique position of

[1] Notably, it is estimated that site characterization of saline reservoirs will likely cost tens of millions of dollars and it would take a decade or more to develop one large scale commercial saline storage reservoir project exceeding 2 million tons/year of CO2.

possessing all of the subsurface information that has been accumulated over the nearly 100-year life of the field. The EHOF has been found to be an ideal candidate for CO2 EOR.

The EHOF was acquired from the federal government in 1998. A combined Supplemental Environmental Impact Statement/Program Environmental Impact Report (SEIS/PEIR) was prepared for the sale of Naval Petroleum Reserve-1 (NPR-1) and published in 1997 (Department of Energy [DOE], 1997). The 1997 SEIS/PEIR evaluated potential environmental impacts of continued oil and gas production under private ownership of NPR-1 for a period in excess of 50 years. In addition to an increase in wells and supporting facilities necessary to support this production, the 1997 SEIS/PEIR considered the future use of enhanced oil recovery techniques, including CO2. Correspondingly, the potential environmental impacts of the maximum economic development of NPR-1 (now EHOF), including, among other EOR techniques, the use of CO2 to enhance oil production.

CO2 EOR Process Overview

The CO2 EOR process can be described in two parts: subsurface EOR process and aboveground CO2 handling process.

Subsurface Process Overview

In CO2 EOR operations, compressed CO2 (which has the characteristics of a liquid) is injected into an oil reservoir through injection wells designed for CO2 injection. The injection pressure is maintained safely below the levels that might compromise the integrity of the confining geologic zones. The CO2 flows from the injection well and dissolves in the oil (CO2 and oil are miscible under these reservoir conditions and form a single-phase solution). The miscibility of the CO2 and the oil is dependent on the characteristics of both the oil reservoir, including pressure and temperature, and the chemical composition of the reservoir fluids. CO2 EOR mixes with oil, resulting in lower oil viscosity, enhanced oil mobility and lower interfacial tension when compared to oil extraction without CO2 EOR.

In order to optimize CO2 EOR performance, a technique of alternating cycles of water injection with cycles of CO2 injection may be used (referred to as “Water Alternating Gas” or “WAG”). The periodic introduction of water behind the CO2-oil miscible solution facilities the "sweeping" of the CO2-oil solution to production wells and further enhances oil recovery.

The current development of the Stevens Reservoirs in the Elk Hills Unit uses a mature pattern of water injection with over 200 water injection wells and an average injection rate for each well of nearly 900 barrels of water per day (bwpd) of water produced from the Elk Hills Unit. OEHI proposes to convert the reservoirs from the current application of all water injection to alternating water and CO2 (WAG). During this process, many of the current water injectors will be converted to CO2 WAG injectors, with estimated average CO2 injection rates between 2 and 20 mmscfd per injection well.

The fluids produced by this process will be a mixture of hydrocarbons (oil and gas), water and CO2, which will be processed on-site. Production operations will be designed to make the most efficient use

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of CO2 as CO2 is a valuable commodity that will be purchased by OEHI from HECA. This will be done by separating the CO2 from the recovered hydrocarbons in a closed loop system. The recovered CO2 will be re-injected into the reservoir as part of the continuous EOR process. Injected and recycled quantities of CO2 will be monitored closely. Since some of the CO2 becomes trapped within the formation during each injection cycle, it is necessary to introduce additional amounts of purchased CO2 to continue the EOR operation.

The reservoir geological environment will determine the extent to which CO2 will be immobilized, trapped and retained in the reservoir, making it difficult to predict the recovery (and trapped) fractions for each pass of CO2 through the reservoir. However, Occidental's extensive experience as a world-wide leader in operating CO2 EOR indicates that during each cycle approximately 30 to 50 percent of the injected CO2 mass will remain trapped in the reservoir and is unrecoverable. However, regardless of the fraction of CO2 trapped during a cycle, the CO2 remains within the closed looped system and absent minor losses due to fugitive emissions and operating losses, the injected CO2 will become trapped in the reservoir when production ceases.

The key CO2 trapping mechanisms that occur in the subsurface include physical trapping, residual gas trapping and geochemical trapping.

- Physical trapping (and trap filling) retains the CO2 in the formation using structural and stratigraphic traps. Physical trapping of the buoyant CO2 is provided by the same impermeable "caprock" that seals the oil and hydrocarbon gases underground.
- Residual trapping and dissolution of the liquid or gaseous CO2 occurs as a result of capillary forces retaining some of the CO2. Residual CO2 trapping is analogous to residual oil saturation (i.e., "trapped" oil) that remains after an oil reservoir is swept with injected water.
- Geochemical trapping describes a series of reactions of CO2 with natural fluids and minerals in the target formation, principally consisting of CO2 dissolution in brine (i.e., solubility trapping), CO2 precipitation as mineral phases (i.e., mineral trapping) and CO2 sorption onto mineral surfaces. Scientific research is continuing to increase the understanding of the chemical processes involved in geochemical trapping.

These trapping mechanisms operate on different time scales, beginning with initial injection of CO2 and have different capacities to trap CO2. Over time, the process of physical and residual CO2 trapping is enhanced by the increasing geochemical processes of solubility trapping and mineral trapping. It is important to note that the physical trapping mechanism alone is expected to sequester all the CO2 purchased from HECA.

Aboveground CO2 Handling Process Overview

CO2 from the HECA Project will be transported via pipeline to the EOR Processing Facility, at which point the CO2 will be distributed to CO2 injection wells placed in a geometric pattern designed to optimize the recovery of oil from the reservoir.

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For each injection well there may be three or more nearby production wells where produced fluids are pumped to the surface and then transported by pipeline in a closed loop system to a centralized collection and processing facility. Typically, these wells are arranged in a consistent geometrical pattern with an injection well in the center and production wells on the perimeter. For example, in a five - spot pattern, there would be four production wells on the four corners of a square geometric pattern, with a single injection well in the center of the pattern. The pattern of injection and production wells may change over time, and is typically based on predictive computer simulations that model reservoir performance based on reservoir characterization and historical operations.

At the surface, the recovered fluids will be transferred to a separator at the EOR Processing Facility where the oil water and natural gas will be separated. The natural gas may include CO2 as the injected gas begins to break through at the production wells. Separated natural gas enters a pipeline for transport to the existing gas processing facility in Section 35R of the Elk Hills Unit where it is combined and processed with other produced gas from the field for sale to customers. The CO2 will be separated from the produced natural gas and CO2 is recompressed for reinjection along with CO2 purchased from the HECA Project to further optimize the CO2 EOR process.

1.3 Purpose and Use of this SEI

The primary purpose of this SEI is to evaluate the potential environmental impacts that could result from implementation of the proposed Project.

Section 15123 of the CEQA Guidelines requires that an EIR contain a brief summary of the proposed action and its consequences. This Executive Summary identifies the Project's significant environmental effects and the mitigation measures and alternatives that would be required for implementation by OEHI to reduce or avoid the effects; areas of concern known to the lead agency, including issues raised by regulatory agencies and the public; and issues to be resolved, including the choice among alternatives and whether or how to mitigate the significant effects. Chapter 4 contains an in-depth discussion of the existing environmental setting at the proposed Project Site, regulations concerning environmental resources, an evaluation of the project's potential environmental impacts, and mitigation measures to reduce environmental impacts.

1.4 Project Overview

1.4.1 Local and Regional Setting

The Elk Hills Unit is located 26 miles (42 Kilometers [km]) southwest of Bakersfield in western Kern County, California. The entire Elk Hills Unit is approximately 48,000 acres.

The EHOF was originally developed as part of the federal Naval Petroleum Reserves and was designated as "NPR-1". The U.S. Navy, the original operator of the field, did not use the customary cadastral survey conventions to refer to the location of a particular section. Instead, it employed a

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"short cut" method in which each distinct Township/Range was identified by a letter designation. Under the cadastral survey method, each township is comprised of 36 one-mile square sections, numbered 1 through 36; each section is referred to by section, township and range designations. Under the Navy's shortcut method, however, each section at the EHOF was identified simply by its section number and the township/range letters. Thus, what would normally be described as "Section 7 of Township 30 South, Range 23 East" was described by the Navy simply as Section 7R." The Navy's convention has persisted and, therefore, all sections within and adjacent to the EHOF are still commonly referred to by this shortcut method.

1.4.2 Surrounding Land Uses

The Elk Hills Unit is located along the southwest edge of the San Joaquin Valley. This area is situated immediately south of, and contiguous with, the Lokern Area of Critical Environmental Concern (ACEC)[2] a part of which (3,111 acres) is controlled by the Bureau of Land Management (BLM).Portions of this surrounding area (2,050 acres), are managed as conservation areas by the Center for Natural Lands Management (CNLM) and OEHI (formerly Plains Exploration and Production Company and Nuevo Energy Company) Habitat Management Lands (200 acres). The remainder is owned by Chevron Corporation and others. The City of Buttonwillow is located directly to the north.

McKittrick Valley and portions of Buena Vista Valley with Highway 33 running NW-SE are to the west. The cities of McKittrick and Derby Acres are located along Highway 33. Approximately ten-miles to the west and across the Temblor Range is the Carrizo Plain National Monument (also an ACEC; 199,030 acres).

To the south of the Elk Hills Unit is the Buena Vista Valley, the majority of which is within another oil field, NPR-2, which was recently transferred from the DOE ownership to the BLM. The City of Taft is located approximately seven-miles to the south. Mostly undeveloped areas are located along Highway 119 to the southeast of Elk Hills Unit.

Lands to the immediate east include Coles Levee Ecological Preserve (CLEP; 6,059 acres), Kern Water Bank Authority (19,900 acres), Tule Elk Reserve State Park and the Kern River. The California Aqueduct and the West Side Canal converge and flow along the north and eastern boundary of Elk Hills Unit, as does the Kern River. The Buena Vista Lake Bed is located immediately southeast of Highway 119. Bakersfield is approximately 26 miles to the northeast. The Elk Hills Unit is circumscribed by Highway 5 to the north and east, Highways 119 and 33 to the south, Highway 33 to the west and Highway 58 to the north. Elk Hills Road runs north and south and bisects the Project area.

[2] Policy and Land Management Act of 1976 (FLPMA, P.L. 94-579). ACEC include public lands where special management attention and direction is needed to protect and prevent irreparable damage to important historic, cultural and scenic values, fish, or wildlife resources or other natural systems or processes or to protect human life and safety from natural hazards. ACEC designation indicates BLM recognizes the significant values of the area and intends to implement management to protect and enhance the resource values.

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1.5 Project Objectives

OEHI's objectives for the project are to:

- Extend and enhance the useful and productive life of the Elk Hills Unit.
- Increase California and domestic energy supplies and enhance energy security by maximizing production of the petroleum reserves.
- Economically maximize oil recovery within the Elk Hills Unit and safely sequester CO2 in accordance with all county, state, and federal safety and environmental rules and regulations.
- Provide a mechanism to mitigate CO2 emission impacts from the nearby HECA Project, the OEHI CO2 EOR Project, and other oil field operations.
- Minimize environmental impacts associated with the construction and operation of the OEHI CO2 EOR Project through choice of technology, project design and implementation of feasible and appropriate mitigation measures.
- Ensure the economic viability of the OEHI CO2 EOR Project by minimizing costs while achieving other Project objectives.

1.6 Proposed Project Characteristics

Specifically, the proposed Project Site includes the following:

- CO2 Injection and Recovery Equipment
- CO2 Supply System
- Satellite Gathering Stations
- Infield Gathering and Injection Distribution Pipelines
- Recovered CO2 Purification and Compression
- Central Tank Battery (CTB)
- Reinjection Compression Facility (RCF)
- CO2 Recovery Plant (CRP)
- Water Treating and Injection Plant
- Backup CO2 Injection Facility
- CO2 Sequestration Monitoring and Verification

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- Supporting Process Systems
- Hazardous Material Management
- Hazardous Waste Management
- Stormwater Management
- Fire Protection
- Control Systems
- Utilities
- Project Buildings/Facilities
- Security Systems
- CO2 Monitoring, Measurement, Verification and Closure

A significant portion of the development will occur in areas where disturbance has already occurred. OEHI will design project components to utilize existing disturbed acreage to the extent feasible.

- The CO2 EOR Processing Facility and the 13 satellites are expected to occupy approximately 135.6 acres.
- The estimated total length of all new pipelines is 652 miles, much of which will be located in existing pipeline corridors that are sited on disturbed acreage.
- The current estimated number of producing and injection wells is approximately 720 (309 injection and 411 production wells). 570 of the maximum projected 720 Project wells necessary for the Project will utilize existing wells. The remaining 150 wells will be new installations.

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1.7 Environmental Impacts

1.7.1 Impacts of the Proposed Project

Table 1-1 below summarizes the environmental impacts and mitigation measures evaluated for the Project as part of this SEI.

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.1 Aesthetics			
AES-1 Have a Substantial Adverse Effect on a Scenic Vista.	No Impact.	No mitigation measures are required.	No Impact.
AES-2 Substantially Alter or Damage a Major Landform or Scenic Resource, including, but not limited to, Trees, Rock Outcroppings, and Historic Buildings within a State Scenic Highway.	No Impact.	No mitigation measures are required.	No Impact.
AES-3 Substantially Alter or Degrade the Existing Visual Character or Quality of the Proposed Project Site and Its Surroundings.	Significant.	**Mitigation Measure AES-1** The surfaces of all structures, equipment, piping, and other associated above-ground project components shall be given low reflectivity finishes with neutral colors to minimize the contrast of the structures with their backdrops. **Mitigation Measure AES-2** In areas requiring major topographic adjustment (including but not limited to the CO2 EOR Processing Facility, satellite locations, new well sites, buried pipelines etc.), topsoil from existing grade to be cut/filled/trenched shall be removed and stockpiled during rough grading and/or trenching operations. Topsoil's shall be reapplied consistently across the new grades and stabilized to allow natural revegetation. **Mitigation Measure AES-3** For any overhead transmission lines, lattice steel towers will not be used. If tubular steel poles	Less than Significant.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		are used (instead of wood) they shall be painted light-gray colors or shall be dulled galvanized steel. **Mitigation Measure AES-4** During construction, temporary construction areas, including construction parking, offices, and construction laydowns, shall be located within OEHI existing operations and out of direct view of the public, to the maximum extent feasible. **Mitigation Measure AES-5** The Project shall utilize existing pipeline corridors, ROW (ROWs), roads, storage areas, and previously disturbed acreage to the maximum extent feasible. All project components shall be designed to minimize disturbed footprint during construction.	
AES-4: Create a New Source of Substantial Light or Glare which would Adversely Affect Day or Nighttime Views in the Area.	Significant.	Implement Mitigation Measures AES-1 through AES-5 as described above. **Mitigation Measure AES-6** All outdoor lighting shall be the minimum required to meet safety and security standards. All light fixtures shall be hooded and/or shielded to reduce potential for glare effects and to prevent light from spilling off the site or up into the sky.	Less than Significant.
4.2 Agricultural Resources			
AG-1 Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Nonagricultural Use	No Impact.	No mitigation measures are required.	No Impact.
AG-2 Conflict with Existing Agricultural Zoning or Williamson Act Contracts	No Impact.	No mitigation measures are required.	No Impact.
AG-3 Involve Other Changes in the Existing Environment which, Because of their Location or Nature, Could Result in Conversion of Farmland to Nonagricultural	No Impact.	No mitigation measures are required.	No Impact.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
Use			
AG-4 Result in the Cancellation of an Open Space Contract, Williamson Act Contract, or Farmland Security Zone Contract	No Impact.	No mitigation measures are required.	No Impact.
4.3 Air Quality			
AQ-1 Conflict with or Obstruct Implementation of an Applicable Air Quality Plan	Less than Significant.	No mitigation measures are required.	Less than Significant.
AQ-2 Result in a Cumulatively Considerable Net Increase of any Criteria Pollutant for which the Region is Non-attainment for Federal or State Standards	Significant.	**Mitigation Measure AQ-1** OEHI shall reduce operational emissions from stationary source activities by implementing the following mitigation measures: a. All permitted equipment with any emissions will include BACT and will comply with all applicable SJVAPCD rules and regulations; b. Fugitive ROG emissions will be mitigated by complying with leak detection and repair (LDAR) requirements contained in SJVAPCD Rule 4409; c. Fugitive dust emissions will be mitigated through implementation of the dust control mitigation measures outlined in Mitigation Measure AQ-2; and d. Emissions from operational activities will be mitigated by providing emission reduction credits (ERC) to offset emission increases from permitted equipment, as required by District Rule 2201. The required amount of ERC will be determined at the time of permit review. **Mitigation Measure AQ-2** OEHI shall reduce fugitive dust emissions during	Less than Significant.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		construction by implementing the following measures: a. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover; b. All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant; c. All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking; d. When materials are transported off-site, all material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained; e. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions). (Use of blower	

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		devices is expressly forbidden); f. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant; g. Any site with 150 or more vehicle trips per day shall prevent carryout and trackout; h. Limit traffic speeds on unpaved roads to 15 mph; i. Suspend excavation and grading activity when winds exceed 20 mph; and j. Limit area subject to excavation, grading, and other construction activity at any one time. **Mitigation Measure AQ-3** OEHI shall reduce exhaust emissions during construction when using construction equipment and vehicles by implementing the following measures: a. Prohibit the use of heavy-equipment during first- or second-stage smog alerts and suspend all construction activities during second-stage smog alerts; b. Maintain equipment engines in proper working order; c. Limit the hours of operation of heavy-duty equipment and/or the amount of equipment in use to the extent feasible; d. OEHI will require that all diesel engines be shut-off when not in use to reduce emissions from idling; e. Require that trucks and vehicles in loading or unloading queues have their engines turned-off	

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		when not in use; and f. Emissions from off-road mobile source construction equipment will be mitigated by requiring that all contractors comply with the California Air Resources board off-road mobile source regulations.	
AQ-3 Violate Any Air Quality Standards or Contribute Substantially to an Existing or Projected Air Quality Violation	Significant.	Impacts will be reduced by implementing Mitigation Measures AQ-1 through AQ-3 outlined above.	Less than Significant.
AQ-4 Expose Sensitive Receptors to Substantial Pollutant Concentrations	Less than Significant.	No mitigation measures are required.	Less than Significant.
AQ-5: Create Objectionable Odors Affecting a Substantial Number of People	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.4. Biological Resources			
BIO-1 Have a Substantial Adverse Impact, 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 the CDFG or the USFWS **BIO-1A** Effects on Wildlife Species Listed as Endangered, Threatened, or Proposed **BIO-1B** Effects on Wildlife Species Listed as California Species of Special Concern **BIO-1C** Effects on Plant Species Listed as Endangered, Threatened or Proposed **BIO-1D** Effects on Plant Species Listed by the California Native Plant	Significant.	**Mitigation Measure BIO-1** Prior to initial ground disturbing activities (e.g., mechanized clearing or rough grading) for all project-related construction components, a qualified biologist shall conduct a preconstruction sweep of the Project Site for special-status wildlife species. During these surveys the biologist will: • Ensure that potential habitats become inaccessible to wildlife (e.g., burrows are removed that would otherwise provide temporary refuge); • In the event of an unanticipated discovery of a special-status ground-dwelling animal, recover and relocate the animal to adjacent suitable habitat within the Project Site at least 200 feet from the limits of grading. • Prior to ground disturbing activities for all project related components, a qualified biologist shall conduct	Less than Significant.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
Society as 1B (rare, threatened or endangered in California)		preconstruction surveys for special status plant species in areas where appropriate habitat exists. • Steep-walled trenches or excavations used during construction at the Project Site shall include escape ramps at a maximum slope of 2:1 every 1000 feet and at each end of the trench(es). Trenches shall be inspected by a qualified biologist for the removal of wildlife immediately prior to final backfilling. • Conduct species specific pre-activity surveys (PAS) in accordance with section 6.2 of the HCP. Should the results of the PAS be positive, then the biologist will recommend avoidance measures as discussed in section 6.2 of the HCP. **Mitigation Measure BIO-2** In accordance with the BO and HCP, avoidance and minimization will be achieved by minimizing future land disturbance on those portions of the EHOF considered high value of the multi species map of the HCP. In order to mitigate for unavoidable impacts to covered species, OEHI will set aside, permanently preserve, enhance, and manage habitat for sensitive species. This land will be set aside in appropriate amounts following appropriate ratios as specified in section 5.2.3 of the HCP. Furthermore, to the greatest extent possible, construction associated with the project should be located on previously disturbed lands located in High Production Areas in order to further reduce impact to listed species. **Mitigation Measure BIO-3** The BO also requires that prior to any activities commencing at the Project Site, OEHI	

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		contractors attend an employee education program approved by the USFWS/CDFG regarding the sensitive biological resources potentially occurring within the Project Site. The program must include, at a minimum, descriptions of the listed species, their habitat, and methods required to reduce impacts from this project. A fact sheet must also be prepared for distribution to all personnel associated with this project. All personnel who attend the employee orientation are required to sign an attendance roster acknowledging their participation in the orientation and their understanding of the mitigation. **Mitigation Measure BIO-4** Best management practices (BMP) have been developed over time at EHOF. These BMP's are implemented by OEHI personnel to avoid take during normal daily operations and are fully discussed in section 6 of the HCP. BMP's pertain to how vehicles are driven, where vehicles and equipment are allowed to operate, construction measures designed to reduce harm to covered species, and who to contact for incidents with covered species. **Mitigation Measure BIO-5** Per the HCP, monitoring will be conducted to document relative abundance and distribution of Covered species in the high production areas, non high production areas, and conservation lands. To document trends, monitoring will be conducted consistently each year and follows to a large extent the protocols that have been established since OEHI obtained ownership of the EHOF in 1998. Monitoring will be used to verify that the HCP is meeting its stated conservation goals and objective.	

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
BIO-2 Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFG or the USFWS	Significant.	**Mitigation Measure BIO-6** Where possible, construction associated with the project shall be limited to areas previously disturbed or located in High Production Areas where Valley Saltbush Scrub is likely already degraded. Compensation lands established for the mitigation of impacts to species that use Valley Saltbush Scrub as habitat will be sufficient to mitigate for the impacts to this sensitive community.	Less than Significant.
BIO-3 Have a substantial adverse impact on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, and coastal wetlands), either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means	No Impact.	No mitigation measures are required.	No Impact.
BIO-4 Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites	Less than Significant.	No mitigation measures are required.	Less than Significant.
BIO-5 Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance	No Impact.	No mitigation measures are required.	No Impact.
BIO-6 Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Communities Conservation Plan, or other approved local, regional, or	Less than Significant.	No mitigation measures are required.	Less than Significant.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
state habitat conservation plan			
4.5 Cultural Paleontological Resources			
CULT-1 Cause a Substantial Adverse Change in the Significance of a Historical Resource	Less than Significant.	No mitigation measures are required.	Less than Significant.
CULT-2 Cause a Substantial Adverse Change in the Significance of an Archaeological Resource	Significant.	**Mitigation Measure CULT-1** Prior to initial ground-disturbing activities the Designated Cultural Resources Specialist will conduct a worker education session for construction supervisory personnel to explain the importance of and legal basis for the protection of known significant archaeological resources. **Mitigation Measure CULT-2** A Native American monitor will be present during Project excavation work in culturally sensitive areas on the EHOF. **Mitigation Measure CULT-3** If a new prehistoric or historic cultural resource site is discovered during construction and determined to be significant, a qualified Archaeologist will prepare and implement a mitigation plan in accordance with state regulations on private lands. This plan will emphasize the avoidance, if possible, of significant archaeological resources. If avoidance is not possible, recovery of a sample of the deposit from which the archaeologist can define scientific data to address archaeological research questions will be considered an effective mitigation measure for damage to or destruction of the deposit. The qualified Archaeologist and archaeological monitor will follow accepted professional standards in recording any finds and will submit the standard Department of Parks and Recreation historic site form (Form DPR 523) and locational information to the	Less than Significant.

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TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Southern San Joaquin Valley Information Center of the California Historic Resources Information System at CSUB. If the qualified Archaeologist determines that the find is not significant, construction will proceed. If the qualified Archaeologist determines that further information is needed to determine whether the find is significant, the County and SHPO will be notified for consultation. Construction will resume at the site as soon as the field data collection phase of any data recovery efforts is completed. **Mitigation Measure CULT-4** If cultural resources are recovered during proposed Project construction, a qualified Archaeologist will contact and offer the resources for curation to a curation facility, that is, a recognized, non-profit archaeological repository with a permanent curator, of any archaeological materials collected during the construction monitoring and mitigation program. The archaeologist shall submit field notes, stratigraphic drawings, and other materials developed as part of the archaeological excavation program to the curation facility along with the archaeological collection. If buried archaeological deposits are found during construction, the archaeologist will prepare a report summarizing the monitoring and archaeological investigatory program implemented to evaluate the find or to recover data from an archaeological site as a mitigation measure. This report will describe the site soils and stratigraphy, describe and analyze artifacts and other materials recovered, and explain the site's significance. This report will be submitted to the curation facility with the collection. **Mitigation Measure CULT-5** The qualified Archaeologist should meet the minimum qualifications for Principal	

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Investigator on federal projects under the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation. The Archaeological Monitor shall be qualified to detect archaeological deposits in the field. The qualified Archaeologist shall be qualified, in addition to site detection, to evaluate the significance of the deposits, consult with regulatory agencies, and plan site evaluation and mitigation activities.	
CULT-3 Directly or Indirectly Destroy a Unique Paleontological Resource or Site or Unique Geologic Feature	Significant.	**Mitigation Measure CULT-6** Prior to the start of construction, the designated paleontological resource specialist would conduct a training session for all project managers and construction personnel that are responsible for operating heavy equipment. The training would focus upon the identification and reporting procedure for the discovery of any previously unrecorded paleontological resources. **Mitigation Measure CULT-7** If paleontological resources are recovered during proposed Project construction, a qualified individual will contact and offer the resources for curation to a paleontological curation facility. **Mitigation Measure CULT-8** All paleontological investigations during the course of the project would result in a formal report submitted to the appropriate agency.	Less than Significant.
CULT-4 Disturb any Human Remains, including those interred outside of formal cemeteries	Significant.	**Mitigation Measure CULT-2** identified above. **Mitigation Measure CULT-9** If human remains are found during construction CEQA requires that further work or disturbance of the site be halted. The discovery will be inspected and the remains be handled in a manner consistent with Public Resources Code 5097.98-99, Health and Safety Code	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
		7050.5, and CEQA Section 15064.5. If the remains are determined to be Native American, the NAHC will be notified within 24 hours as required by Public Resources Code 5097. The NAHC will notify designated Most Likely Descendants who will provide recommendations for the treatment of the remains within 24 hours. The NAHC will mediate any disputes regarding the treatment of remains.	
4.6 Geology and Soils			
GEO-1 Expose People or Structures to Substantial Adverse Effects Involving the Rupture of a Known Earthquake Fault	Less than Significant.	No mitigation measures are required.	Less than Significant.
GEO-2 Expose People or Structures to Substantial Adverse Effects Involving Strong Seismic Ground Shaking	Less than Significant.	No mitigation measures are required.	Less than Significant.
GEO-3 Expose People or Structures to Substantial Adverse Effects Involving Seismic-Related Ground Failure, Including Liquefaction	Less than Significant.	No mitigation measures are required.	Less than Significant.
GEO-4 Expose People or Structures to Substantial Adverse Effects Involving Landslides	Significant.	**Mitigation Measure GEO-1** The applicant shall design cut/fill slopes for an adequate factor of safety, considering material type and compaction, identified during the site-specific geotechnical study. The slope of cut surfaces shall be no steeper than 2:1 (horizontal to vertical units), unless the applicant furnishes a soils engineering or an engineering geology report, or both, stating that the site has been investigated and giving an opinion that a cut at a steeper slope will be stable and will not create a hazard to public or private property. **Mitigation Measure GEO-2** The	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		applicant shall cut slopes with a slope ratio compatible with the known geologic conditions and/or shall stabilize the slope by using stabilizing methods such as a buttressed fill. **Mitigation Measure GEO-3** Project facilities where slopes exceed 4:1 shall require specific consultation and approval by the Kern County Engineering and Survey Services Department.	
GEO-5 Result in Substantial Soil Erosion or Loss of Topsoil	Significant.	**Mitigation Measure GEO-4** OEHI shall limit grading to the minimum area necessary for construction. **Mitigation Measure GEO-5** As required by Kern County, OEHI shall prepare an Erosion Control Plan to mitigate potential loss of soil and erosion. The plan will be submitted for review and approval by the Kern County Engineering and Survey Services Department. The plan will include the following: • Best management practices (BMPs) will be implemented to minimize soil erosion. • Provisions to maintain flow in washes, should it occur, throughout construction. • Sediment collection facilities as may be required by the Kern County Engineering and Survey Services Department. **Mitigation Measure GEO-6** OEHI shall water disturbed areas during construction to reduce dust and minimize loss of soils from wind (see Section 4.3, "Air Quality," for additional discussion). **Mitigation Measure GEO-7** In all areas disturbed by the Project, OEHI shall salvage topsoil and reuse during restoration.	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
		Mitigation Measure GEO-8 OEHI shall use existing roads to the greatest extent feasible to minimize increased erosion.	
GEO-6 Located on Soil that is Unstable	Significant.	**Mitigation Measures-GEO-1** through **GEO-3**.	Less than Significant.
GEO-7 Located on Expansive Soils	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.7 Hazards and Hazardous Materials			
HAZ-1 Routine Transport, Use, or Disposal of Hazardous Materials.	Less than Significant.	No mitigation measures are required.	Less than Significant.
HAZ-2 Create a Significant Hazard for the Public or the Environment through Reasonably Foreseeable Upset and Accident Conditions Involving the Release of Hazardous Materials into the Environment	Less than Significant.	No mitigation measures are required.	Less than Significant.
HAZ-3 Project Located on a Site Which is Included on a List of Hazardous Materials Sites Compiled Pursuant to Government Code Section 65962.5 and, as a Result, Create a Significant Hazard to the Public or the Environment	Less than Significant.	No mitigation measures are required.	Less than Significant.
HAZ-4 Result in a Safety Hazard for People Residing or Working in the Project Area for a Project Located within the Kern County ALUCP	Less than Significant.	No mitigation measures are required.	Less than Significant.
HAZ-5 Private Airstrip Operations within vicinity of proposed Project resulting in safety hazards for people residing or working in the proposed Project Site	No Impact.	No mitigation measures are required.	Less than Significant.
HAZ-6 Impair Implementation of or Physically Interfere with an Adopted Emergency Response	Less than Significant.	No mitigation measures are required.	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
Plan or Emergency Evacuation Plan			
HAZ-7 Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Wildland Fires	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.8 Hydrology and Water Quality			
HYD-1 Violate Any Water Quality Standards or Waste Discharge Requirements	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-2 Deplete Groundwater Supplies or Interfere with Groundwater Recharge	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-3 Result in Impacts on the Existing Drainage Patterns	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-4 Alter Existing Drainage Patterns of the Site or Area, Causing Flooding	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-5 Result in Impacts on Runoff Water and Drainage Capacity	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-6 Place Housing within a 100-year Flood Hazard Area	No Impact.	No mitigation measures are required.	No Impact.
HYD-7 Place within a 100-Year Hazard Area Structures that Would Impede or Redirect Flood Flows	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-8 Expose People or Structures to a Significant Risk of Loss, Injury, or Death involving Flooding	Less than Significant.	No mitigation measures are required.	Less than Significant.
HYD-9 Result in Impacts Caused by Seiche, Tsunami, or Mudflow	No Impact.	No mitigation measures are required.	No Impact.
4.9 Land Use and Planning			
LU-1 Physically Divide an Established Community	No Impact.	No mitigation measures are required.	No Impact.
LU-2 Conflict with any Applicable Land Use Plan, Policy, or Regulation of an	Less than Significant.	No mitigation measures are required.	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
Agency with Jurisdiction over the Project			
LU-3 Conflict with any Applicable Habitat Conservation Plan or Natural Community Conservation Plan	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.10 Mineral Resources			
MIN-1 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	Less than Significant.	No mitigation measures are required.	Less than Significant.
MIN-2 Result in the Loss of Availability of a Locally Important Mineral Resource Recovery Site Delineated on a Local General Plan, Specific Plan, or other Land Use Plan	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.11 Noise			
NOISE-1 Expose Persons to Noise in Excess of Standards Established in the Kern County General Plan or Noise Ordinances, or other Applicable Standards of Other Agencies	Less than Significant.	No mitigation measures are required.	Less than Significant.
NOISE-2 Expose Persons to Excessive Ground Borne Vibration or Ground Borne Noise Levels	Less than Significant.	No mitigation measures are required.	Less than Significant.
NOISE-3 Cause a Substantial Permanent Increase in Ambient Noise Levels in the Project Vicinity Above Levels Existing	Less than Significant.	No mitigation measures are required.	Less than Significant.
NOISE-4 Cause a Substantial Temporary or Periodic Increase in Ambient Noise Levels in the Project Vicinity above Levels Existing	Less than Significant.	No mitigation measures are required.	Less than Significant.
NOISE-5 Expose People Residing or Working in the	Less than Significant.	No mitigation measures are required.	Less than Significant.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
Project Area to Excessive Noise Levels for a Project Located within the Kern County Airport Land Use Compatibility Plan			
NOISE-6 Expose People Residing or Working in the Project Area to Excessive Noise Levels for a Project within the Vicinity of a Private Airstrip	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.12 Population and Housing			
POP-1 Induce Substantial Population Growth	Less than Significant.	No mitigation measures are required.	Less than Significant.
POP-2 Cause a Displacement of a Substantial Number of Existing Housing, Necessitating the Construction of Replacement Housing Elsewhere	Less than Significant.	No mitigation measures are required.	Less than Significant.
POP-3 Cause a Displacement of a Substantial Number of People, Necessitating the Construction of Replacement Housing Elsewhere	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.13 Public Services			
PUB-1 Adversely Affect Fire Protection Services	Less than Significant.	No mitigation measures are required.	Less than Significant.
PUB-2 Adversely Affect Police Protection/Law Enforcement Services	Less than Significant.	No mitigation measures are required.	Less than Significant.
PUB-3 Adversely Affect School Capacity	Less than Significant.	No mitigation measures are required.	Less than Significant.
PUB-4 Adversely Affect Parks and Recreational Facilities and Services	Less than Significant.	No mitigation measures are required.	Less than Significant.
PUB-5 Adversely Affect Medical Services	Less than Significant.	No mitigation measures are required.	Less than Significant.
PUB-6 Impact to Library Services	Less than Significant.	No mitigation measures are required.	Less than Significant.
4.14 Recreation			

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
REC-1 Result in Increased Use of Parks	Less than Significant.	No mitigation measures are required.	Less than Significant.
REC-2 Include Recreational Facilities or Require the Construction or Expansion of Recreational Facilities that Might Have an Adverse Physical Effect on the Environment	No Impact.	No mitigation measures are required.	No Impact.
4.15 Transportation and Traffic			
TRAF-1 Conflict with an Applicable Plan, Ordinance, or Policy, Establishing, Measures of Effectiveness for the Performance of the Circulation System	Significant.	**Mitigation Measure TRAF-1** OEHI will schedule construction activities to occur between the hours of 6:30AM and 3:30PM to minimize Project related traffic during the AM peak hours of 7:00 – 9:00AM and PM peak hours of 4:00 – 6:00PM.	Less than Significant.
TRAF-2 Exceed Level of Service Standards on County Roads or State Highways	Significant.	Implementation of **Mitigation Measure TRAF-1**.	Less than Significant.
TRAF-3 Result in a Change in Air Traffic Patterns, Including Either an Increase in Traffic Levels or a Change in Location that Results in Substantial Safety Risks	No Impact.	No mitigation measures are required.	No Impact.
TRAF-4 Substantially Increase Hazards caused by a Design Feature (such as Sharp Curves or Dangerous Intersections) or Incompatible Uses (such as Agricultural Equipment)	Less than Significant.	No mitigation measures are required.	Less than Significant.
TRAF-5 Result in Inadequate Emergency Access	Less than Significant.	No mitigation measures are required.	Less than Significant.
TRAF-6 Conflict with Adopted Policies, Plans, or Programs Regarding Public Transit, Bicycle, or Pedestrian Facilities, or Otherwise Decrease the Performance or Safety of Such Facilities	No Impact.	No mitigation measures are required.	No Impact.
4.16 Utilities and Services			

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
UTIL-1 Exceeds Wastewater Treatment Requirements of the RWQCB	No Impact.	No mitigation measures are required.	No Impact.
UTIL-2 Require or Result in the Construction of New Water or Wastewater Treatment Facilities or Expansion of Existing Facilities, the Construction of Which Could Cause Significant Environmental Effects	No Impact.	No mitigation measures are required.	No Impact.
UTIL-3 Have Insufficient Water Supplies Available to Serve the Project from Existing Entitlements and Resources or Require Expanded Entitlements	Less than Significant.	No mitigation measures are required.	Less than Significant.
UTIL-4 Require or Result in the Construction of New Storm Water Drainage Facilities or Expansion of Existing Facilities, the Construction of which Could Cause Significant Environmental Effects	No Impact.	No mitigation measures are required.	No Impact.
UTIL-5 Result in a Determination by the Wastewater Treatment Provider which Serves or may Serve the Project that it has Inadequate Capacity to Serve the Project's Projected Demand in Addition to the Provider's Existing Commitments	No Impact.	No mitigation measures are required.	No Impact.
UTL-6 Served by a Landfill with Insufficient Permitted Capacity to Accommodate the Project's Solid Waste Disposal Needs	Less than Significant.	No mitigation measures are required.	Less than Significant.
UTL-7 Conflict with Federal, State, and Local Statutes Related to Solid Waste	No Impact.	No mitigation measures are required.	No Impact.

1.0 EXECUTIVE SUMMARY

TABLE 1-1: SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES			
Environmental Impact	**Level of Significance Before Mitigation**	**Mitigation Measure**	**Level of Significance After Mitigation**
4.17 Environmental Justice			
EJ 1 Cause a Disproportionately High and Adverse Impact on Low-Income or Minority Communities Adjacent to or in the Affected Vicinity of the Project Area	Less than Significant.	No mitigation measures are required.	Less than Significant.
EJ 2 Substantially Increase Project Air Emissions that Disproportionately Impact Low-Income or Minority Communities in Proximity to the Project Site	Less than Significant.	No mitigation measures are required.	Less than Significant.
EJ 3 Degrade the Health and Safety of Low-Income or Minority Communities Disproportionately	No Impact.	No mitigation measures are required.	No Impact.
EJ 4 Fail to Provide for or Encourage Effective Participation of Low-Income or Minority Communities Adjacent to, or in the Affected Vicinity of, the Project Area in the Environmental Review and Decision-Making Process for this Project	Significant.	**Mitigation Measure EJ-1** Conduct at least two public scoping meetings at different times within 5 miles of each environmental justice community with the potential to be affected by the proposed Project (e.g., 6 miles); Buttonwillow and Ford City. A notice of each public scoping meeting must be posted in at least one local newspaper 3-7 days prior to each meeting. A notice of each pending meeting should also be posted at each meeting location at least 7 days in advance of each meeting	Impacts of the proposed Project on global climate change are beneficial. OEHI will implement Mitigation Measure GHG-1 to verify the success of CO2 sequestration and ensure this potential impact remains beneficial.
4.18 Greenhouse Gas Emissions			
GHG-1 Generates Greenhouse Gas Emissions, Either Directly or Indirectly, that may have a Significant Impact on the Environment	Less than Significant.	No mitigation measures are required.	Less than Significant.
GHG-2 Conflicts with any Applicable Plan, Policy or Regulation of an Agency Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases	Less than Significant.	No mitigation measures are required.	Less than Significant.

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1.8 Alternatives to the Proposed Project

1.8.1 Alternatives Analyzed in this SEI

Table 1-2, below, provides a summary of the alternatives impact analysis. A more detailed alternatives analysis is provided in Chapter 6, "Alternatives."

TABLE 1-2: SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS OF PROJECT AND PROJECT ALTERNATIVES

	Proposed Project (CO2 EOR and Sequestration)	**No-Project Alternative** (Continued Oil Field Production and Use)
Extent to Which Project Objectives Satisfied	**Total**	**None**
Aesthetics Impacts	Significant but Mitigable	Less than Significant
Agriculture Impacts	No Impact	No Impact
Air Quality Impacts	Significant but Mitigable	Significant but Mitigable
Biological Resources Impacts	Significant but Mitigable	Significant but Mitigable
Cultural and Paleontological Resources Impacts	Significant but Mitigable	Significant but Mitigable
Geology / Soils Impacts	Significant but Mitigable	Significant but Mitigable
Greenhouse Gases Impacts	Less than Significant	Significant but Mitigable
Hazards / Hazardous Materials Impacts	Less than Significant	Less than Significant
Hydrogeology and Water Quality Impacts	Less than Significant	Less than Significant
Land Use / Planning Impacts	Less than Significant	Less than Significant
Mineral Resources Impacts	Less than Significant	Less than Significant
Noise Impacts	Less than Significant	Less than Significant
Population and Housing Impacts	Less than Significant	Less than Significant
Public Services Impacts	Less than Significant	Less than Significant
Environmental Justice Impacts	Significant but Mitigable	Less than Significant
Recreation Impacts	Less than Significant	Less than Significant
Transportation / Traffic Impacts	Significant but Mitigable	Less than Significant
Utilities and Service Systems Impacts	Less than Significant	Less than Significant

The No Project alternative would not meet any of the Project objectives (Section 1.5) to enhance and maximize oil production of the Elk Hills Unit while providing a mechanism to mitigate CO2 emission impacts from the nearby HECA Project.

2.0 INTRODUCTION

2.0 Introduction

2.1 Intent of California Environmental Quality Act

Although not a California Environmental Quality Act (CEQA) document, this Supplemental Environmental Information (SEI) has been prepared and is intended to be equivalent in content and format pursuant to the following guidelines:

- The CEQA (Public Resources Code, Section 21000 et seq.);
- State CEQA Guidelines (CEQA Guidelines) (California Code of Regulations, Title 14, Chapter 3, Section 15000 et seq.); and
- The Kern County CEQA Implementation Document (Kern County 2004b).

2.2 Purpose of this Supplemental Environmental Information

The purpose of this SEI is to identify:

- The potential impacts of the proposed Project on the environment and indicate the manner in which those impacts found to be significant can be avoided or mitigated;
- Any unavoidable adverse impacts that cannot be mitigated; and
- Reasonable and feasible alternatives to the proposed Project that would eliminate any significant adverse environmental impacts or reduce the impacts to a less than significant level.

This SEI also discloses growth-inducing impacts; economic and social impacts; impacts found not to be significant; and significant cumulative impacts of past, present, and reasonably anticipated future projects.

2.3 Terminology

To assist reviewers in understanding this SEI, the following terms are defined by the CEQA Guidelines:

Project means the whole of an action that has the potential for resulting in a physical change in the environment, directly or ultimately. For purposes of this SEI, Project refers to the OEHI CO2 EOR Project.

Environment means the physical conditions that exist in the area and that would be affected by a proposed Project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. The area involved is where significant direct or indirect impacts

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would occur as a result of the proposed Project. The environment includes both natural and artificial conditions.

Impacts analyzed under CEQA must be related to a physical change. Impacts are:

- Direct or primary impacts that would be caused by the proposed Project and would occur at the same time and place; or
- Indirect or secondary impacts that would be caused by the proposed Project and would be later in time or farther removed in distance but would still be reasonably foreseeable. Indirect or secondary impacts may include growth-inducing impacts and other effects related to induced changes in the pattern of land use; population density or growth rate; and related effects on air and water and other natural systems, including ecosystems.

Significant impact on the environment means a substantial, or potentially substantial, adverse change in any of the physical conditions in the area affected by the proposed Project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance. An economic or social change by itself is not considered a significant impact on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant.

Mitigation consists of measures that avoid or substantially reduce the proposed Project's significant environmental impacts by:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or
- Compensating for the impact by replacing or providing substitute resources or environments.

Cumulative impacts are two or more individual impacts that, when considered together, are considerable or that compound or increase other environmental impacts. The following statements also apply when considering cumulative impacts:

- The individual impacts may be changes resulting from a single project or separate projects.
- The cumulative impact from several projects is the change in the environment that results from the incremental impact of the proposed Project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over time.

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This SEI uses a variety of terms to describe the level of significance of adverse impacts. These terms are defined as follows:

No Impact. No adverse impact would occur.

Less Than Significant. An impact that is adverse but that does not exceed the defined thresholds of significance. Less than significant impacts do not require mitigation.

Significant. An impact that exceeds the defined thresholds of significance and would or could cause a substantial adverse change in the environment. Mitigation measures are recommended to eliminate the impact or reduce it to a less than significant level.

Significant And Unavoidable. An impact that exceeds the defined thresholds of significance and cannot be eliminated or reduced to a less than significant level through the implementation of mitigation measures.

2.4 Format and Content

This SEI addresses the potential environmental effects of the proposed Project. The potential environmental effects were analyzed based on the proposed Project as described in the Preliminary Project Description (Pre-FEED Stage) and the Project Description Addendum (Chapter 3.0 of this SEI). The SEI addresses potential environmental impacts on the following resources and issue areas:

- Aesthetics
- Agricultural resources
- Air quality
- Biological resources
- Cultural and paleontological resources
- Geology and soils
- Hazards and hazardous materials
- Hydrology and water quality
- Mineral resources
- Land use and planning
- Noise
- Population and housing

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- Public services
- Recreation
- Transportation/traffic
- Utilities and service systems
- Environmental justice
- Greenhouse Gas Emissions

2.4.1 Contents and Organization

This SEI is organized into the following chapters:

- Chapter 1.0, "Executive Summary," provides Project description of the proposed Project and a summary of the environmental impacts and mitigation measures.
- Chapter 2.0, "Introduction," provides CEQA compliance information, intent, purpose, and organization of the SEI. Chapter 2.0 also presents a list of other projects considered within the cumulative impact analysis of each issue area.
- Chapter 3.0, "Project Description Addendum," provides a description of proposed Project modifications, enhancements, and assumptions made since preparation of the Pre-FEED Project Description.
- Chapter 4.0, "Environmental Setting, Impacts, and Mitigation Measures," contains a detailed environmental analysis of the existing conditions at the proposed Project site and vicinity of the proposed Project, potential proposed Project impacts, mitigation measures, and cumulative impacts.
- Chapter 5.0, "Consequences of Project Implementation" presents an analysis of the proposed Project's potential cumulative and growth-inducing impacts as well as irreversible commitment of resources.
- Chapter 6.0, "Alternatives," describes a reasonable range of alternatives to the proposed Project that could reduce the significant environmental effects that cannot be avoided.
- Chapter 7.0, "Bibliography," identifies reference sources for the SEI.

The analysis of each environmental category in Chapter 4.0 is organized as follows:

- "Environmental Setting" describes the physical conditions that exist at this time and that may influence or affect the topic being analyzed.

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- "Regulatory Setting" provides state and federal laws and the Kern County General Plan's goals, policies, and implementation measures that apply to the topic being analyzed.
- "Impacts and Mitigation Measures" presents the determination of the level of significance for the resource area, discusses the impacts of the proposed Project in each resource area, and provides a discussion of feasible mitigation measures to reduce any significant impacts.
- "Cumulative Impacts" discusses and analyzes the cumulative impacts of the proposed Project.

2.5 Cumulative Impacts

Cumulative impacts are the project's impacts combined with the impacts of other "related past, present and reasonably foreseeable future projects that would likely result in similar impacts and are located in the same geographic area" (CEQA Guidelines §15355). As set forth in the CEQA Guidelines, the discussion of cumulative impacts must reflect the severity of the impacts, as well as the likelihood of their occurrence; however, the discussion need not be as detailed as the discussion of environmental impacts attributable to the project alone. CEQA Guidelines §15130(b)). As stated in CEQA, §21083(b), "a project may have a significant effect on the environment if the possible effects of a project are individually limited but cumulatively considerable."

According to the CEQA Guidelines:

> *Cumulative impacts refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.*
>
> *(a) The individual effects may be changes resulting from a single project or a number of separate projects.*
>
> *(b) The cumulative impact from several projects is the change in the environment, which results from the incremental impact of the project when added to other closely related past, present, and reasonable foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time (CEQA Guidelines §15355*).

In addition, as stated in the CEQA Guidelines, it should be noted that:

> *The mere existence of significant cumulative impacts caused by other projects alone shall not constitute substantial evidence that the proposed project's incremental effects are cumulatively considerable (CEQA Guidelines §15064(h)(4)).*
>
> *Cumulative impact discussions for each environmental issue area are provided at the end of each technical analysis contained within Chapter 4.*

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Projects Considered in the Cumulative Impact Analysis

Projects considered in the cumulative impaction analysis were identified by the HECA Project as well as other projects proposed by OEHI, using a list approach of a six-mile radius (CEQA Guidelines §15130 (b)(1)(A)). Table 2-1 lists the projects considered within the cumulative impact analyses for each issue area.

There are 23 projects within a six-mile radius, currently under review or pending approval in the vicinity of the proposed Project Site. The projects included in the cumulative impact analysis are provided below.

TABLE 2-1: PROPOSED PROJECTS WITHIN 6-MILES OF THE PROJECT SITE

Project Location	Applicant	Required Approvals / Use Type	Request
Adjacent to the North and West of the proposed Project Site	Dykstra Dairies / David Albers	CUP / Agriculture	CUP to established a 1,061-Acre Dairy (121-Acre Dairy, 739 Acres of Liquid Waste Disposal/Spreading, and 201 Acres for Solid Waste Disposal/Spreading (Palm Ranch)
Southeast corner of 7th Standard Road and Brandt Road	Affentranger, Franz (Pine Dairy)	CUP / Agriculture	CUP to establish a 589.35-Acre Dairy and 1,973.28-Acre Crop Area (Pine Dairy)
Northwest corner of Stockdale Highway and Enos Lane	Stockdale Investor, LLC/David Wood	GPA / Residential *(note: assume max of 2640 residential dwelling units)*	GPA from resource – intensive agriculture (R-LA) and Service Industrial (SI) to low/medium-density residential (LMR) max 10 units/net acre
Southeast corner of Enos Lane at union	Gravis, Corky/Metro Ready Mix	CUP / Industrial	CUP to establish a concrete batch plant
Tracy Avenue, Buttonwillow	Rio Bravo Vista/Mcintosh and Associates	PD / Commercial	Precise development for "La Quinta" hotel
345 Driver Road	Petro Ready Mix Pete Pedroza	PD / Industrial	Precise development for concrete batch plant
12611 South Enos Lane	Goetting, Charles / Bruce Anderson	ZCC / Oil	Zoning change / amendment from exclusive agriculture (A) to Natural Resource 20-Acre minimum lot size [NR(20)]
7th Standard Road at Enos Lane	Dhillon, Randeep / Pasquini	PD / Commercial	Precise Development for Retail / Restaurants
Taft Landfill – Elks Hills Road	Kern County Waste Management	GPA / Industrial	Modify CUP to vertically expand an existing landfill; GPA from mineral and petroleum (Map Code 8.4) to solid waste disposal facility buffer (Map Code 3.4.1).

2.0 INTRODUCTION

TABLE 2-1: PROPOSED PROJECTS WITHIN 6-MILES OF THE PROJECT SITE

Project Location	Applicant	Required Approvals / Use Type	Request
Southeast corner of Taft Highway and Enfo Lane	Schackman, Conrad and Scott by Wiley Hughes Survey	GPA; ZCC; Exclusion / Industrial	GPA from extensive agriculture (Map Code 8.3) to light industrial (Map Code 7.1); zoning change/amendment from exclusive agriculture (A) district to light industrial (M-1) district; and exclusion from agricultural preserve boundaries No. 10 to establish five 2,000-square foot warehouse and outdoor storage lots
N/S Stockdale Highway, ¼ mile East of Enos Lane	Matuk, Mike and Aileen / Marino and Assoc	GPA; ZCC / Residential *(note: assume max of 210 residential dwelling units)*	GPA to rural residential (max 2.5-acre lot size); zoning change/amendment to estate minimum lot size 2½ acres [E(2½)] district and residential suburban (RS) combining district.
Northwest corner of Enos Lane and Highway 58	Stonefield Development / Mcintosh and Assoc	GPA; ZCC / Mixed	GPA to Low-density residential (LMR); zoning change/amendment to low-density residential (R-1) district; construction 1450 dwelling units (350 apartments, 700 single-family dwellings, and 400 condos), 10 acres commercial, 12 acre3s elementary school, 15 acres park.
South 7th Standard Road, between Enos Lane and Martin	Beech Street Development / Mcintosh and Assoc	APA; ZCC / Residential *(note: assume max of 1169residential dwelling units)*	SPA to low-density residential (LMR); zoning change/amendment to low-density residential (R-1) district
Highway 43 at Country Triangle Road	Stockbuilding Supply / Klassen Corp	PD / Industrial	PD for lumber truss manufacturing / warehouse includes variance for reduction of parking, may require general plan amendment of circulation element; zoning variance for reduced parking.
Southwest corner of Highway 58 and Highway 43	Cn Holdings by San Joaquin Engineering	ZCC; Exclusion / Mixed *(note: assume max of 149 residential dwelling units)*	Zoning change/amendment to estate minimum lot size 1-acre [E(1)] district, general commercial (C-2) district, and precise development (PD) combining district; exclusion from agricultural preserve #9.

2.0 INTRODUCTION

TABLE 2-1: PROPOSED PROJECTS WITHIN 6-MILES OF THE PROJECT SITE

Project Location	Applicant	Required Approvals / Use Type	Request
Enos Lane and Highway 119 Southwest corner	Kenneith Kerr by David Rickles Consulting	GPA; ZCC / Industrial	GPA from mineral and petroleum (Map Code 8.4) to highway commercial (Map Code 6.3); zoning change/amendment from exclusive agriculture (A) district to light industrial (M-1) district. Includes exclusion from agricultural preserve
N/S Rosedale Highway, ¼ mile east of Enos Lane	Moreno, Federico and Magdalena	SPA; ZCC; PD / Industrial	SPA from rural residential to service industrial (SI_; zoning change/amendment from E-5 [RS} to medium industrial (M-2) district and precise development (PD) combining district; precise development for contractors storage yard.
Northwest corner of Rosedale and Enos Lane	Patterson, Ed by Dewalt Corp	GPA; ZCC / Industrial	SPA from RI-A to RMP; zoning change/amendment from natural resource 20-acre minimum lot size [NR(20)] to natural resource 5-acre minimum lot size [NR(5)] and precise development (PD) combining district for contractors storage yard.
22356 Rosedale Highway	Wattenbarger, Scott by Porter and Associates	SPA; ZCC / Industrial	SPA from rural residential (RR) to service industrial (SI); zoning change/amendment from exclusive agriculture (A) district to medium industrial (M-2) district
7626 Superior Road	Cooper, Michael and Cheryl / D and D	ZCC; Exclusion / Industrial	Zone change/amendment from exclusive agriculture (A) to natural resource 5 gross acre minimum lot size [NR(5)] district; exclusion from agricultural preserve
Located at the existing Occidental gas plant	Occidental of Elk Hills	Authority to construct (air permits) / Industrial	Construct and operate a cryogenic natural gas processing plant. Currently designated as Limited Agriculture and is currently zoned as Limited Agriculture (A-1). Pursuant to Section 19.14.020(E) of the Zoning Ordinance of Kern County; gas exploration and production are a permitted use in Zone A-1. The core property in which the proposed gas plant will be located is zoned Limited Agriculture (A-1), which is consistent with the surrounding land use.

2.0 INTRODUCTION

TABLE 2-1: PROPOSED PROJECTS WITHIN 6-MILES OF THE PROJECT SITE			
Project Location	**Applicant**	**Required Approvals / Use Type**	**Request**
Located in Section 11 and 12, T.30.S, R.22E., MDB&M, approximately 1 mile south of State Highway 58 and approx four miles southwest of the California Aqueduct.	11Z Development / Occidental of Elk Hills, Inc.	Well permits / Industrial	Limited to no more than 10 oil and gas wells and associated infrastructure. A portion of this pipeline corridor would require a new right of way. Entire project currently zone A (Exclusive Agriculture).
The facility will be located near the Elk Hills Field and the unincorporated community of Tupman in western Kern County, California	Hydrogen Energy International LLC / jointly owned by BP Alternative Energy North America Inc. and Rio Tinto Hydrogen Energy LLC	Authority for certification (Cal energy Comm) / Industrial	HECA - gasify 100 percent petroleum coke (petcoke) (or blends of petcoke and coal, as needed) to produce hydrogen to fuel a combustion turbine operating in combined cycle mode - predominantly used for agricultural purposes
19Z Diatomite Development Project, Section 19, T30S, R22E, MDB & M, Kern County	Plains Exploration & Production Company	IS/MND	Oil & Gas Exploration / Production (49 Oil & Gas Wells)
Diatomite & North Midway Sunset Development, Section 1, 2, 3, 12 and 11 T31S, R22E, Section 36, T30S, R22E MDB&M, Kern County	Berry Petroleum Company	IS/MND	Enhanced oil recovery via cyclic steam injection.

2.6 Incorporation by Reference

The following documents are hereby incorporated by reference into this SEI and are available for review at the Kern County Planning Department. A brief synopsis of the scope and content of these documents is provided below.

Kern County General Plan (2004)

The Kern County General Plan is a policy document with planned land use maps and related information that is designed to give long-range guidance to those County officials making decisions affecting the growth and resources of the unincorporated Kern County jurisdiction, excluding the metropolitan Bakersfield planning area. This document, adopted on June 15, 2004, helps to ensure that day-to-day decisions conform to the long-range program designed to protect and further the public interest as related to Kern County's growth and development and mitigate environmental

impacts. The General Plan also serves as a guide to the private sector of the economy in relating its development initiatives to the public plans, objectives, and policies of the County (Kern County 2004a).

Kern County Zoning Ordinance (February 2005)

According to Chapter 19.02.020, Purposes, Title 19 was adopted to promote and protect the public health, safety, and welfare through the orderly regulation of land uses throughout the unincorporated area of Kern County. Further, the purposes of this title are to:

- Provide the economic and social advantages resulting from an orderly planned use of land resources;
- Encourage and guide development consistent with the Kern County General Plan;
- Divide Kern County into zoning districts of a number, size, and location deemed necessary to carry out the purposes of the Kern County General Plan and this title;
- Regulate the size and use of lots, yards, and other open spaces;
- Regulate the use, location, height, bulk, and size of buildings and structures;
- Regulate the intensity of land use;
- Regulate the density of population in residential areas;
- Establish requirements for off-street parking;
- Regulate signs and billboards; and
- Provide for the enforcement of the regulations of Chapter 19.02 (Kern County Planning Department 2005).

2007 Destination 2030: Regional Transportation Plan

The latest Regional Transportation Plan was adopted in the summer of 2007. 2007 Destination 2030 is a long-term (20-year) general plan for the region's transportation network, and encompasses projects for all types of travel, including aviation and freight movement. The plan assesses environmental impacts of proposed projects, and establishes air quality conformity as required by federal regulations. The document also discusses inter-modal and multi-modal transportation activities. (Kern COG 2007).

2.0 INTRODUCTION

County of Kern Housing Element (2002–2007)

The development and preservation of adequate and affordable housing is important to the well-being of the residents and the economic prosperity of the County. To plan for the development of adequate housing for all income segments, a Housing Element was prepared as a part of the Kern County General Plan. This document specifically addresses housing needs and resources in the County's unincorporated areas (Kern County 2002). The Housing Element must maintain consistency with the other elements of the Kern County General Plan.

Kern County Airport Land Use Compatibility Plan (2006)

The Kern County Airport Land Use Compatibility Plan (ALUCP) was originally adopted in 1996, and has since been amended to comply with Aeronautics Law, Public Utilities Code (Chapter 4, Article 3.5) regarding public airports and surrounding land use planning. As required by that law, proposals for public or private land use developments that occur within defined airport influence areas are subject to compatibility review. The principle airport land use compatibility concerns addressed by the plan are (1) exposure to aircraft noise; (2) land use safety with respect to both people and property on the ground and the occupants of aircraft; (3) protection of airport air space; and (4) general concerns related to aircraft overflights.

The ALUCP identifies policies and compatibility criteria for influence zones or planning area boundaries. The ALUCP maps and labels these zones as A, B1, B2, C, and D, ranging from the most restrictive (A – airport property-runway protection zone) to the least restrictive (D – disclosure to property owners only). As required by law, the following affected cities have adopted the ALUCP for their respective airports: Bakersfield, California City, Delano, Shafter, Taft, Tehachapi, and Wasco.

2.7 Sources

This SEI is dependent upon information from many sources. Some sources are studies or reports that have been prepared specifically for this document. Other sources provide background information related to one or more issue areas that are discussed in this document.

The sources and references used in the preparation of this SEI are listed in Chapter 7, "Bibliography".

3.0 PROJECT DESCRIPTION ADDENDUM

3.0 Project Description Addendum

3.1 Introduction and Purpose

This Addendum has been prepared to supplement the previously submitted Project Description. In preparing this Supplemental Environmental Information (SEI), Stantec Consulting Corporation (Stantec) is using an updated project description based on the design from the Preliminary Front End Engineering Design (Pre-FEED) analysis as modified by additional engineering studies provided by Occidental of Elk Hills, Inc. (OEHI) for the carbon dioxide (CO2) Enhanced Oil Recovery (EOR) Project. The additional studies provide more refined details on the Project well requirements, well disturbance footprints, pipeline length requirements, pipeline right of way (ROW) disturbances, personnel requirements, and baseline case assumptions. A list of key existing project description materials available for the proposed Project at the time this document was prepared is referenced in Section 3.6.

The purpose of this Addendum is to incorporate new assumptions provided by OEHI to best describe the Project Site in order to complete a California Environmental Quality Act (CEQA) equivalent evaluation herein referred to as a SEI to be submitted to the California Energy Commission (CEC) for the Project.

3.2 Summary of Modified Project Elements

3.2.1 CO2 EOR Project Wells

The original Project Description provided by ManageTech identified a projected total of 550 injection and production wells. Upon additional evaluation, OEHI has increased the number of projected wells to 720 (309 injection wells and 411 production wells). OEHI has designed the Project to utilize existing wells to the maximum extent feasible. It is estimated that 570 of the 720 wells necessary for the proposed Project will utilize pre-existing well locations. The remaining 150 wells will be new installations.

Utilizing existing wells and pads will substantially reduce the amount of Project disturbances and reduce the potential air quality biological and cultural impacts that could result from Project implementation. Well installation disturbance footprints are discussed further in Section 3.4.2.

3.2.2 Well Installation and Conversion Schedule

Table 3-1 (Well Installation and Conversion Schedule) lists the number of new wells installed and number of existing wells that will be converted to use for the Project on an annual basis.

3.0 PROJECT DESCRIPTION ADDENDUM

TABLE 3-1: WELL INSTLLATION AND CONVERSION SCHEDULE			
Year	**Number of New Wells Installed**	**Number of Existing Wells Converted for Project Use**	**Total Wells**
2014	0	36	36
2015	0	36	36
2016	18	18	36
2017	4	32	36
2018	0	36	36
2019	0	36	36
2020	8	28	36
2021	0	36	36
2022	9	27	36
2023	27	9	36
2024	0	36	36
2025	20	16	36
2026	0	36	36
2027	0	36	36
2028	0	36	36
2029	20	16	36
2030	0	36	36
2031	21	15	36
2032	0	36	36
2033	23	13	36
Totals	150	570	720

3.0 PROJECT DESCRIPTION ADDENDUM

3.3 Pipelines

3.3.1 Ancillary Project Support Pipelines

The original Project Description estimated approximately 550 miles of ancillary piping for operation of the CO2 EOR Project (which equated to approximately 1 mile of pipeline per well). Further analyses of Project well and piping requirements performed by OEHI indicate that between approximately 552-652 miles of pipeline may be necessary. The higher estimate of 652 miles was developed in consideration of surface encumbrances (e.g., topographic constraints, goal of utilizing existing pipeline ROWs to the maximum extent feasible, and avoidance of environmentally and culturally sensitive areas of concern). The higher estimate of 652 miles of supporting pipelines (anticipated worst-case scenario) was used within this SEI to analyze potential environmental impacts of the Project pipelines. A Project pipeline summary is provided below in Table 3-2 (Project Pipeline Summary).

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Satellite 1											
Liquid Gathering	8,308	9,814	12"	500	CS - HDPE		x				
Water Injection	8,360	9,875	12"	3000	CS - HDPE		x				
Gas Gathering	8,312	9,819	18"	500	CS - HDPE			x			59
Gas Gathering	8,312	9,819	18"	500	CS - HDPE			x			
Low Purity CO_2	8,332	9,842	6"	3500	CS			x			
High Purity CO_2	8,353	9,867	6"	3500	CS			x			
Sub- Totals Trunklines **49,977**											
Production Flowline	76,767	90,681	4"	2200	CS - IPC	x					
Injection Flowline	48,207	56,945	4"	3000	SS				x		40
Sub- Totals Flowlines **124,974**											
Satellite 2											
Liquid Gathering	9,296	10,981	12	500	CS - HDPE		x				
Water Injection	9,438	11,149	12	3000	CS - HDPE		x				
Gas Gathering	9,283	10,966	18	500	CS - HDPE			x			59
Gas Gathering	9,283	10,966	18	500	CS - HDPE			x			
Low Purity CO_2	9,946	11,749	6	3500	CS			x			
High Purity CO_2	9,432	11,142	6	3500	CS			x			
Sub- Totals Trunklines **56,678**											
Production Flowline	69,809	82,462	4	2200	CS - IPC	x					
Injection Flowline	47,625	56,257	4	3000	SS				x		40
Sub- Totals Flowlines **117,434**											
Satellite 3											
Liquid Gathering	10,304	12,172	10"	500	CS - HDPE		x				
Water Injection	9,927	11,726	10"	3000	CS - HDPE		x				
Gas Gathering	10,323	12,194	16"	500	CS - HDPE			x			52
Low Purity CO_2	9,946	11,749	4"	3500	CS			x			
High Purity CO_2	9,934	11,735	4"	3500	CS			x			
Sub- Totals Trunklines **50,434**											
Production Flowline	63,006	74,426	4"	2200	CS - IPC	x					
Injection Flowline	33,528	39,605	4"	3000	SS				x		40
Sub- Totals Flowlines **96,534**											

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Satellite 4											
Liquid Gathering Lateral	2,814	3,324	12"	500	CS - HDPE		x				
Water Injection Lateral	3,315	3,916	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	2,818	3,329	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	3,309	3,909	6"	3500	CS			x			
Sub- Totals Trunklines											
12,256											
Production Flowline	82,513	97,468	4"	2200	CS - IPC	x					
Injection Flowline	69,694	82,326	4"	3000	SS				x		40
Sub- Totals Flowlines											
152,207											
Satellite 5											
Liquid Gathering Lateral	3,352	3,960	10"	500	CS - HDPE		x				
Water Injection Lateral	3,533	4,173	10"	3000	CS - HDPE		x				
Gas Gathering Lateral	3,363	3,973	16"	500	CS - HDPE			x			47
CO_2 Injection Lateral	3,526	4,165	4"	3500	CS			x			
Sub- Totals Trunklines											
13,774											
Production Flowline	39,806	47,021	4"	2200	CS - IPC	x					
Injection Flowline	44,782	52,899	4"	3000	SS				x		40
Sub- Totals Flowlines											
84,588											
Satellite 6											
Liquid Gathering Lateral	3,641	4,301	10"	500	CS - HDPE		x				
Water Injection Lateral	3,903	4,610	10"	3000	CS - HDPE		x				
Gas Gathering Lateral	3,650	4,312	16"	500	CS - HDPE			x			47
CO_2 Injection Lateral	3,894	4,600	4"	3500	CS			x			
Sub- Totals Trunklines											
15,088											
Production Flowline	43,147	50,967	4"	2200	CS - IPC	x					
Injection Flowline	42,926	50,706	4"	3000	SS				x		40
Sub- Totals Flowlines											
86,073											

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Satellite 7											
Liquid Gathering Lateral	3,584	4,234	12"	500	CS - HDPE		x				
Water Injection Lateral	3,921	4,632	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	3,586	4,236	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	3,911	4,620	6"	3500	CS			x			
Sub- Totals Trunklines 15,002											
Production Flowline	102,702	121,317	4"	2200	CS - IPC	x					
Injection Flowline	129,728	153,241	4"	3000	SS				x		40
Sub- Totals Flowlines 232,430											
Satellite 8											
Liquid Gathering Lateral	1,083	1,279	12"	500	CS - HDPE		x				
Water Injection Lateral	1,121	1,324	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	1,091	1,289	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	1,113	1,315	6"	3500	CS			x			
Sub- Totals Trunklines 4,408											
Production Flowline	59,072	69,779	4"	2200	CS - IPC	x					
Injection Flowline	75,066	88,672	4"	3000	SS				x		40
Sub- Totals Flowlines 134,138											
Satellite 9											
Liquid Gathering Lateral	5,769	6,815	12"	500	CS - HDPE		x				
Water Injection Lateral	6,139	7,252	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	5,768	6,813	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	6,132	7,243	6"	3500	CS			x			
Sub- Totals Trunklines 23,808											
Production Flowline	56,004	66,155	4"	2200	CS - IPC	x					
Injection Flowline	53,868	63,632	4"	3000	SS				x		40
Sub- Totals Flowlines 109,872											
Satellite 4 - 9 Gathering Trunklines											
Liquid Gathering	79,276	93,645	16"	500	CS - HDPE		x				
Water Injection	79,512	93,924	16"	3000	CS - HDPE		x				
Gas Gathering	79,092	93,427	26"	500	CS - HDPE			x			47
CO_2 Injection	79,448	93,848	12"	3500	CS			x			
Sub-Total Gath. T/L 4 - 9 317,328											

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Satellite 10											
Liquid Gathering Lateral	946	1,117	12"	500	CS - HDPE		x				
Water Injection Lateral	643	760	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	958	1,132	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	639	755	6"	3500	CS			x			
Sub- Totals Trunklines											
3,186											
Production Flowline	66,692	78,780	4"	2200	CS - IPC	x					
Injection Flowline	50,499	59,652	4"	3000	SS				x		40
Sub- Totals Flowlines											
117,191											
Satellite 11											
Liquid Gathering Lateral	1,543	1,823	12"	500	CS - HDPE		x				
Water Injection Lateral	1,237	1,461	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	1,555	1,837	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	1,235	1,459	6"	3500	CS			x			
Sub- Totals Trunklines											
5,570											
Production Flowline	65,685	77,590	4"	2200	CS - IPC	x					
Injection Flowline	63,009	74,429	4"	3000	SS				x		40
Sub- Totals Flowlines											
128,694											
Satellite 12											
Liquid Gathering Lateral	1,793	2,118	10"	500	CS - HDPE		x				
Water Injection Lateral	2,111	2,494	10"	3000	CS - HDPE		x				
Gas Gathering Lateral	1,786	2,110	16"	500	CS - HDPE			x			47
CO_2 Injection Lateral	2,098	2,478	4"	3500	CS			x			
Sub- Totals Trunklines											
7,788											
Production Flowline	82,496	97,448	4"	2200	CS - IPC	x					
Injection Flowline	56,074	66,237	4"	3000	SS				x		40
Sub- Totals Flowlines											
138,570											

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Satellite 13											
Liquid Gathering Lateral	864	1,021	12"	500	CS - HDPE		x				
Water Injection Lateral	912	1,077	12"	3000	CS - HDPE		x				
Gas Gathering Lateral	872	1,030	18"	500	CS - HDPE			x			47
CO_2 Injection Lateral	902	1,065	6"	3500	CS			x			
Sub- Totals Trunklines 3,550											
Production Flowline	51,558	60,903	4"	2200	CS - IPC	x					
Injection Flowline	31,137	36,781	4"	3000	SS				x		40
Sub- Totals Flowlines 82,695											
Satellite 10 - 13 Gathering Trunklines											
Liquid Gathering	120,570	142,423	16"	500	CS - HDPE		x			Note that there are actually 2 lines each with 1/2 the footage in cell D189	
Water Injection	120,554	142,404	16"	3000	CS - HDPE		x			Note that there are actually 2 lines each with 1/2 the footage in cell D190	
Gas Gathering	120,564	142,416	26"	500	CS - HDPE			x		Note that there are actually 2 lines each with 1/2 the footage in cell D188	59
CO_2 Injection	120,558	142,409	12"	3500	CS			x		Note that there are actually 2 lines each with 1/2 the footage in cell D191	
Sub- Totals Gath. Lines 482,246											
CO_2 Trunkline from 27S to 7R (A1 / A2) and Laterals											
CO_2 Injection	61,013	72,072	12"	3500	CS			x		Note this line will be in same ROW as Satellite 10-13 Gathering Trunklines (see rows 188-191)	40
CO_2 Lateral to 346-7R	1,739	2,054	6"	3500	CS				x		40
CO_2 Lateral to 357-7R	1,173	1,386	6"	3500	CS				x		40
CO_2 Lateral to 356-7R	722	853	6"	3500	CS				x		40
CO_2 Lateral to 355-7R	603	712	6"	3500	CS				x		40
CO_2 Lateral to 354-7R	1,526	1,803	6"	3500	CS				x		40
CO_2 Lateral to 364-7R	1,537	1,816	6"	3500	CS				x		40
CO_2 Lateral to 353-7R	2,400	2,835	6"	3500	CS				x		40
Sub-Total CO2 Trunkl. 70,713											
Tie-In Pipelines from 27S to 3G											
Residue Gas	8,019	9,472	6"	1200	CS		x				
Nitrogen	8,452	9,984	8"	1200	CS		x				

3.0 PROJECT DESCRIPTION ADDENDUM

Service	Length	Length w/ Design All.	Size	Pressure	Material	Above Ground Concrete Sleepers *	Above Ground Pipe Rack *	Buried - Multiline ROW	Buried - Single Line ROW	Comments	Buried Lines Disturbed ROW Width (ft)
	5%	12.5%									
Tie-In Pipelines from 27S to 18G and 13B											
Oil	37,661	44,487	8"	400	CS		x				
Water Trunkline	48,339	57,100	10"	400	CS - HDPE		x				
Water Lateral	1,460	1,725	10"	400	CS - HDPE		x				
Water Lateral	1,403	1,657	10"	400	CS - HDPE		x				
Water Lateral	1,910	2,256	10"	400	CS - HDPE		x				
Water Lateral	836	988	10"	400	CS - HDPE		x				
Water Lateral	689	814	10"	400	CS - HDPE		x				
Sub-Total Tie-in											
54,637											
Tie-In Pipeline from 27S to 35R											
NGL	33,166	39,177	3"	300	CS		x				
Fuel Gas	8,019	9,472	6"	1200	CS		x				
FG Supply to A1/A2 Area	29,054	34,320		300	CS		x				
TOTAL (FEET)	**2,916,214**	**3,444,778**									
TOTAL (MILES)	**552**	**652**									

* Note that above ground piping will need to be buried underneath roads. Calculations should assume approximately 70 ft distance from the edge of the road to where the pipe enters/exits the gounds. So for a road that is 40 ft wide, the total length that the line will be buried is 180 ft. For a line that crosses at a 45°, the buried footage is 250 ft. For a line that crosses at a 30°, the buried footage is 360 ft.

3.0 PROJECT DESCRIPTION ADDENDUM

3.4 Assumptions

3.4.1 ROW Width

Pipelines will be installed within existing ROWs and/or previously disturbed corridors to the maximum extent feasible. Disturbances will also be minimized as a result of multiple Project pipelines being bundled when practical and some types of pipelines being installed above ground. Table 3-2 lists the estimated ROW widths for proposed buried pipelines. As shown in Table 3-2, pipeline ROWs will vary between 40 and 59 feet in width (dependent upon line diameter and whether there are multiple lines installed within the same ROW). Table 3-2 also includes installation methodologies for the pipeline system (e.g., above or below ground, pipe racks, single or multi-line ROW).

3.4.2 Well Installation Footprints

The disturbance footprint for each new well to be installed as part of the proposed Project was calculated based on the use of the Ensign 533 and 535 drilling rigs. The Ensign 533 and 535 drill rigs have an estimated 130 feet wide by 280 feet long (sump and drill rig/pad) disturbance footprint. This equates to an approximately 36,400 square-foot or approximately 0.84 acres of disturbance per new well.

3.4.3 Project Disturbance Estimates

Implementation of the proposed Project will result in both permanent and temporary land disturbances. Table 3-3 (Estimated Project Disturbances) presents the total estimated disturbances from each Project component.

3.0 PROJECT DESCRIPTION ADDENDUM

TABLE 3-3: ESTIMATED PROJECT DISTURBANCES			
Project Component	**Project Quantity**	**Acres Disturbed**	**Type of Disturbance**
New Well Installations (130′ x 280′ = 0.84 acres/well)	150	126	Permanent
CO2 EOR Processing Facility and Tank Battery	1	101.8	Permanent
CO2 EOR Satellite Stations (2.6 acres each)	13	33.8	Permanent
4-Inch Diameter Buried Pipelines (40′ right of way)	777,057 feet	714	Temporary
6-Inch Diameter Buried Pipelines (59′ right of way)	63,903 feet	87	Temporary
12-Inch Diameter Buried Pipelines (47′ right of way)	261,019 feet	282	Temporary
16-Inch Diameter Buried Pipelines (47′ right of way)	19,122 feet	21	Temporary
18-Inch Diameter Buried Pipelines (59′ right of way)	54,852 feet	74	Temporary
26-Inch Diameter Buried Pipelines (59′ right of way)	199,656 feet	270	Temporary
Total Permanent Disturbance = 261.6 Acres			
Total Temporary Disturbance = 1,447 Acres			

3.5 Personnel Requirements

3.5.1 Project Construction Personnel Requirements

OEHI has developed manpower loading requirements for each major Project component. These manpower estimates were converted into total personnel days by assuming 10 hour workdays and 250 work days per year. Construction labor totals presented in average personnel required per day of the construction year are included below in Table 3-4 (Construction Personnel Requirements).

3.0 PROJECT DESCRIPTION ADDENDUM

TABLE 3-4: CONSTRUCTION PERSONNEL REQUIREMENTS

Construction Year	Personnel Totals (average persons/day/year)	Project Components
2014	195	Main Plant Facilities, Satellites 1 & 2, pipelines, well conversions
2015	385	Main Plant Facilities, Satellites 1, 2, & 3, pipelines, well conversions
2016	64	Satellites 3 & 4, Satellites 4 to 9 gathering trunk lines, well installations/completions, well conversions
2017	299	Main Plant Facilities, Satellites 4 & 5, Satellites 4 to 9 gathering trunk lines, well installations/completions, well conversions
2018	231	Main Plant Facilities, Satellite 5, pipelines, well conversions
2019	329	Main Plant Facilities, Satellite 6, pipelines, well conversions
2020	49	Satellites 6 & 7, well installations/completions, well conversions
2021	74	Satellite 7, well conversions
2022	7	Well installations/completions, well conversions
2023	19	Satellite 8, well installations/completions, well conversions
2024	85	Main Plant Facilities, Satellites 8, well conversions
2025	81	Main Plant Facilities, well installations/completions, well conversions
2026	8	Satellite 9
2027	69	Satellites 9 & 10, Satellites 10 to 13 gathering trunk lines, well conversions
2028	217	Satellites 10 & 11, Satellites 10 to 13 gathering trunk lines, well conversions
2029	53	Satellite 11, well installations/completions, well conversions
2030	8	Satellite 12, well conversions
2031	52	Satellite 12, well installations/completions, well conversions
2032	7	Satellite 13, well conversions
2033	42	Satellite 13, well installations/completions, well conversions

3.0 PROJECT DESCRIPTION ADDENDUM

3.5.2 Baseline Construction Personnel Assumptions

The Elk Hills Oil Field (EHOF) currently employs 345 OEHI personnel and 2,650 contractor personnel on a daily basis (Manage Tech, 2009). Some of this existing on-site labor force will be utilized for Project construction. It is estimated that 75 percent of labor requirements for well and pipeline installation can be accomplished using on-site personnel currently involved in existing operations at the Elk Hills Unit. Additionally, 25 percent of labor requirements needed for construction of facilities and satellite gathering stations would be fulfilled in a similar manner.

3.5.3 Operational Personnel Assumptions

Operation of the Project will result in an incremental increase in personnel requirements beyond those that are currently involved in day to day work activities. The Project is expected to create 25 fulltime, on-site employment positions (20 at the CO2 EOR Processing Facility and 5 field representatives).

3.6 Supporting Documentation

Extensive information is available on the EHOF, CO2 EOR Project, and HECA Project. Below is a list of the primary project description information that has been developed. Other than the Preliminary Project Description (Pre-FEED Stage) that was previously submitted, all of the documents below are considered confidential and proprietary and will not be submitted to the CEC for inclusion in the administrative record.

- *Pre-FEED Engineering Study, Process Design Basis*, Mustang Engineering, April 15, 2010.
- *Preliminary Project Description (Pre-FEED Stage)*, ManageTech Solutions, April 16, 2010.
- *Pre-FEED Engineering Study, Execution Schedule*, Mustang Engineering, April 23, 2010.
- *Pre-FEED Engineering Study, Overall Design Basis*, Mustang Engineering, April 28, 2010.
- *Pre-FEED Engineering Study, Project design drawings, Mustang Engineering, misc dates.*

4.0 Environmental Analyses

4.1 Introduction

Chapter 4 presents the environmental analysis for each subject examined in this SEI. Chapter 4 is subdivided into individual subsections, each of which addresses a specific subject. The following subsections and subjects and included in Chapter 4:

Subject	Section Number
Aesthetics	4.1
Agricultural Resources	4.2
Air Quality	4.3
Biological Resources	4.4
Cultural/Paleontological Resources	4.5
Geology and Soils	4.6
Hazards and Hazardous Materials	4.7
Hydrology and Water Quality	4.8
Land Use and Planning	4.9
Mineral Resources	4.10
Noise	4.11
Population and Housing	4.12
Public Services	4.13
Recreation	4.14
Transportation and Traffic	4.15
Utilities and Services	4.16
Environmental Justice	4.17
Greenhouse Gas Emissions	4.18

4.0 ENVIRONMENTAL ANALYSES

Subsection Format

Each subsection consists of five basic parts: Introduction, Environmental Setting, Regulatory Setting, Impacts/Mitigation Measures and Cumulative Impacts. Each subsection includes an Introduction, which introduces the topic and provides an overview of the impacts to be evaluated. Each subsection includes an Environmental Setting which normally constitutes the baseline physical conditions and a discussion of the policy and relevant technical background. In addition, each subsection includes a Regulatory Setting or a discussion of the various regulations and regulatory agencies pertinent to each impact category. Each subsection includes the Impacts and Mitigation Measures section for each topic which addresses impacts related to the Project and describes mitigation measures. Finally, each subsection includes a Cumulative Impacts section which addresses the cumulative impacts of the proposed Project relative to the projects identified in Chapter 2 for cumulative projects.

Corresponding mitigation measures, unless otherwise noted, will be sufficient to reduce impacts to a less than significant level. When more than one mitigation measure is recommended for a specific impact, all the measures will be required to reduce the impact to a level of less than significant unless the word "or" or "alternatively" appears in the list of mitigation measures. Less than significant impacts have also been identified and discussed for the topical areas in this Chapter. No mitigation is required for less than significant impacts.

Each impact is briefly described and numbered in bold lettering. Text then follows to provide discussion and analysis. At the end of the impacts discussion, mitigation measures are listed and numbered. The summary table in the Executive Summary includes the same text headings and the mitigation measures.

Under CEQA, a significant impact is defined as a substantial, or potentially substantial, adverse change in the environment (Public Resources Code, Section 21068). The criteria for determining significance of a particular impact are identified prior to the impact discussion in each topical section, and are consistent with significance criteria set forth in Appendix G of the State CEQA Guidelines (and the Kern County CEQA Implementation Document).

4.1 Aesthetics

4.1.1 Introduction

Aesthetics, as addressed in the California Environmental Quality Act (CEQA), refers to visual considerations in the physical environment (CERES, 2009). Because a person's reaction and attachment to a given viewshed are subjective, visual changes inherently affect viewers differently. Accordingly, aesthetics analysis, or visual resource analysis, is a systematic process to logically assess visible change in the physical environment and the anticipated viewer response to that change. This section describes the existing landscape character of the Project area, existing views of the area from various on-the-ground vantage points, the visual characteristics of the proposed Project, and the landscape changes that would be associated with the construction and operation of the proposed Project, as seen from various vantage points.

4.1.2 Terminology and Concepts

Visual Resource Terminology and Concepts

When viewing the same landscape, people may have different responses to that landscape and any proposed visual changes, based upon their values, familiarity, concern, or expectations for that landscape and its scenic quality. Because each person's attachment to and value for a particular landscape is unique, visual changes to that landscape inherently affect viewers differently. However, generalizations can be made about viewer sensitivity to scenic quality and visual changes. Recreationists, hikers, equestrians, tourists and people driving for pleasure are expected to have high concern for scenery and landscape character. People who are commuting daily through the same landscape generally have a moderate concern for scenery, while people working at industrial sites (such as oil fields) generally have a lower concern for scenic quality or changes to existing landscape character. The visual sensitivity of a landscape is affected by the viewing distances at which it is seen, such as close-up or far away. The visual sensitivity of a landscape also is affected by the travel speed at which a person is viewing the landscape (high speeds on a highway, low speeds on a hiking trail, or stationary at a residence). The Project was reviewed for sensitive resources with the following viewing ranges:

Foreground – 0 to 0.5 mile from the observer's position. At this distance, the observer can view details of trees, shrubs, wildflowers, and animals.

Middleground – 0.5 to 3 miles from the observer's position. At this distance, the observer can see forest stands, natural openings, masses of shrubs, and rock outcrops.

Background – 3 miles to horizon from the observer's position. At this distance, the observer can view mountain peaks, ridgelines, and patterns of forest stands and openings.

4.1 AESTHETICS

Sensitive Viewing Areas and Key Observation Points

To assess the proposed Project's potential impacts on visual resources, an identification was made of the view areas most sensitive to the proposed Project's potential visual impacts, and six (6) Key Observation Points (KOPs) were selected for detailed analysis. For the KOPs, photo documentation was conducted to serve as a basis for documenting the proposed Project's potential effects. In evaluating the sensitivity of the viewing areas potentially affected by the proposed Project, consideration was given to distance from the proposed Project Site, numbers of viewers, and the presence of residential or recreational uses. The sensitive viewing areas selected for analysis are indicated on Figure 4.1-1: Project Viewsheds and KOPs, and the views from the KOPs are described below.

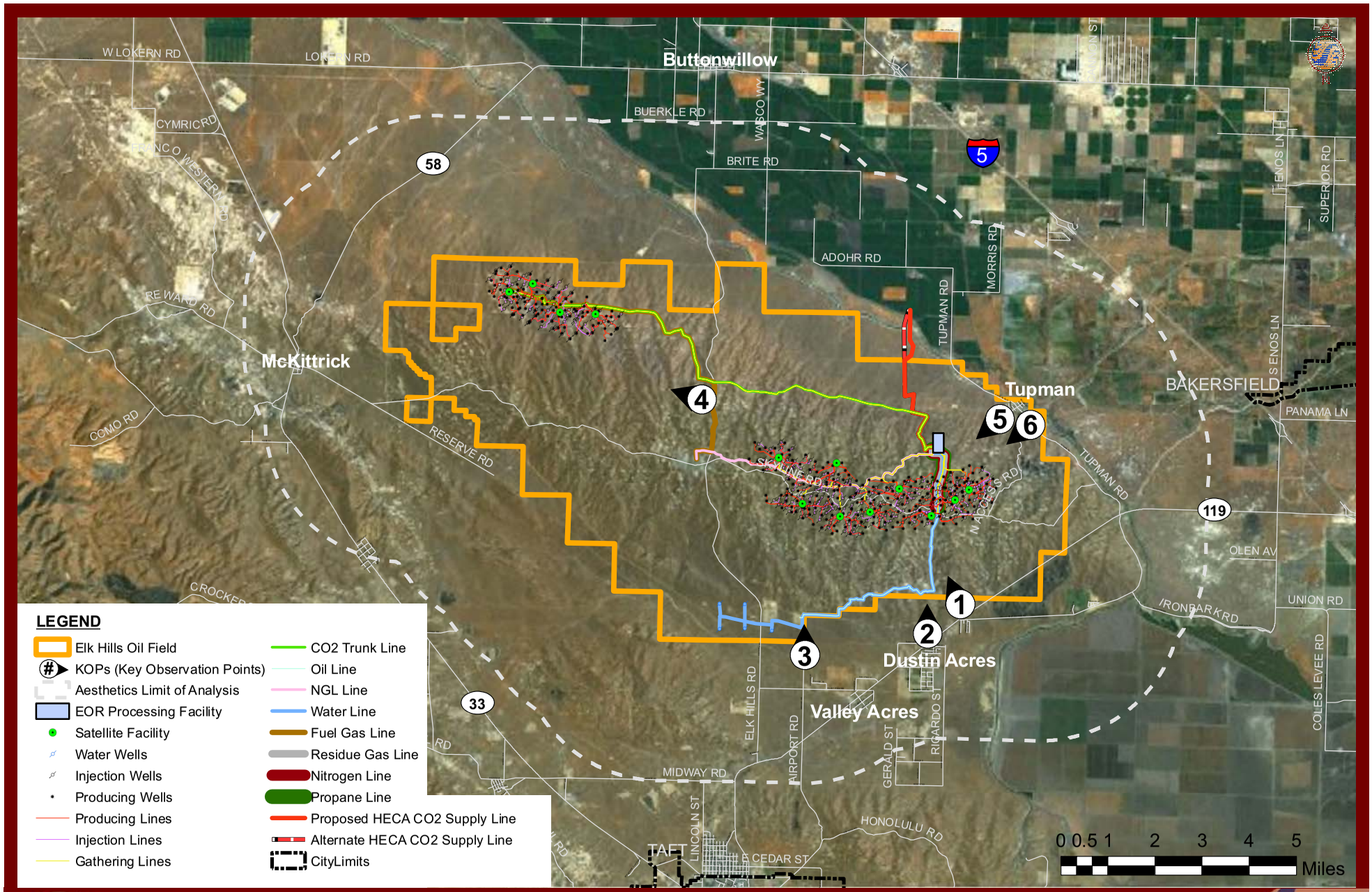

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Fig. 4.1-1

Project Viewshed and KOPs

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4.1 AESTHETICS

The discussion of the views seen from the KOPs includes ratings of the visual quality of the landscapes that they represent. These ratings were developed based on a series of in-field observations, review of photos of the area, review of methods for assessment of visual quality, and review of research on public perception of the environment and scenic beauty ratings of landscape scenes. The final assessment of the visual quality of the views from each of the KOPs was made based on professional judgment that took a broad spectrum of landscape assessment factors into consideration in a holistic way. The factors considered included evaluation of:

- Natural features, including topography, water courses, rock outcrops, and natural vegetation
- Positive and negative effects of man-made alterations and built structures on visual quality
- Visual composition, including assessment of the complexity and vividness of patterns in the landscape
- Spatial organization, including assessment of criteria such as perceived accessibility, mystery, enclosure, scale, image, refuge, prospect, and contemplation

The relevance of these factors for landscape evaluation has been established by landscape perception and assessment research that has taken place over the past 20 years. The final landscape quality ratings developed based on these considerations were expressed in terms of the six landscape quality classes listed in Table 4.1-1. This rating system is based on the scale developed for use with an artificial intelligence system for evaluation of landscape visual quality developed by a group of landscape scholars at Virginia Tech (Buhyoff et al., 1994). This scale provides a robust framework for the qualitative ratings because it is based on the findings of the full range of available research on the ways in which the public evaluates visual quality. In addition, the scale has a common-sense quality and is easily understood because it defines landscape quality in relative terms, contrasting landscapes that are average in visual quality with those that are above and below average, and those that fall at the top and bottom of the landscape quality spectrum.

4.1 AESTHETICS

TABLE 4.1-1. LANDSCAPE VISUAL QUALITY SCALE USED IN RATING THE AREAS POTENTIALLY AFFECTED BY OEHI CO2 EOR PROJECT	
Rating	**Explanation**
Outstanding Visual Quality	A rating reserved for landscapes with exceptionally high visual quality. These landscapes will be significant regionally and/or nationally. They usually contain exceptional natural or cultural features that contribute to this rating. They will be what we think of as "picture post card" landscapes. People will be attracted to these landscapes to be able 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 are often landscapes which have high potential for recreational activities or in which the visual experience is important.
Moderately High Visual Quality	Landscapes which 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.
Moderate Visual Quality	Landscapes which have average scenic value. They usually lack significant man-made 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.
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 the landscape is not dominated by these features. 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 with low scenic value. The landscape is often dominated by visually discordant man-made alterations; or they are landscapes that do not include places that people will find inviting and lack interest in terms of two-dimensional visual attributes.
Note: Rating scale based on Buhyoff et al., 1994.	

4.1.3 Environmental Setting

This section discusses the existing visual character of the region, the existing visual conditions in the proposed Project Site, and the onsite aesthetic characteristics. Also discussed are the existing sources of light and glare within the proposed Project Site and a characterization of the viewers and their sensitivity to visual quality change.

Regional Context and Character

The proposed Project is located approximately 26 miles southwest of Bakersfield in western Kern County, in the EHOF. The Project Site sits on the southwestern edge of the San Joaquin Valley. To the immediate north of the site is the Lokern Area of Critical Environmental Concern (ACEC) which is managed for numerous sensitive and endangered animal species. Approximately 3,110 acres of the

ACEC is controlled by the Bureau of Land Management (BLM). The Center for Natural Lands Management (CNLM) and OEHI operate approximately 200 acres of the surrounding area as conservation areas. Also north of the site is the Tule Elk State Natural Reserve (SNR) which is operated by California State Parks to protect a herd of tule elk that were once in danger of extinction.

Lands to the east include the 6,059 acre Coles Levee Ecological Preserve (CLEP) and a 19,900 acre parcel owned by the Kern Water Bank Authority. The California Aqueduct and West Side Canal converge and flow along the north and eastern boundary of the site. The Kern River also flows along this boundary. Areas to the south and west include the Buena Vista Valley, Buena Vista Lake Bed, Midway Valley and Temblor Range. Beyond the Temblor Range is the 199,030-acre Carrizo Plain National Monument and ACEC.

Several towns are in the project vicinity including Buttonwillow (north), Tupman (northeast), Dustin Acres and Valley Acres (southeast), Taft and Fellows (south), Derby Acres (southwest), and McKittrick (west). Major roadways include SR 58 to the north and west, Insterstate-5 to the north and east, Highways 119 and 33 to the south and east, and SR 33 to the south and west. Bisecting the site north-south is Elk Hills Rd and east-west is Skyline Rd Elk Hills Rd is publically accessible while Skyline Rd is a private gated road.

The character of the surrounding regional landscape is generally rural and undeveloped. The rural flat irrigated agricultural lands of the San Joaquin Valley are to the north and east of the site with dry desert-like rolling/semi-mountainous terrain to the south and west. The site itself and adjacent lands are used primarily for resource extraction such as oil/natural gas production and gravel mining.

Proposed Project Site Existing Aesthetic Characteristics

The proposed Project Site is approximately 48,000 acres characterized by grass and scrub-covered rolling hills that have been substantially altered by decades of oil extraction operations. Elevations of the hills after which the oil field was named vary and range up to 1,551 feet above mean sea level. The entire Project Site is generally open in character with very few trees and sparse shrub vegetation. The most visually prominent features on the proposed Project Site are the dark contrasting forms of various types and scales of oil extraction equipment. The topography of the existing site has been extensively altered to accommodate the large flat pads and access roadways required for operation and maintenance of the oil field. In general, the majority of these facilities are seen at a substantial distance of one mile or more as distant foreground or background elements.

Potential Project Site Visibility

Where there are open views toward the proposed Project Site, the proposed Project has the potential to be visible over long distances. However, as a practical matter, the boundaries of the viewshed were set at 3 miles from the proposed Project Site in directions where views were not otherwise blocked by buildings, trees, topography or other obstructions. This distance was selected because elements of a view that is three miles or more away are considered to be a part of the background, the landscape zone in which little color or texture is apparent, colors blur into values of blue or gray, and individual visual impacts become least apparent (USDA Forest Service 1973, pp. 56-57).

4.1 AESTHETICS

The most prominent element of the proposed Project, the CO2 EOR Processing Facility, will be most visible in views from the community of Tupman. In addition, some small components of the proposed Project will be partially visible from the communities of Dustin Acres, Valley Acres, and motorists on portions of Elk Hills Rd, SR 58, Tupman Road, and SR 119. Detailed discussions of the visibility of the Project from these vantage points are available in the associated KOP discussions below. Skyline Rd. traverses the project site east-west. This roadway is private access only. Visibility of the project will be very limited or blocked by combinations of distance and topography from the nearby communities of Taft, Fellows, Derby Acres, McKittrick, Buttonwillow, to visitors at the Tule Elk Hills State Reserve picnic areas and interpretive stations and from motorists on SR 33. Accordingly, these locations have not been considered further in this analysis.

Project Components

The primary Project components are listed below.

- CO2 and Water Distribution Pipelines (sizes vary up to 12″)
- Satellite Gathering Systems (a total of 13 Satellites)
- Infield Distribution Flowlines, Injection Lines and Gathering Pipelines
- NWS Low Pressure Injection Facility (A1/A2)
- CO2 EOR Processing Facility
    - Central Tank Battery (CTB) including Water Treating and Injection
    - Reinjection Compression Facility (RCF)
    - CO2 Recovery Plant (CRP)
- Utilities and Infrastructure, including tie-in Pipelines

Key Observation Points

A field survey was conducted in September 2010 to photograph and document visual features on and around the proposed Project Site. The site and surrounding environment were observed from various KOPs and photographically documented to provide a baseline upon which to analyze visual impacts (see Figures 4.1-1 through 4.1-4). The degree of impact is contingent upon the magnitude and intensity of change in the visual resources and the viewer's responses to those changes based on viewer sensitivity. Below is a brief description of the view and visual quality of the KOPs considered in this analysis. Potential impacts to the KOPs are discussed in Section 4.1.5.

KOP 1: Dustin Acres – Hwy 119 and Golf Course Rd

The upper right image of Figure 4.1-2 represents the view from KOP 1, which was selected to represent the view of a number of residences near this intersection and from motorists travelling to/from the Mifflin Buena Vista Golf Course, which can both be considered sensitive viewers. From

this vantage point the foreground is dominated by SR 119. The middle ground is the relatively undisturbed scrub covered base of the Elk Hills and in the background and composing the horizon line are the Elk Hills which also show little evidence of the oil extraction operations taking place just over the hill. The visual quality of this KOP can be considered moderately-low to moderate.

KOP 2: Dustin Acres - Hwy 119 and Tank Farm Rd

The lower right image of Figure 4.1-2 represents the view from KOP 2, which was selected to represent the view of a number of residences whose properties abut Tank Farm Rd or Sun Ridge Ave. From this vantage point the foreground and middle ground consist of relatively flat visually intact grasslands with sparse shrub vegetation. In the middle ground, approximately one-mile away, above-ground sections of a pipeline can be seen as a dark weathered-steel line contrast against the tan colored grasses. In the background are the Elk Hills and EHOF with evidence of significant topographic disturbance from roadway cuts and the cut/fill slopes of engineered pads for buildings and extraction equipment. On the horizon are many tall vertical structures such as derricks, power poles, communication towers etc. The visual impacts of these background elements are lessened due to distance (2.5-3 miles) however, it remains apparent that man-made alterations have been made to the hills. The visual quality of this KOP can be considered low to moderately-low.

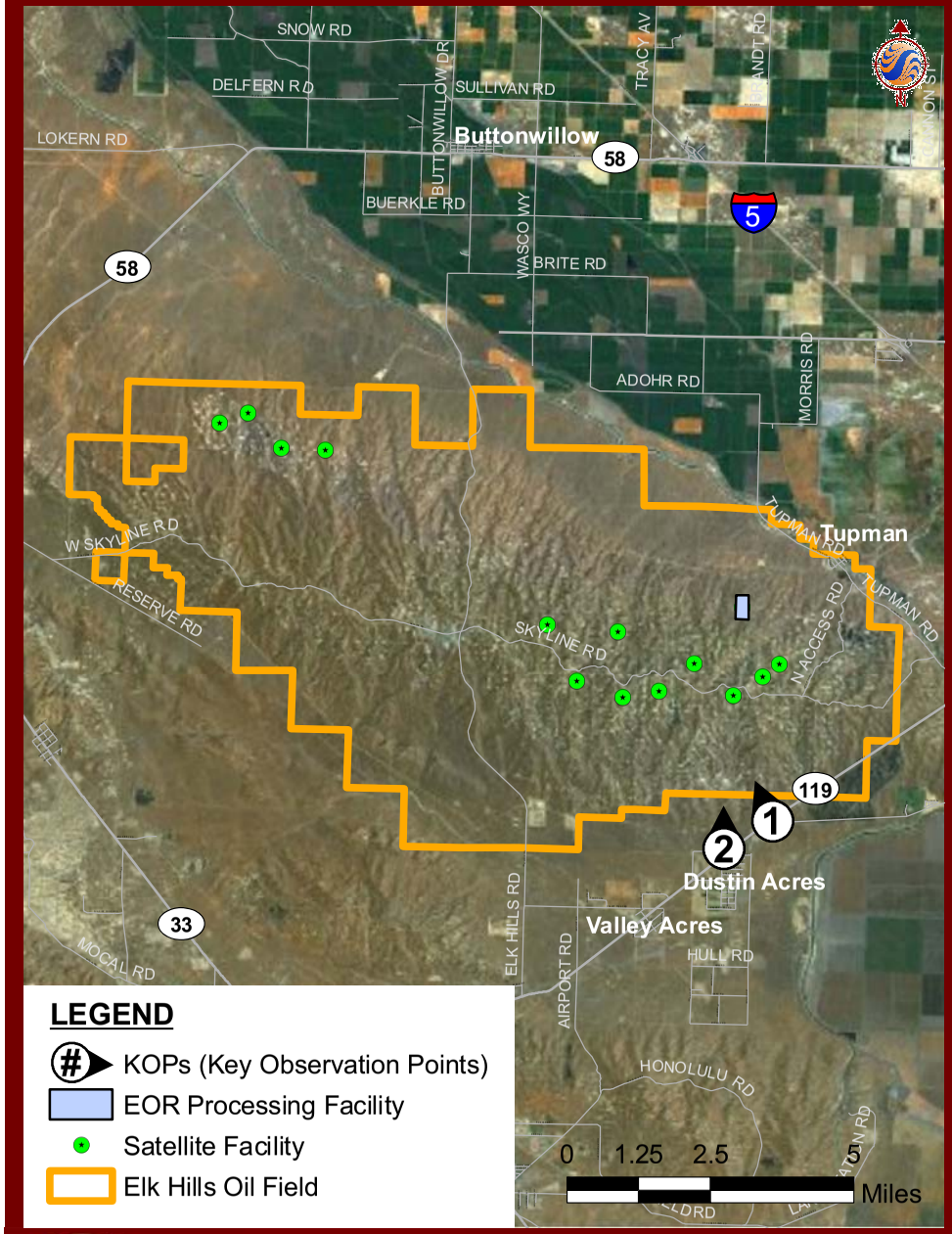

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Fig. 4.1-2

Key Observation Points 1 and 2

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KOP 3: Valley Acres looking north from Airport Rd

The upper right image of Figure 4.1-3 represents the view from KOP 3, which was selected to represent the view from the residents of Valley Acres. This KOP is also representative of the views of motorists on Valley West Rd through Valley Acres who are looking toward the Project. In general the view from this KOP is very similar to KOP 2 in Dustin Acres, with the added distance of approximately one half mile from the proposed alterations. The foreground and middle ground consist of relatively flat land with dense shrub vegetation. In the far middle ground is a substantial dense collection of large white cylindrical tanks used for oil separation. In the background are the Elk Hills and EHOF with evidence of significant topographic disturbance from roadway cuts and the cut/fill slopes of engineered pads for buildings and extraction equipment. On the horizon are many tall vertical structures such as derricks, power poles, communication towers etc. The visual impacts of these background elements are lessened due to distance (3-3.5 miles), however it remains apparent that man-made alterations have been made to the hills. The visual quality of this KOP can be considered low to moderately-low.

KOP 4: Elk Hills Rd Looking Northwest

The lower right image of Figure 4.1-3 represents the view from KOP 4, which was selected to represent views within the project site along Elk Hills Road near where the proposed CO2 trunk line (from Stevens Reservoir to Northwest Stevens Reservoir), gathering line, and producing line cross under the roadway. The foreground view from this location consists of fence lines, unpaved roadways, and utility poles. An existing pipeline that passes under Elk Hills Road approximately 300 feet south of the KOP location can be seen bearing up the hill directly toward the aging white cylindrical tower in the middle ground left of the image. The middle ground view is dominated by the characteristic topography of the Elk Hills. Crossing through the hills are several unpaved roadways, engineered pads for buildings and extraction equipment, power poles, etc. The background views are of seemingly unaltered Elk Hills land though a few derricks and poles project up against the ridgeline. In the distant background is the eastern slope of the Temblor Range. The visual quality of this KOP can be considered low.

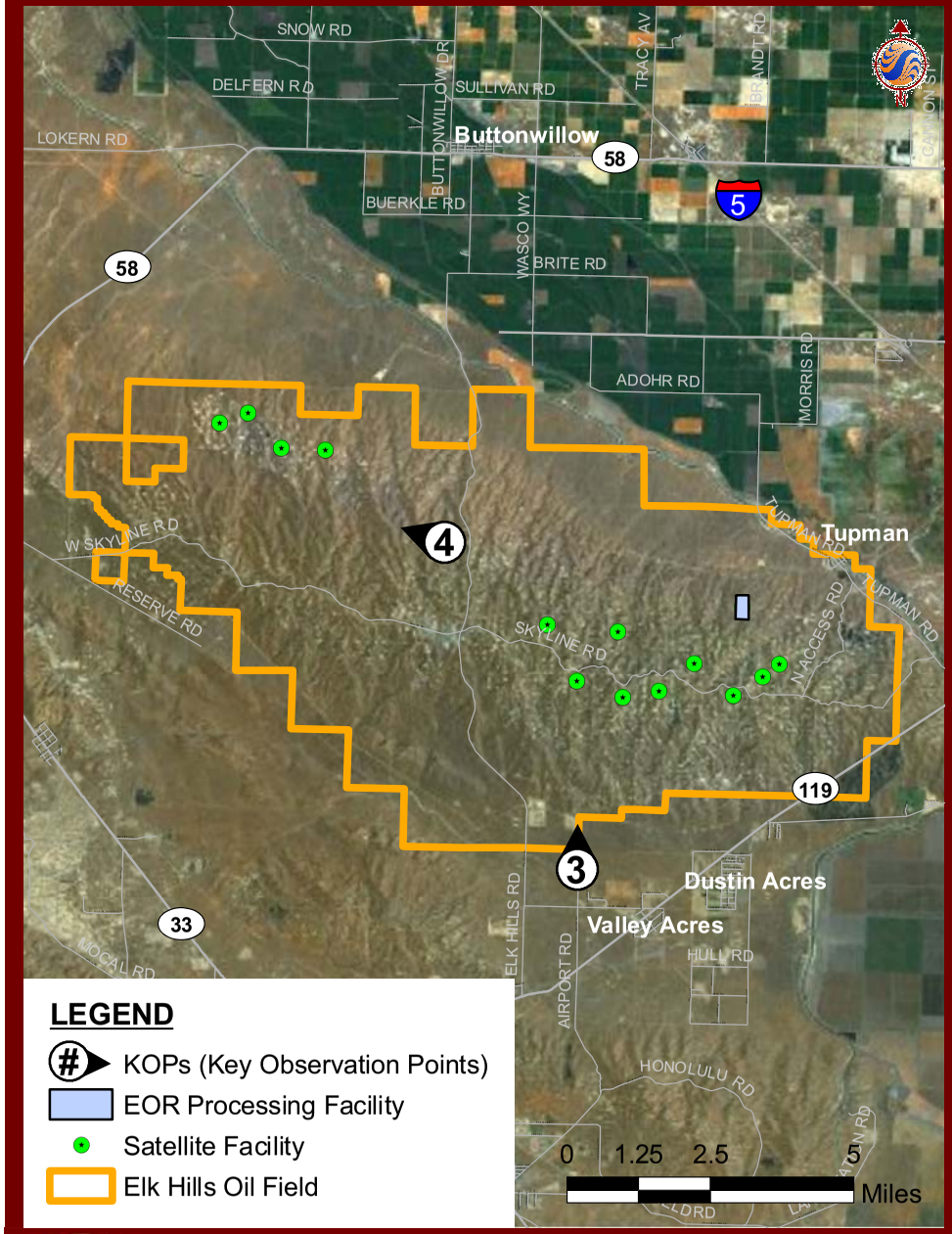

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Fig. 4.1-3

Key Observation Points 3 and 4

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KOP 5: Tupman looking southwest from Grace Ave

The upper right image of Figure 4.1-4 represents the view from KOP 5, which was selected to represent the views toward the proposed Project Site from the southwestern border of the community and Elk Hills Elementary. The existing foreground and middle ground view consists of the grass covered topography of the Elk Hills. The distant middle ground and background views are of the higher elevations of the Elk Hills, which have been substantially altered by decades of oil production operations. Large undeveloped areas are divided by unpaved roads and steep cut-fill slopes anchor industrial buildings and various configurations of extraction machinery. The dark profiles of these man-made elements project above the horizon line in contrast to the sky beyond. From this distance (1.5+ miles) these impacts begin to blend into the background, however it is apparent that man-made alterations are present. The visual quality of this KOP can be considered moderately-low to low.

KOP 6: Tupman looking south-southwest near the post office

The lower right image of Figure 4.1-4 represents the view from KOP 6, which was selected to represent views toward the proposed Project Site from the eastern entrance to the community of Tupman, near the post office. The majority of views toward the Project Site on the approach to Tupman are screened by significant topography, however at the east entrance to the community a view opens up from which some of the most direct views of the Project Site will be available. From this vantage point the foreground and middle ground consist of relatively flat visually intact grasslands with little to no shrub vegetation. The far middle ground and background are very similar to KOP 5 however some middle ground topography partially screens these views. The visual quality of this KOP can be considered moderately-low to low.

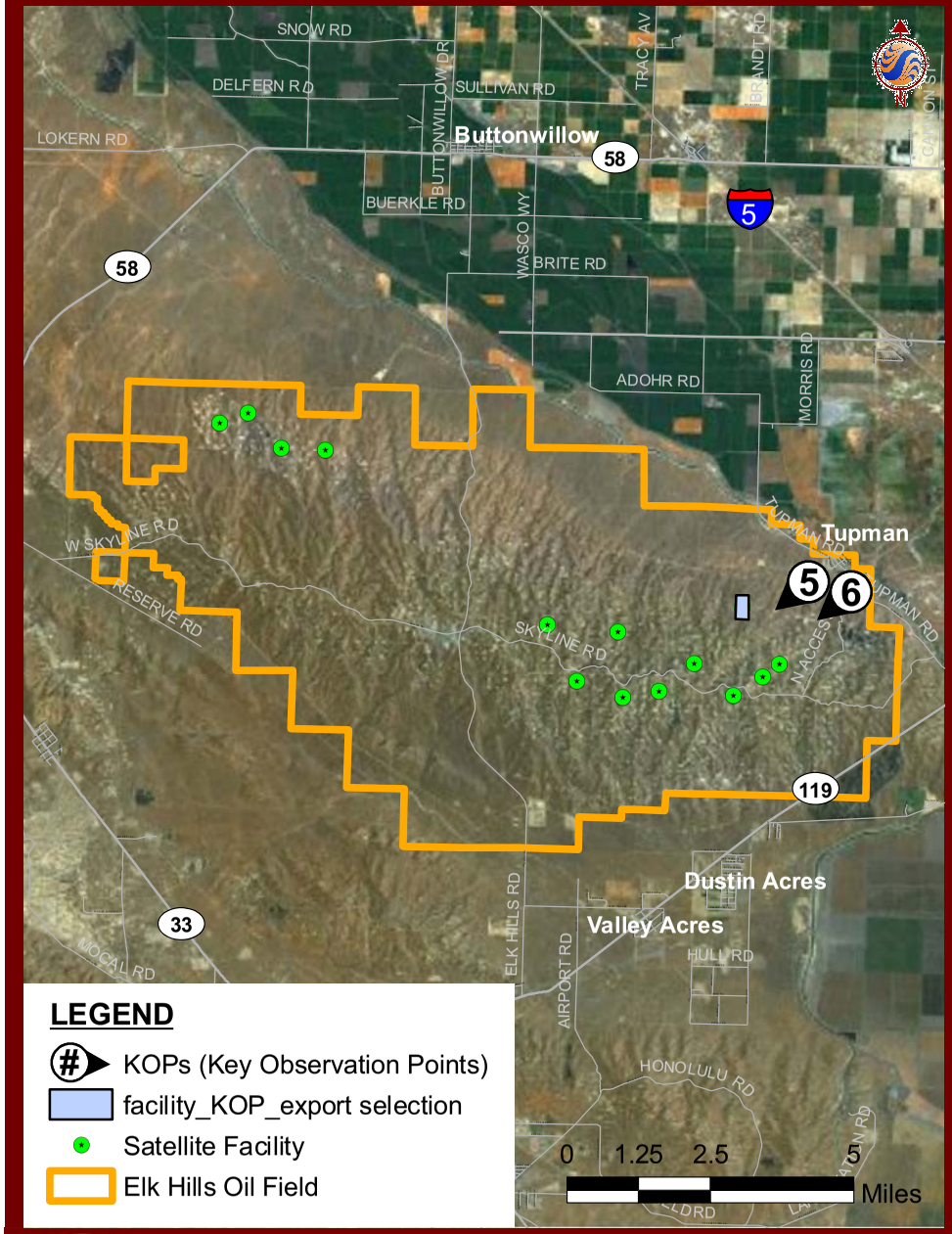

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Fig. 4.1-4

Key Observation Points 5 and 6

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Light and Glare

Analysis of potential light and glare impacts with regard to visual resources considers the following:

- Artificial sky glow: The brightening of the night sky attributable to human-created sources of light.
- Glare: Light that causes visual discomfort or disability or a loss of visual performance.
- Spill light: Light from a lighting installation that falls outside of the boundaries of the property on which the installation is sited.
- Light trespass: Spill light that because of quantitative, directional, or type of light causes annoyance, discomfort, or loss in visual performance and visibility.

The areas surrounding the Project Site consist primarily of large areas dedicated to agricultural crops and rural residences. These areas do not generate substantial amounts of glare, lighting, or illumination, and their ambient nighttime illumination levels are very low.

State Scenic Highways

A Scenic Route is any freeway, highway, road, or other public right-of-way which traverses an area of exceptional scenic quality. A Scenic Route must be officially designated as a Scenic Route by the State of California. A route shall not be selected as scenic until a plan and program for the protection and enhancement of adjacent roadside viewshed land is available for implementation.

The California Scenic Highways Master Plan designates three State highways in Kern County as an "Eligible State Scenic Highway":

- State Route 14 and State Highway 395
- State Route 58 between Mojave and Boron
- Five miles of State Route 41 in northwest Kern County

In addition to the already identified "Eligible State Scenic Highways," other highways under consideration for designation or protection through the Scenic Corridor Combining District of the Kern County General Plan, Circulation Element, include Highway 58 between Tehachapi and Bakersfield.

4.1.4 Regulatory Setting

This section describes the laws, ordinances, regulations, or standards relevant to the visual resource issues associated with the proposed Project. No federal, state, or regional laws, ordinances, regulations and standards (LORS) are known that would apply to the proposed Project's visual resource issues. However, visual resource and urban design concerns germane to the proposed Project are addressed in the *Kern County General Plan.*

4.1 AESTHETICS

Local

Kern County General Plan

Policies

Light and Glare Policies

Policy 47. Ensure that light and glare from discretionary new development projects are minimized in rural as well as urban areas.

Policy 48. Encourage the use of low-glare lighting to minimize nighttime glare effects on neighboring properties.

Scenic Route Corridors Policies

Policy 1. Kern County should consider designating local scenic highway routes, where appropriate, throughout the County.

Policy 2. Various methods of protecting, and enhancing the scenic qualities of land and uses within corridor boundaries must be devised and carried out.

Policy 3. Standards for corridor protection should parallel those established by State Scenic Highway Law (1963) and outlined in State guidelines.

Kern County Zoning Ordinance

The site is zoned (A) Agriculture and (A-1) and Limited Agriculture. Review of these chapters as well as Chapter 19.98 Oil and Gas Production did not reveal any ordinances for these districts applicable to the proposed Project. Please see the Land Use section of this document for discussions of allowable uses, height restrictions, etc. applicable to the project.

State

California Department of Transportation

The California Scenic Highway Program preserves and protects scenic highway corridors from changes that would diminish their aesthetic value. The California Department of Transportation designates scenic highway corridors and establishes those highways that are eligible for the program. The program was created in 1963 with the enactment of the State Scenic Highways Law. The street and highway code includes a list of those highways that are either eligible for designation or are designated. The proposed Project Site is not within the viewshed of any Designated State Scenic Highway. Currently, there are no Officially Designated Scenic Highways within Kern County. The Scenic Highway Program identifies SR 14 north of Mojave and SR 58 east of Mojave as "Eligible State Scenic Highways," which is distinct from an official scenic designation.

4.1 AESTHETICS

4.1.5 Impacts and Mitigation Measures

Methodology

The potential impacts associated with the proposed Project are evaluated through a comparison of the Project with the existing baseline conditions. The visual resources information for the Aesthetics Section was compiled from site photographs and site surveys conducted by Stantec in September 2010. To assess the potential visual impacts, the proposed Project Site was observed from various locations and photographically documented in its surrounding context.

Aesthetics, as addressed in the CEQA, refers to visual considerations. Aesthetics (or visual resources) analysis is a process to logically assess visible change and anticipated viewer response to that change. The methodology for conducting the following visual analysis included the following steps:

- Objective identification of visual features of the landscape;
- Assessment of the character and quality of those resources relative to overall regional visual character; and
- Assessment of the potential significance of features in the landscape to the people who see them and their sensitivity to the proposed changes to those features.

Thresholds of Significance

The CEQA Guidelines and the Kern County CEQA Implementation Document state that the Project would be considered to have a significant impact if it would:

- Have a substantial adverse effect on a scenic vista;
- Substantially alter or damage a major landform or scenic resource, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- Substantially alter or degrade the existing visual character or quality of the proposed Project Site and its surroundings; and/or
- Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

Project Impacts

IMPACT AES-1 Have a substantial adverse effect on a scenic vista

There are no designated scenic vistas in proximity to the Project Site that could be impacted by the proposed Project. No impact on a scenic vista will result from Project implementation.

Mitigation Measures:

No mitigation measures are required.

Level of Significance after Mitigation:

No Impact.

IMPACT AES-2 Substantially alter or damage a major landform or scenic resource, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway

There are no officially designated or eligible state scenic highways in proximity to the Project Site that could be impacted by the proposed Project. No impact will occur to major landforms or scenic resources within a state scenic highway.

Mitigation Measures:

No mitigation measures are required.

Level of Significance after Mitigation:

No Impact.

IMPACT AEA-3 Substantially Alter or Degrade the Existing Visual Character or Quality of the Proposed Project Site and Its Surroundings.

The development of the Project will alter and degrade the existing visual character and quality of the proposed Project Site and its surroundings. The existing character of the Site is heavily industrial with large areas of significant disturbance. A significant portion of the Project will utilize these existing disturbed acreages, well sites and pipeline alignments, however additional pipelines, satellites, and well sites will be developed. An evaluation of potential impacts to each KOP considered within this analysis is presented below.

KOP 1: Dustin Acres – Hwy 119 and Golf Course Rd

From this vantage point the far middle ground and background topography would limit most if not virtually all views of any proposed Project elements both during construction and operations. Some vehicle and truck traffic on SR 119 associated with the proposed Project would be visible from this KOP. However as the roadway is a state highway, truck and vehicle traffic is common. This is considered a less than significant impact.

KOP 2: Dustin Acres - Hwy 119 and Tank Farm Rd

Some proposed pipeline installation areas would be visible from SR 119 and Tank Farm Road. A majority of their length would run parallel to an existing pipeline in the middle ground of this KOP. Visual impacts during construction would be associated with construction equipment and ground disturbance for portions that are buried. Above-ground sections may also be visible depending on the

final alignment and siting of the waterline relative to the existing pipeline. The majority of the equipment will simply replace existing equipment. Considering the level of existing alteration, the distance of the impacts and the mitigation measures proposed below the overall magnitude of change will be less than significant.

KOP 3: Valley Acres looking north from Airport Rd

Some proposed pipeline installation areas would be visible from this KOP. A majority of their length would run parallel to an existing pipeline in the middle ground of this KOP. This existing pipeline which runs at grade above-ground through the middle ground of this KOP is not visible due to the dense shrub vegetation. Visual impacts during construction would be associated with construction equipment only, and the new sections are not likely to be visible. In the distant background, new and upgraded equipment may be partially visible in addition to one or more of the new satellite facilities. As with KOP 2, considering the level of existing alteration, the distance of the impacts and the mitigation measures proposed below the overall magnitude of change from KOP 3 will be less than significant.

KOP 4: Elk Hills Rd Looking Northwest

In general, the only notable alterations that will be visible from Elk Hills Rd. will be the alterations required during the construction of and before reestablishment of vegetation near the three pipelines noted above. The pipeline will follow the alignment of the existing pipeline under the roadway but will divert to the north (right) over the small hill in the middle ground left straight toward the flat pad in the middle ground left to the right of the cylindrical tower. It will then proceed along a new alignment across the hillsides, potentially resulting in additional visual impacts in a middle ground view for motorists along Elk Hills Rd. Although the middle ground view is substantially altered, an effort should be made to align the pipeline adjacent to existing alterations, such as the existing roadway cuts, and other pipeline alignments visible in aerial photography. Aside from the visual impacts of the pipeline, from this vantage point the far middle ground and background topography would limit most if not virtually all views of any proposed Project elements in the northwest portion of the Site both during construction and operations. The addition of these pipelines would be considered a less than significant impact considering the heavily altered nature of the existing landscape.

KOP 5: Tupman looking southwest from Grace Ave

This viewpoint represents a vantage point where portions of the CO2 EOR Processing Facility may be visible from the community. However, due to the up-slope view of the facility from the KOP and surrounding topography, only limited components may be visible. Residents travelling southwest on Grace Avenue around the bend onto Kern Avenue toward the elementary school could have a partial view of the facility. The facility's position relative to the community will become that of a distant middle ground object behind the rolling middle ground grasslands. The closest portion of the facility would be approximately 1.5 miles from the KOP. Viewer sensitivity would be considered moderate to moderately high from this location. Although distance, topography, and similarities in overall character with elements of the existing viewshed may lessen the impact of the CO2 EOR Processing

Facility, a combination of viewer sensitivity, scale, potentially significant topographic alterations, and its position relative to the community could have a significant impact on a sensitive viewing population. This is considered a potentially significant impact. The mitigation measures presented below have been incorporated to reduce this potential impact.

KOP 6: Tupman looking south-southwest near the post office

From this vantage point the closest and most prominent project elements would be construction equipment involved in injection and production well installations in the distant hills. Equipment used for these activities is already part of daily operations and will not substantially alter the existing viewshed. Support piping from this vantage point will be below ground surface and not visible. Impacts at night and during construction would be minimal from this distance. Limiting visual factors of scale, distance and topography, combined with minimal legible changes over the existing conditions would yield a less that significant visual impact from this KOP.

KOP Impact Summary

The visual character of these facilities will be in keeping with the existing overall character of the site, and to the casual observer, the changes will be less than significant. The view of the CO2 EOR Processing Facility from Tupman will be the most notable and significant change produced by the Project due to the scale and magnitude of the facility and the sensitivity of residential viewers and school children. Mitigation measures have been proposed based on the analysis and impact statements in the KOP analysis.

Mitigation Measures

Mitigation Measure AES-1 The surfaces of all structures, equipment, piping, and other associated above-ground project components shall be given low reflectivity finishes with neutral colors to minimize the contrast of the structures with their backdrops.

Mitigation Measure AES-2 In areas requiring major topographic adjustment (including but not limited to the CO2 EOR Processing Facility, satellite locations, new well sites, buried pipelines etc.), topsoil from existing grade to be cut/filled/trenched shall be removed and stockpiled during rough grading and/or trenching operations. Topsoil's shall be reapplied consistently across the new grades and stabilized to allow natural revegetation.

Mitigation Measure AES-3 For any overhead transmission lines, lattice steel towers will not be used. If tubular steel poles are used (instead of wood) they shall be painted light-gray colors or shall be dulled galvanized steel.

Mitigation Measure AES-4 During construction, temporary construction areas, including construction parking, offices, and construction laydowns, shall be located within OEHI existing operations and out of direct view of the public, to the maximum extent feasible.

4.1 AESTHETICS

Mitigation Measure AES-5 The Project shall utilize existing pipeline corridors, ROW (ROWs), roads, storage areas, and previously disturbed acreage to the maximum extent feasible. All project components shall be designed to minimize disturbed footprint during construction.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT AES-4: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

Nighttime lighting presently in the area surrounding the project consists of low scattered lighting associated with rural residences, farming operations, surrounding communities, and headlights from motorists on area roadways. Developed oil production sites on the Project Site currently produce substantial amounts of trespass and nighttime light (Taft General Plan EIR, 2009).

The CO2 EOR Processing Facility for this Project will include security lighting capable of producing a substantial concentrated source of nighttime light. The lighting at this facility would be most visible from the town of Tupman and from a few locations along Tupman Road where views of the facility are not otherwise blocked by topography. The lighting associated with this facility is considered potentially significant. The 13 satellite stations and well sites are not expected to have lighting. Illumination levels for the Project have been set at 20 lux for outdoor areas and 50 lux for walkways platforms and stairs (Mustang 2010). Devices producing these lighting levels have the potential for substantial light spill and sky glow if not properly shielded. These fixtures will be subject to the local zoning ordinances and mitigation measures below.

The CO2 EOR Processing Facility will be equipped with one or more emergency flares that have the potential to emit light during nighttime operations. There are existing emergency flares currently being operated within the EHOF. The addition of one or more emergency flares at the facility is not expected to substantially alter the amount of light being emitted from the EHOF. Use of these emergency flares will be limited to temporary non-routine events and is a necessary safety feature. Light emitted from the infrequent use of the flares is not expected to result in a significant impact.

The combination of broad geographic distribution, topographic variations of the existing landscape, and the fact that the nighttime character of the areas where this new lighting will occur is already developed with significant lighting will likely result in minimal noticeable impacts for sensitive viewers. The lighting associated with the Project will be required to meet minimum safety and security standards and will not be substantial enough, after mitigation, to significantly affect motorists.

The materials proposed for many project elements are capable of producing glare, if not properly finished or painted. Kern County Zoning Ordinances and the mitigation measures proposed in this section should sufficiently mitigate this potential impact. No substantial sources of day or nighttime glare are therefore expected to be created by the elements of the proposed Project, as the Project will be required to be in compliance with these ordinances and mitigation measures.

Mitigation Measures

Implement Mitigation Measures AES-1 through AES-5 as described above.

Mitigation Measure AES-6 All outdoor lighting shall be the minimum required to meet safety and security standards. All light fixtures shall be hooded and/or shielded to reduce potential for glare effects and to prevent light from spilling off the site or up into the sky.

Level of Significance after Mitigation

Impacts would be less than significant.

4.1.6 Cumulative Impacts

The geographic extent of the cumulative impacts analysis for visual resources is the same as the extent of the regional setting, as described above. That extent is defined as the viewsheds from which the proposed Project might be seen (set at 3 miles for this project), including immediate foreground, foreground, middle ground, and background viewing distances.

In the vicinity of the proposed Project, there are many past projects and activities that have modified the landscape and changed the naturally evolving landscape character. Some of these past activities have adversely affected natural-appearing landscape character and visual quality including other nearby extraction and oil production operations, scattered rural/agricultural developments, transmission lines, substations, and development of surrounding communities. Agricultural developments in the vicinity include irrigated and dry-crop farming, and irrigated fields have introduced lush green landscapes into the otherwise dry, relatively barren desert environment that was previously covered by creosote bush scrub. Oil extraction equipment and operations have introduced a distinct industrial overlay and motion into an otherwise natural motionless landscape. These types of impacts are expected to continue and evolve into the foreseeable future.

As discussed above, development throughout the cumulative effects area for visual resources is primarily that of agricultural lands, residential and commercial developments near the surrounding communities, and also includes additional development of oil and mineral extraction industries. Most of the reasonably foreseeable future projects within the proposed project vicinity are expected to be characteristic of past and ongoing projects.

The Project's potential contribution to cumulative impacts is inextricably tied to the additional visual impacts of the proposed HECA plant, a 473-acre power-generating facility situated on agricultural land 1.5 miles northwest of Tupman. The Visual Resources document prepared for the HECA project analyzes the introduction of the significant, large-scale, industrial development into an active-production, contiguous agricultural landscape. The aesthetic impact of the HECA project was found to be less than significant with mitigation. Mitigation measures including landscaping and berming on and off the Project Site are proposed. Considering that the proposed Project is limited to CO2 EOR (and supporting facilities) within an active oil field and visual impacts have been mitigated to a less than

significant level, the proposed Project is not expected to substantially contribute to a cumulative aesthetic impact. The Project will have a less than significant cumulative aesthetic impact.

Mitigation Measures

Implement Mitigation Measure AES-1 through AES-6 as described above.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.2 Agricultural Resources

4.2.1 Introduction

This section presents an evaluation of the potential environmental effects from the proposed Project on agriculture resources.

4.2.2 Environmental Setting

4.2.2.1 Statewide

The State of California is the nation's most productive agricultural state, and currently contains 26.7 million acres of active farmland. Of the top ten agricultural producing counties nationwide, nine are located in California: Fresno, Tulare, Monterey, Kern, Merced, Stanislaus, San Joaquin, San Diego, Ventura, and Kings. Approximately 76,500 farming operations were located in California in the year 2005. This number represents less than four percent of the nation's total farming operations. However, these farms account for approximately 13 percent of the national gross cash receipts, with $25.7 billion in direct sales for 2004. Approximately 350 crops are recognized in the state, including seeds, flowers, and ornamentals. California's top 20 crop and livestock commodities account for 80 percent of the state's gross farm income.

4.2.2.2 Regional

Agriculture has been an integral part of the Kern County economy since the introduction of livestock in the 1860s. Livestock grazing on large land grants and some production of grain under dry-farming methods were the chief agricultural pursuits until about 1880. Rapid agricultural development occurred after 1880 due to the development of irrigation (harnessing the uncontrolled flow of water from the Kern River), inexpensive land, favorable crop yields, the advent of two railroads, the development of the petroleum industry, and access to markets.

According to the 2005 Agricultural Crop Report, prepared by the Kern County Agricultural Commissioner's Office, there are approximately 873,005 acres of harvested farmland cultivated in Kern County. Agriculture provides the backbone of the County's economy, with a total value of in excess of $3.5 billion. The County produces over 250 different crops: over 30 types of fruit and nuts, over 40 types of vegetables; over 20 field crops; as well as lumber, nursery stock, livestock, poultry, and dairy products. Alone, the County outranks the agricultural production of 20 states.

4.2.2.3 Agricultural Land Conversion

Kern County is among California's leading counties in total loss of farmland to urbanization. From 1992 to 2002, farmland and "interim" farmland in Kern County decreased by 50,831 acres. Approximately one-third of this decrease was due to urban-related changes, while two-thirds was associated with the idling of farmland due to a variety of factors. Review of the Kern County Open Space Subvention Act application report for the year 2005 indicates a total of 636,600 acres of

farmland were enrolled in Williamson Act (a California law that provides relief of property tax to owners of farmland and open-space land in exchange for a ten-year agreement that the land will not be developed or otherwise converted to another use) contracts for the year. Of this total, 19,055 acres filed for non-renewal in 2005. Disenrollment does not necessarily mean that the land in question has been permanently removed from agricultural production. The land, for example, may have been converted to grazing land, or become non-irrigated and thus non-prime farmland.

4.2.2.4 Project Site

The proposed Project is located approximately 26 miles west of the City of Bakersfield and approximately 1.5 miles northwest, west, and southwest of the unincorporated community of Tupman in western Kern County, California.

The Kern County General Plan identifies land use designations for the proposed Project Site as Mineral and Petroleum and Extensive Agriculture. The proposed Project is located in an area zoned for limited agriculture, exclusive agriculture, and natural resource extraction.

Adjacent land uses include nearby agricultural lands and agricultural estates to the north, and residences in the community of Tupman to the east. The existing land uses to the south, west, east, and areas to the north of the proposed Project Site consist of undeveloped land.

4.2.2.5 Elevation and Water Availability

The proposed Project Site ranges in elevation between approximately 300 to 1,550 feet above sea level from north to south.

Land use north of the proposed Project Site is used for agriculture including cultivating cotton. This portion of the proposed Project Site and adjacent areas to the north, northwest, east, and southeast are considered "prime farmland" according to the California Division of Land Resource Protection Farmland Mapping and Monitoring Program (FMMP) and have a water supply for irrigation.

4.2.3 Regulatory Setting

4.2.3.1 Local

Kern County General Plan

Kern County (County) has general plan land use designations to provide for agricultural activities and production that seek to preserve prime agricultural lands from urban encroachment. The proposed Project general plan land use designations include: Intensive Agriculture (General Plan Map Code 8.1), Extensive Agriculture (General Plan Map Code 8.3), and Mineral and Petroleum (General Plan Map Code 8.4). The Kern County General Plan has one more land use designation to support agricultural land use activities known as Resource Reserve (General Plan Map Code 8.2) which is not utilized on the proposed Project Site.

4.2 AGRICULTURAL RESOURCES

Map Code 8.1 Intensive Agriculture areas are devoted to the production of irrigated crops having a potential for such uses. Other agricultural uses, while not directly dependent on irrigation for production, may also be consistent with the Intensive Agriculture land use designation. Permitted uses would include, but are not limited to, the following:

> *Irrigated cropland, orchards, vineyards, horse ranches, raising of nursery stock, ornamental flowers and Christmas trees, fish farms, bee keeping, farm facilities, related use; one single-family dwelling unit, cattle fee yards, dairies, dry land farming, livestock grazing, water storage, groundwater recharge acres, mineral, aggregate, and petroleum exploration and extraction, hunting clubs, wildlife preserves, farm labor housing, public utility uses, and agricultural industries pursuant to provisions of the Kern County Zoning Ordinance, and land within development areas subject to significant physical constraints.*

Map Code 8.3 Extensive Agriculture uses involve large amounts of land with relatively low value-per-acre yields, such as livestock grazing, dry land farming, and woodlands. Permitted uses would include, but are not limited to, the following:

> *Livestock grazing, dry land farming, ranching facilities, wildlife and botanical preserves, and timber harvesting; one single-family dwelling unit, irrigated croplands, water storage or groundwater recharge areas, mineral, aggregate, and petroleum exploration and extraction, and recreation activities, such as gun clubs and guest ranches, and land within development areas subject to significant physical constraints.*

Map Code 8.4 Mineral and Petroleum uses involve areas which contain producing or potentially productive petroleum fields, natural gas, and geothermal resources, and mineral deposits of regional and statewide significance. Uses are limited to activities directly associated with the resource extraction. Permitted uses would include, but are not limited to, the following:

> *Mineral and petroleum exploration and extraction, including aggregate extraction;* extensive and intensive agriculture; mineral and petroleum processing (excluding *petroleum refining); natural gas and geothermal resources; pipelines; power transmission facilities; communication facilities; equipment storage yards; and borrow pits.*

The Land Use/Conservation/Open Space Element of the *Kern County General Plan* contains goals, policies and objectives for the planned management, conservation and open space within the unincorporated areas of the County. Due to the close interrelationship between land use, conservation, and open space issues, Kern County's Land Use/Conservation/Open Space Element provides for a variety of land uses for future economic growth while also assuring the conservation of the County's agricultural, natural and resource attributes. The policies, goals, and implementation measures in the Kern County General Plan for agricultural resources applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below.

4.2 AGRICULTURAL RESOURCES

1.9 Resource (Land Use, Conservation, and Open Space Element)

Goals

Goal 1. To contain new development within an area large enough to meet generous projections of foreseeable need, but in locations which will not impair the economic strength derived from the petroleum, agriculture, rangeland, or mineral resources, or diminish the other amenities which exist in the County.

Goal 2. Protect areas of important mineral, petroleum, and agricultural resource potential for future use.

Goal 3. Ensure the development of resource areas minimize effects on neighboring resource lands.

Goal 5. Conserve prime agriculture lands from premature conversion.

Policies

Policy 1. Appropriate resource uses of all types will be encouraged as desirable and consistent interim uses in undeveloped portions of the County regardless of General Plan designation.

Policy 5. Areas of low intensity agriculture use (Map Code 8.2 (Resource Reserve), Map Code 8.3 (Extensive Agriculture), Map Code 8.5 (Resource Management)) should be of an economically viable size in order to participate in the State Williamson Act Program/Farmland Security Zone Contract.

Policy 7. Areas designated for agricultural use, which include Class I and II and other enhanced agricultural soils with surface delivery water systems, should be protected from incompatible residential, commercial, and industrial subdivision and development activities.

Policy 11. Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through utilization of grading and flood protection ordinances.

Policy 12. Areas identified by the Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service) as having high range-site value should be conserved for Extensive Agriculture uses or as Resource Reserve, if located within a County water district.

Policy 18. Actively monitor the actions of local, state, and federal agencies related to energy development in Kern County and lobby and present its position on such matters as needed to protect County interests.

Policy 19. Work with other agencies to define regulatory responsibility concerning energy related issues.

Policy 20. Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreational, and other beneficial uses while acknowledging existing land use patterns.

4.2 AGRICULTURAL RESOURCES

Implementation Measures

Implementation Measure C. The County Planning Department will seek review and comment from the County Engineering and Survey Services Department on the implementation of the National Pollution Discharge Elimination System for all discretionary projects.

Implementation Measure F. Prime agricultural lands, according to the Kern County Interim-Important Farmland 2000 map produced by the Department of Conservation, which have Class I or II soils and a surface delivery water system shall be conserved through the use of agricultural zoning with minimum parcel size provisions.

Implementation Measure G. Property placed under the Williamson Act/Farmland Security Zone Contract must be in a Resource designation.

Implementation Measure I. Periodically review the Zoning Ordinance to reflect new technology and energy sources, and encourage these types of uses for new development.

Implementation Measure J. The County shall continue to monitor new legislation as it relates to energy production and periodically review the General Plan and Zoning Ordinance for any required updates.

Kern County Zoning Code

The Kern County Code Title 19 contains the zoning classifications to implement the Kern County General Plan. Title 19 contains two zoning classifications pertaining to the substantive standards applicable for agricultural zoning classifications which are 19.12 Exclusive Agriculture District (A) and 19.14 Limited Agriculture District (A-1).

19.12 Exclusive Agriculture (A) District designates areas suitable for agricultural uses and to prevent the encroachment of incompatible uses onto agricultural lands and the premature conversion of such lands to nonagricultural uses. Uses in the A District are limited primarily to agricultural uses and other activities compatible with agricultural uses. Permitted uses within this zoning classification include: growing and harvesting crops, breeding and raising animals, agriculture industry, residential uses, agricultural related commercial uses and oil or gas exploration and production.

19.14 Limited Agriculture (A-1) District designates areas suitable for a combination of estate-type residential development, agricultural uses, and other compatible uses. Final map residential subdivisions are not allowed in the A-1 District. Uses in the A-1 District are limited primarily to agricultural uses and other activities compatible with agricultural uses. Permitted uses within this zoning classification include: growing and harvesting crops, breeding and raising animals, agriculture industry, residential uses, agricultural related commercial uses, and oil or gas exploration and production.

Kern County Health and Safety Code

Kern County Code Title 8 Health and Safety regulates nuisance and health issues related to conflicting land uses such as often occur between agricultural land uses and residential land uses. Under Chapter 8.56 Right-to-Farm and Right-to-Business existing agricultural operations are protected from future residential land uses pushing out the old agricultural land uses due to incompatibility. Chapter 8.56.010 Not a Nuisance states the following:

> *No agricultural, ranching, hydrocarbon extraction or refining, energy production or mining activity, operation, or facility, or appurtenances thereof, as defined in Civil Code Sections 3482.5(e) and 3482.6(e), or any transportation activity in conjunction therewith, lawfully established and conducted or maintained in a manner consistent with lawful, proper and accepted customs and standards as established by similar activities in the same locality, shall be or become a nuisance, public or private, due to any changed condition in or about the locality, including, but not limited to, unrelated residences, if it was not a nuisance at the time it began.*
>
> *This section shall not apply where the activity, operation, facility or appurtenances thereof, obstructs the free passage or use, in the customary manner, of any navigable lake, river, bay, stream, canal or basin, or any public park, square, street or highway. This section shall not apply if the activity, operation, facility or appurtenances thereof, or any transportation activity in conjunction therewith, constitutes a nuisance, public or private, as specifically defined or described in or pursuant to any provision of statewide California law. (Ord. G-6664 § 2, 2000)*

Williamson Act Standard Uniform Rules

The County has adopted a set of Agricultural Preserve Standard Uniform Rules that identify land uses that are considered compatible uses within agricultural preserves established under the Williamson Act. The Williamson Act (officially, the California Land Conservation Act of 1965) is a California law that provides relief of property tax to owners of farmland and open-space land in exchange for a ten-year agreement that the land will not be developed or otherwise converted to another use. The motivation for the Williamson Act is to promote voluntary land conversation, particularly farmland conservation. These rules are designed to restrict the uses of land enrolled in a Williamson Act contract to agriculture or other compatible uses. Agricultural uses include crop cultivation, grazing operations, commercial wind farms, livestock breeding, dairies, and uses that are incidental to agricultural uses. Other compatible uses include the erection of gas, electric, communications, water, and other similar public utilities (Kern County Planning Department 2004).

4.2.3.2 State

California Department of Conservation

In 1982, the State of California created the Farmland Mapping and Monitoring Program within the California Department of Conservation to carry on the mapping activity from the NRCS on a continuing basis.

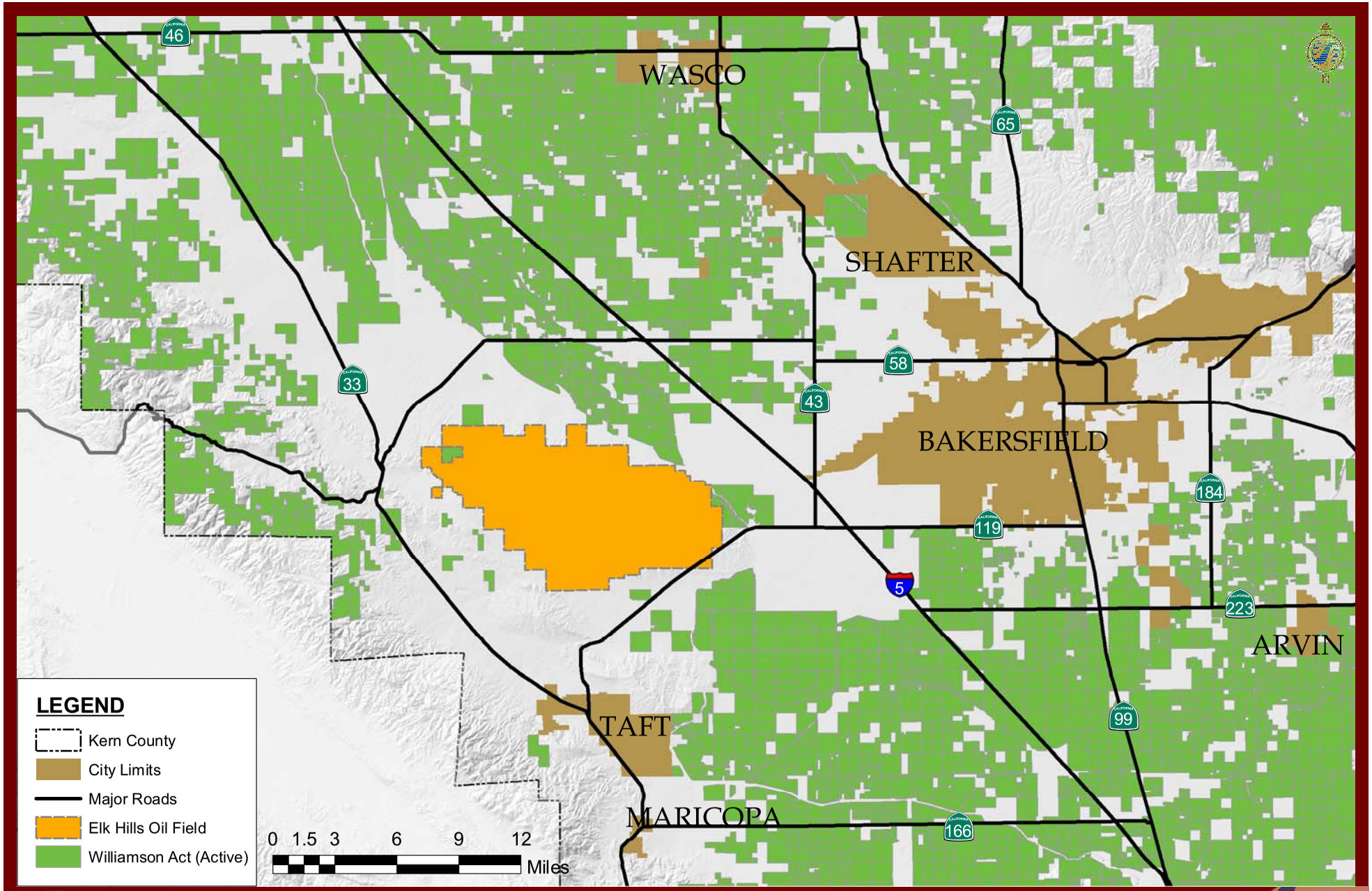
4.2 AGRICULTURAL RESOURCES

Land Conservation Act

The California Land Conservation Act (LCA), also known as the Williamson Act, was adopted initially by the State of California in 1965 with the basic intent of encouraging the preservation of the State's agricultural lands in view of the increasing trends toward their urbanization. The LCA established a land contract procedure whereby the County Board of Supervisors could stabilize (i.e., not increase) taxes on certain qualifying lands in return for an owner's guarantee to keep the lands in agricultural preserve status for a 10-year period. A Williamson Act contract is automatically renewed each year, unless a notice of non-renewal is initiated by the land owner or the County. Once a notice of non-renewal is given, the contract remains in place on the land for the remaining nine-year term. Once the nine years pass, the land is no longer restricted to agricultural or open space uses. Additionally, once a notice of non-renewal is submitted, the taxes on the land are annually reassessed in accordance with a formula set in the Williamson Act (Figure 4.2-1 Williamson Act Lands Map).

The criteria used for determining "prime agricultural lands" are defined by the Williamson Act as follows:

- All land that qualifies for rating as Class I or Class II in the Natural Resource Conservation Service Land Use Capabilities Classifications;
- Land that qualifies for rating 80 through 100 in the Storie Index Rating (a numerical value indicating the relative suitability of a soil group for general agricultural practices);
- Land that supports livestock used for the production of food and fiber and that has an annual carrying capacity equivalent to at least one animal unit per acre, as defined by the United States Department of Agriculture;
- Land planted with fruit- or nut-bearing trees, vines, bushes, or crops that have a nonbearing period of less than 5 years and will normally return during the commercial bearing period from the production of unprocessed agricultural plant production not less than $200 per acre per year; and
- Land that has returned from the production of unprocessed agricultural plant products a gross value of not less than $200 per acre per year for three of the previous 5 years.



Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Fig. 4.2-1

Kern County Williamson Act Active Contracts

Stantec
2590 Venture Oaks Way, Sacramento, CA 95833
Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185802314

OEHI CO2 EOR Project - Supplemental Environmental Information

4.2 AGRICULTURAL RESOURCES

California Right to Farm Act

Right-to-farm laws are designed to strengthen the legal position of farmers when neighbors sue them for private nuisance, and to protect farmers from anti-nuisance ordinances and unreasonable controls on farming operations. In summary, the California Right-to-Farm Act (California Civil Code §3482.5) states the following:

"No agricultural activity, operation, or facility conducted or maintained for commercial purposes, and in a manner consistent with proper and accepted customs and standards, as established and followed by similar agricultural operations in the same locality, shall be or become a nuisance, private or public, due to any changed condition in or about the locality, after it has been in operation for more than three years if it was not a nuisance at the time it began".

"No activity of a district agricultural association that is operated in compliance with Division 3 (commencing with Section 3001) of the Food and Agricultural Code, shall be or become a private or public nuisance due to any changed condition in or about the locality, after it has been in operation for more than three years if it was not a nuisance at the time it began".

Farmland Security Zone Act

The Farmland Security Zone Act is similar to the Williamson Act and was passed by the California State Legislature in 1999 to ensure that long-term farmland preservation is a part of public policy. Farmland Security Zone Act contracts are sometimes referred to as "Super Williamson Act Contracts." Under the provisions of this act, a landowner already under a Williamson Act contract can apply for Farmland Security Zone status by entering into a contract with the county. Farmland Security Zone classification automatically renews each year for an additional 20 years. In return for a further 35 percent reduction in the taxable value of land and growing improvements (in addition to Williamson Act tax benefits), the owner of the property promises not to develop the property into nonagricultural uses.

4.2.3.3 Federal

Farmland Mapping and Monitoring Program

Important Farmland maps are prepared periodically for most of the state's agricultural areas based on information from the NRCS's soil survey maps, land inventory and monitoring criteria developed by the NRCS, and land use information mapped by the California Department of Water Resources. These criteria generally are expressed as definitions that characterize the land's suitability for agricultural production, physical and chemical characteristics of the soil, and actual land use. Important Farmland maps generally are updated every two years. Please see Figure 4.2-2 FMMP Designations, for FMMP classifications of the proposed Project Site and surrounding properties that may be impacted by the proposed Project.

4.2 AGRICULTURAL RESOURCES

Public Resources Code Section 21060.1 defines agricultural land for the purposes of assessing CEQA environmental impacts using the FMMP and the following FMMP Important Farmland Map categories.

Prime Farmland - Farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.

Farmland of Statewide Importance - Farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.

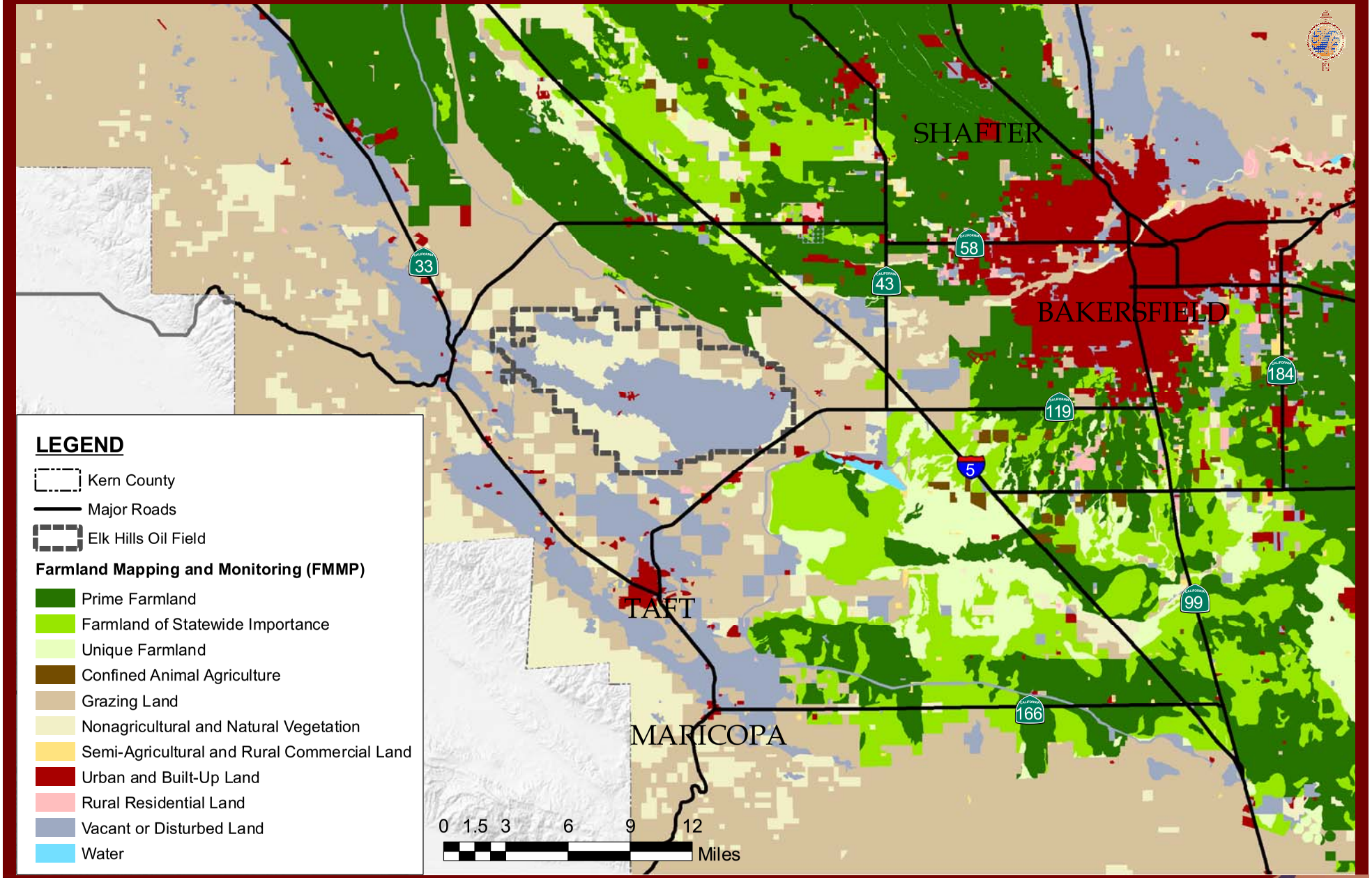
Unique Farmland - Farmland of lesser quality soils used for the production of the states leading agricultural crops. This land is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.

Farmland of Local Importance - Land of importance to the local agricultural economy as determined by each county's board of supervisors and a local advisory committee.

Grazing Land - Land on which the existing vegetation is suited to the grazing of livestock. This category was developed in cooperation with the California Cattlemen's Association, University of California Cooperative Extension, and other groups interested in the extent of grazing activities. The minimum mapping unit for Grazing Land is 40 acres.

Urban & Built-Up Land - Land occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. This land is used for residential, industrial, commercial, construction, institutional, public administration, railroad and other transportation yards, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, water control structures, and other developed purposes.

Other Land - Land not included in any other mapping category. Common examples include low density rural developments; brush, timber, wetland, and riparian areas not suitable for livestock grazing; confined livestock, poultry or aquaculture facilities; strip mines, borrow pits; and water bodies smaller than forty acres. Vacant and nonagricultural land surrounded on all sides by urban development and greater than 40 acres is mapped as Other Land.



Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Fig. 4.2-2

Kern County Important Farmland (FMMP)

Stantec
2590 Venture Oaks Way, Sacramento, CA 95833
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Project # 185802314

OEHI CO2 EOR Project - Supplemental Environmental Information

4.2 AGRICULTURAL RESOURCES

4.2.4 Environmental Impacts and Mitigation Measures

4.2.4.1 Methodology

The analysis in this section was conducted through review of (1) the most current California Department of Conservation, Division of Land Resource Protection's Important Farmland Map and farmland conversion tables; (2) NRCS soils information; and (3) Kern County's Williamson Act Map.

In addition, a compatibility analysis was completed to determine whether development of the proposed Project would be incompatible with agricultural uses on parcels currently under Williamson Act contracts or adjacent to the proposed Project Site or substantially impact designated important farmland.

4.2.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on agricultural resources if it would:

Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use;

Conflict with existing zoning for agricultural use or a Williamson Act contract;

Involve other changes in the existing environment which, because of their location or nature, could result in conversion of Farmland to nonagricultural use; or

Result in the cancellation of an open space contract made pursuant to the California Land Conservation Act of 1965, Williamson Act contract, or Farmland Security Zone contract for any parcel of 100 or more acres.

4.2.4.3 Project Impacts

The following impact discussion addresses potential effects the proposed Project could have on agricultural resources.

IMPACT AG-1 Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Nonagricultural Use

Proposed Project components are not located on prime farmland, unique farmland, or farmland of statewide importance. As such, the proposed Project will not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural use. The proposed Project will have no such agricultural use conversion impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT AG-2 Conflict with Existing Agricultural Zoning or Williamson Act Contracts

There are no proposed Project components that are located on lands under Williamson Act contracts; therefore the Project does not have the potential to conflict with Williamson Act contracts. Based on Kern County zoning designations (shown in Figure 4.9-2), all proposed Project components will be located in areas zoned for Exclusive Agriculture (A) or Limited Agriculture (A-1). The permitted land uses for the above zoning designations are listed in Chapters 19.12 and 19.14 of the Kern County Zoning Ordinance. Both Chapters specify that resource extraction and energy development uses are permitted within theses zoning districts.

Specifically, the zoning ordinance states that oil and gas exploration and production pursuant to Chapter 19.98 of the zoning ordinance is allowed without the need for a conditional use permit. Chapter 19.98 further states that no review or permit shall be required for the drilling of any steam injection well, steam drive well, service well, or any well intended for the exploration for or development or production of oil, gas, and other hydrocarbon substances, or for any related accessory equipment, structure, or facility in the Exclusive Agriculture (A) or Limited Agriculture (A-1) Districts. As all of the proposed Project components are related to oil and gas production (including related accessory equipment, structures, and facilities), the proposed Project complies with the zoning ordinance and will not conflict with existing agricultural zoning. No impact will result.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT AG-3 Involve Other Changes in the Existing Environment which, Because of their Location or Nature, Could Result in Conversion of Farmland to Nonagricultural Use

The proposed Project site is not irrigated, and historically has been undeveloped and used for oil production. The California Department of Conservation FMMP classifies the majority of the proposed Project Site as “grazing land” or “nonagricultural and natural vegetation” with southern portions classified as “vacant disturbed land.” The proposed Project does not include any component that has the potential to involve other changes in the existing environment which, because of their location or nature, could result in conversion of farmland to nonagricultural use. As such, the proposed Project will have no indirect agricultural use conversion impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT AG-4 Result in the cancellation of an open space contract, Williamson Act contract, or Farmland Security Zone contract

The proposed Project does not include any component that has the potential to result in the cancellation of an Open-Space Contract, Williamson Act Contract, or Farmland Security Zone. As such, the proposed Project will have no agricultural contract cancellation impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.2.5 Cumulative Impacts

As discussed in Section 4.2.4, the proposed Project will not result in an impact to agricultural resources; including no conversion of farmlands, conflicts with agricultural zoning, or cancellation of agriculture land contracts. As such, the proposed Project will not contribute to cumulative agricultural resource impacts.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have no cumulative impact.

4.3 AIR QUALITY

4.3 Air Quality

4.3.1 Introduction

This section of the SEI addresses the potential air quality impacts associated with the construction and operation of the proposed Project.

4.3.2 Environmental Setting

Responsibility for attaining and maintaining ambient air quality standards in California is divided between the California Air Resources Board (CARB) and regional air pollution control districts. The CARB divides the state into air basins based on topography and county boundaries.

Kern County, where the proposed project is located, is split between the Mojave Desert Air Basin (MDAB) to the east and the San Joaquin Valley Air Basin (SJVAB) to the west. The proposed Project is located entirely in the SJVAB. The SJVAB consists of the western half of Kern County, and all of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare Counties.

Climate

The primary factors that determine air quality are the locations of air pollutant sources and the amounts of pollutants emitted. Meteorological and topographical conditions are also important. The proposed Project Site is located near the unincorporated community of Tupman, Kern County within the jurisdiction of the SJVAPCD.

SJVAB, which is approximately 250 miles long and 35 miles wide, is the second largest air basin in the state. Air pollution, specially the dispersion of air pollutants, is directly related to a region's topographic features. The SJVAB is defined by the Sierra Nevada Mountains in the east (8,000 to 14,000 feet in elevation), the Coast Range in the west (averaging 3,000 feet in elevation), and the Tehachapi Mountains in the south (6,000 to 8,000 feet in elevation).

Predominant wind directions for the region are from the west-southwest, and north, with average wind speeds of 2.4 – 3.3 miles per hour and 2.0 – 3.4 miles per hour, respectively [*Supplemental Environmental Impact Statement, DOE/EIS-0158, Petroleum Production at Maximum Efficient Rate, Naval Petroleum Reserve No.1 (Elk Hills), Kern County, California, Department of Energy*, July 1993]. Wind speeds are slightly higher in the afternoon and evening than in the morning and early afternoon, with the strongest surface winds occurring in the spring and fall. Flow from the west-southwest is primarily indicative of nocturnal drainage originating from higher terrain west and southwest of the monitoring station. Northerly winds represent the prevailing daytime down-valley flow observed at most locations in the southern San Joaquin Valley, stimulated by surface heating effects along the Valley floor.

4.3 AIR QUALITY

The SJVAB has an inland Mediterranean climate, averaging more than 260 sunny days per year. The valley floor is characterized by warm, dry summers and cooler winters. Long-term average temperature and precipitation data have been collected at Buttonwillow, the surface meteorological station nearest to the proposed Project Site (National Oceanic and Atmospheric Administration (NOAA) Cooperative Observers Program (COOP) ID 041244).

Temperature and precipitation data for the proposed Project Site in calendar year 2008 are provided on Table 4.3.1.

Temperature

Average low and high temperatures during the summer vary from the high 60 degrees Fahrenheit (°F) to the mid-90°F, respectively. Summer precipitation is extremely low due to the strong stationary high-pressure system located off the coast that prevents most weather systems from moving through the area. The proposed Project Site receives an average of 5.75 inches of rain annually. During the winter, average low and high temperature vary from the mid-30°F to the mid-50°F, respectively. About 80 percent of the precipitation in the area occurs from November through March.

Precipitation

As shown on Table 4.3.1, the annual average total precipitation in Buttonwillow was approximately 5.65 inches in 2008. OEHI reports that the EHOF receives approximately 5.75 inches of rain annually. Precipitation is confined primarily to the winter months with some occurring in the fall and spring.

4.3 AIR QUALITY

TABLE 4.3.1 TEMPERATURE AND PRECIPITATION DATA BUTTONWILLOW STATION, CA

Month	Average Temperatures (°F)			Precipitation (inches)
	Low	High	Daily	
January	35.1	56.3	45.7	1.08
February	38.9	63.2	51.1	1.08
March	43	69.1	56	1
April	47.2	76	61.6	0.56
May	54	84.7	69.4	0.22
June	60	92.4	76.2	0.05
July	65.2	98.4	81.8	0.02
August	63.2	96.7	80	0.02
September	57.6	91.5	74.6	0.13
October	48.6	81,5	65.1	0.28
November	39.1	67.4	53.3	0.54
December	34.4	57.1	45.8	0.67
Annual Average Temperature	**48.9**	**77.9**	**63.4**	**N/A**
Annual Total Precipitation	**N/A**	**N/A**	**N/A**	**5.65**

Reference: Revised Application for Certification for HECA, Kern County, CA, Volume I, URS, May 2009

State and Federal Ambient Air Quality Standards

Ambient Air Quality Standards

The CARB and the U.S. Environmental Protection Agency (EPA) establish ambient air quality standards for criteria pollutants at thresholds intended to protect public health. The standards for some pollutants are based on other values such as protection of crops or avoidance of nuisance conditions. Table 4.3.2 summarizes the state California Ambient Air Quality Standards (CAAQS) and the federal National Ambient Air Quality Standards (NAAQS).

The CARB designates all areas within the state as either attainment (having air quality better than the CAAQS) or nonattainment (having a pollution concentration that exceeds the CAAQS more than once in three years). Likewise, the EPA designates all areas of the U.S. as either being in attainment of the NAAQS nonattainment if pollution concentrations exceed the NAAQS.

Because attainment/non-attainment is pollutant-specific, an area may be classified as non-attainment for one pollutant and attainment for another. Similarly, because the state and national standards differ, an area could be classified as attainment for the federal standard of a pollutant while it may

4.3 AIR QUALITY

be nonattainment for the state standard of the same pollutant. Some areas are unclassified, which means no monitoring data are available. Unclassified areas are considered to be in attainment. The attainment status of the SJVAPCD for CAAQS and NAAQS in the area where the proposed Project is located is shown in Table 4.3-3 and is discussed in more detail below under "Ambient Air Monitoring."

TABLE 4.3-2 AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards		Federal Standards		
		Concentration	Method[4]	Primary	Secondary	Method
Ozone (O3)	8 hour	0.07 ppm **(137 µg/m^3)**	Ultraviolet Photometry	0.075 ppm **(147 µg/m^3)**	Same as Primary Standard	Ultraviolet Photometry
	1 hour	0.09 ppm **(180 µg/m^3)**		–		
Respirable Particulate Matter (PM10)	**24 Hour**	**50 µg/m^3**	Gravimetric or Beta Attenuation	**150 µg/m^3**	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	**20 µg/m^3**		–		
Fine Particulate Matter (PM2.5) (1997 Standard)	Annual Arithmetic Mean	**12 µg/m^3**	Gravimetric or Beta Attenuation	**15 µg/m^3**	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	24 Hour	**–**		**65 µg/m^3**		
Particulate Matter (PM2.5) (2006 Standard)	Annual Arithmetic Mean	–	Gravimetric or Beta Attenuation	**15 µg/m^3**	Primary Standard	Inertial Separation and Gravimetric Analysis
	24 Hour	**–**		**35 µg/m^3**		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10 mg/m^3)	Non-Despersive Infrared Photometry (NDIR)	9 ppm **(10 µg/m^3)**	None	Non-Dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m^3)		35 ppm **(40 µg/m^3)**		
Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	0.30 ppm **(56 µg/m^3)**	Gas Phase Chemiluminescence	0.053 pm **(100 µg/m^3)**	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.18 ppm **(338 µg/m^3)**		–		
Sulfur Dioxide (SO2)	Annual Arithmetic Mean	–	Ultraviolet Fluorescence	0.03 ppm **(80 µg/m^3)**	–	Spectrophotometry (Pararosaniline Method)
	24 Hour	0.04 ppm **(105 µg/m^3)**		0.14 ppm **(365 µg/m^3)** -	–	

4.3 AIR QUALITY

TABLE 4.3-2 AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards		Federal Standards		
		Concentration	Method[4]	Primary	Secondary	Method
		-				
	1 Hour	0.25 ppm **(655 µg/m³)**		–	–	–
Lead	**30 Day**	**1.5 µg/m³**	Atomic Absorption	–	–	–
	Calendar Quarter	**–**		**1.5 µg/m**	Same as Primary Standard	High Volume Sampler and Atomic Absorption
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more (0.7 – 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent. Method: Beta Attenuation and Transmittance through Filter Tape.		No Federal Standards		
Sulfates	**24 Hour**	**25 µg/m**	Ion Chromatography	No Federal Standards		
Hydrogen Sulfide	1 Hour	0.03 ppm **(42 µg/m³)**	Ultraviolet Fluorescence	No Federal Standards		
Vinyl Chloride[8]	24 Hour	0.01 ppm **(26 µg/m³)**	Gas Chromatography	No Federal Standards		

4.3 AIR QUALITY

TABLE 4.3-3 SJVAPCD ATTAINMENT STATUS		
Pollutant	**Designation/Classification**	
	Federal Standards	**State Standards**
Ozone – 1 hour	No Federal Standarda	Non-attainment/Severe
Ozone – 8 hour	Non-attainment/Extremeb	Non-attainment
PM10	Attainmentc	Non-attainment
PM2.5	Non-attainmentc	Non-attainment
Carbon Monoxide	Unclassified/Attainment	Unclassified/Attainment
Nitrogen Dioxide	Unclassified/Attainment	Attainment
Sulfur Dioxide	Unclassified/Attainment	Attainment
Lead Particulates	No Designation	Attainment
Source: SJVAPCD http://www.valleyair.org/aqinfo/attainment.htm		

Notes:

a. Effective June 15, 2008, the EPA revoked the federal 1-hour ozone standard, including associated designations and classifications. EPA had previously classified the SJVAB as extreme non-attainment for this standard. EPA approved the 2004 Extreme Ozone Attainment Demonstration Plan on March 8, 2010 (effective April 7, 2010). Many applicable requirements for extreme 1-hour ozone on-attainment areas continue to apply to the SJVAB.

b. Although the San Joaquin Valley was originally classified as serious non-attainment for the 1997 8-hour ozone standard, EPA approved Valley re-classification to extreme non-attainment in the Federal Register on May 5, 2010 (effective June 4, 2010).

c. On September 25, 2008, EPA re-designated the San Joaquin Valley to attainment for the PM10 NAAQS and approved the PM10 Maintenance Plan.

d. San Joaquin Valley is designated non-attainment for the 1997 PM2.5 NAAQS. EPA designated the Valley as non-attainment for the 2006 PM2.5 NAAQS on November 13, 2009 (effective December 14, 2009)

4.3 AIR QUALITY

Per the CAAQS, the SJVAPCD is designated severe non-attainment for the ozone 1-hour standard, and non-attainment for the ozone 8-hour, PM10, and PM2.5 standards. CAAQS classifies SJVAPCD attainment/unclassified for carbon monoxide (CO); attainment for nitrogen dioxide (NO2), sulfur dioxide (SO2), lead particulate, sulfates, and vinyl chloride; and unclassified for visibility-reduced particle standards.

Per the NAAQS, the SJVAPCD is designated extreme non-attainment for the 8-hour ozone and PM2.5 standards. NAAQS classifies SJVAPCD attainment for PM10; and attainment/unclassified for CO, NO2, and SO2. SJVAPCD is not classified for lead particulate. There are no federal standards for ozone 1-hour, hydrogen sulfide, sulfates, visibility-reducing particle, and vinyl chloride standards.

Based on its recent non-attainment status, SJVAPCD developed the following plans to meet state planning requirements:

- 2004 Extreme 1-Hour Ozone Attainment Demonstration Plan;
- 2007 8-Hour Ozone Plan;
- 2007 PM10 Maintenance Plan; and
- 2008 PM2.5 Plan.

Ozone 1-Hr. In 2004, the SJVAPCD, in conjunction with CARB, EPA, and eight regional Transportation Planning Agencies in the San Joaquin Valley, developed the Extreme Ozone Attainment Demonstration Plan (OADP) to meet requirements for 1-hour ozone planning documents. It identifies emission reductions needed to attain the federal 1-hour ozone standards by November 15, 2010. The OADP includes the following provisions required by the Clean Air Act:

- Implementation of all reasonably available control measures as expeditiously as practical;
- Make reasonable further progress; and
- Include enforceable emissions limitations and such other control measures means or techniques which are needed and appropriate to demonstrate compliance.

The OADP also includes the following provisions required by the California Clean Air Act and the California Health & Safety Code:

- Use of best available retrofit control technology (BARCT) for existing permitted sources; and
- Every feasible measure.

To satisfy these requirements, the OADP includes control measures for stationary sources subject to SJVAPCD regulations and control measure for mobile and area sources subject to CARB rules.

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On August 21, 2008, the SJVAPCD adopted clarifications for the 2004 OADP for 1-hour ozone. On March 8, 2010, the EPA approved the SJVAPCD's 2004 OADP for 1-hour ozone.

Ozone 8-Hr. The SJVAPCD worked in partnership with federal, state, and local agencies to reduce the impact of motor vehicles on air quality, which are a large source of ozone precursor emissions in the San Joaquin Valley. The 2004 8-Hour Ozone Plan contains a comprehensive list of regulatory and incentive-based measures to reduce emissions and ozone and particulate matter precursors throughout the Valley, and calls for advancements in pollution control technologies for mobile and stationary sources, and a significant increase in state and federal funding to create necessary reductions in emissions to achieve attainment with the federal ozone standard. The 2007 8-Hour Ozone Plan was completed in April 2007.

PM10. In June of 2003, the SJVAPCD adopted the 2003 PM10 Plan, which presented their strategy for attaining the NAAQS for particulate matter with a diameter of 10 microns or less in the San Joaquin Valley Non-attainment Area by December 31, 2010. The 2003 PM10 Plan was amended in 2004 and 2006 for the purpose of updating data which demonstrated the reduction of PM10 pollution in the Valley and reaffirmed the 2003 PM10 Plan control strategy. On October 30, 2006, EPA issued a Final Rule determining that the Valley had attained NAAQS for PM10, but that a re-designation to attainment was not warranted because other federal CCA requirements had not been met. Verification of continued attainment was documented in the 2007 PM10 Maintenance Plan.

PM2.5. In 1997, the EPA set two PM2.5 standards: a 24-hour standard to protect against short-term health impacts, and a 12-month (annual) standard to protect against longer-term impacts. The SJVAPCD complied with the 24-hour standard, based on data from 2004 through 2006. However, the EPA revised the 24-hour standard to lower levels in 2006. Because additional formal rulemaking is required by the EPA before states can submit plans for the new 2006 PM2.5 standard, the 2008 PM2.5 Plan focuses primarily on the strategy to attain the 1997 annual standard.

Ambient Air Monitoring

The SJVAPCD is responsible for air quality management within the SJVAB, including monitoring to determine whether pollutant concentrations meet state and national air quality standards. The SJVAPCD is also responsible for adopting controls, in conjunction with the CARB, to improve air quality.

The SJVAPCD has five air quality monitoring stations in the Bakersfield area. The monitoring station closest to the proposed Project Site is the Walker Street Station in Shafer, CA, located approximately 13 miles to the northeast. Historic data for this station include O3 and NO2 only. The next closest stations are the 5558 California Avenue and Golden State Highway Stations in Bakersfield, CA, located approximately 17 and 21 miles, respectively, east of the proposed Project Site. Historic data for both of these stations include: O3, PM10, PM2.5, CO, NO2, SO2, and, with the exception that the Golden State Highway station does not monitor SO2.

4.3 AIR QUALITY

Available data for the 5558 California Avenue and Golden State Highway stations for 2007, 2008, and 2009 were used for comparative analysis. Tables 4.3-4 through 4.3-9 present summaries of the monitored air quality for O3, PM10, and PM2.5, for both of the stations.

TABLE 4.3-4 BACKGROUND AMBIENT AIR QUALITY FOR 1-HOUR OZONE

CARB Air Monitoring Station	Number of Days Exceeding 1-Hour NAAQS (0.12 ppm)			Number of Days Exceeding 1-Hour CAAQS (0.09 ppm)			Maximum 1-Hour Concentration (ppm)		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
5558 California Ave	0	1	0	4	15	16	0.117	0.127	0.120
Golden State Hwy	1	0	0	1	9	1	0.127	0.115	0.096

TABLE 4.3-5 BACKGROUND AMBIENT AIR QUALITY FOR 8-HOUR OZONE

CARB Air Monitoring Station	Number of Days Exceeding 8-Hour NAAQS (0.08 ppm)			Number of Days Exceeding 8-Hour CAAQS (0.07 ppm)			Maximum 8-Hour Concentration (ppm)		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
5558 California Ave	25	40	34	49	60	58	0.106	0.111	0.094
Golden State Hwy	14	21	4	26	36	24	0.103	0.106	0.085

TABLE 4.3-6 BACKGROUND AMBIENT AIR QUALITY DATA FOR 24-HOUR PM10-NATIONAL

CARB Air Monitoring Station	Annual Average ($\mu g/m^3$)			Days Exceeding NAAQS (>150 $\mu g/m^3$)			Maximum 24-Hour Concentration NAAQS (150 $\mu g/m^3$)		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
5558 California Ave	45.6	53.6	*	*	3.3	0	115.0	262.3	94.5
Golden State Hwy	54.8	59.7	*	0	*	0	131.0	267.4	138.2

Note: * = There was insufficient data available to determine the value.

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TABLE 4.3-7 BACKGROUND AMBIENT AIR QUALITY DATA FOR 24-HOUR PM10-STATE

CARB Air Monitoring Station	Annual Average (µg/m³)			Days Exceeding CAAQS (>50 µg/m³)			Maximum California 24-Hour Concentration CAAQS (50 µg/m³)		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
5558 California Ave	48.5	55.3	41.2	129.5	169.5	83.6	118.0	263.6	99.0
Golden State Hwy	*	*	*	*	*	*	135.0	266.8	139.5

Note: * = There was insufficient data available to determine the value.

TABLE 4.3-8 BACKGROUND AMBIENT AIR QUALITY DATA FOR 24-HOUR PM2.5-NATIONAL

CARB Air Monitoring Station	Annual Average (ppm)			Days Exceeding NAAQS (>65 µg/m³)			Maximum 24-Hour Concentration National		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
5558 California Ave	21.9	21.9	19.0	*	66.7	45.5	85.8	99.3	195.5
Golden State Hwy	19.9	17.8	14.3	*	*	*	86.6	65.3	71.5

Note: * = There was insufficient data available to determine the value.

TABLE 4.3-9 BACKGROUND AMBIENT AIR QUALITY FOR 24-HOURS PM2.5-STATE

CARB Air Monitoring Station	Annual Average (ppm)			Maximum 24-Hour Concentration State		
	2007	2008	2009	2007	2008	2009
5558 California Ave	22.0	*	21.2	93.7	99.3	195.5
Golden State Hwy	25.2	*	*	154.0	88.7	71.5

Note: * = There was insufficient data available to determine the value.

Description of Pollutants

The following is a general description of the sources, and physical and health effects for air pollutants that may be associated with the proposed Project.

4.3 AIR QUALITY

Ozone

Ozone is a photochemical pollutant, and is a regional air pollutant. It is generated over a large area and is transported and spread by wind. Ozone is the primary constituent of smog. Ozone is created through a photochemical reaction by sunlight acting on other air pollutants (called precursors), specifically NOX and reactive organic gases (ROGs).

Common sources of ozone precursors include emissions from consumer products, gasoline vapors, chemical solvents, and combustion products of various fuels. The ozone-forming chemical reactions often take place in another location, catalyzed by sunlight and heat. High ozone concentrations can form over large regions when emissions from motor vehicles and stationary sources are carried hundreds of miles from their origins.

Ozone Health Effects

High concentrations of ozone can adversely affect the human respiratory system. Many respiratory ailments, as well as cardiovascular disease, are aggravated by exposure to high ozone. Ozone also damages agricultural crops and some man-made materials, such as rubber, paint and plastics.

Volatile Organic Compounds and Reactive Organic Gases

Hydrocarbons are organic gases that are formed solely of hydrogen and carbon. There are several subsets of organic gases including Volatile Organic Compounds (VOCs) and ROGs. Both VOCs and ROGs are emitted from incomplete combustion of hydrocarbons or other carbon-based fuels and the terms are often used interchangeably. Combustion engine exhaust, oil refineries, and oil-fueled power-plants are the primary sources of hydrocarbons. Another source of hydrocarbons is evaporation from petroleum fuels, solvents, dry cleaning solutions, and paint.

VOCs and ROGs Health Effects

The primary health effect of hydrocarbons results from the formation of ozone and its related health effects. High levels of hydrocarbons in the atmosphere can interfere with oxygen intake by reducing the amount of available oxygen though displacement. Carcinogenic forms of hydrocarbons are considered Toxic Air Contaminants, or air toxics.

Carbon Monoxide

CO is emitted by mobile and stationary sources as a result of incomplete combustion of hydrocarbons or other carbon-based fuels. CO is an odorless, colorless, poisonous gas that is highly reactive. CO is a byproduct of motor vehicle exhaust, which contributes more than two-thirds of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions. These emissions can result in high concentrations of CO, particularly in local areas with heavy traffic congestion. Other sources of CO emissions include industrial processes and fuel combustion in sources such as boilers and incinerators.

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CO Health Effects

CO enters the bloodstream and binds more readily to hemoglobin than oxygen, reducing the oxygen-carrying capacity of blood, thus reducing oxygen delivery to organs and tissues. The threat from CO is most serious for those who suffer from cardiovascular disease. Healthy individuals are also affected, but only at higher levels of exposure. CO binds strongly to hemoglobin, the oxygen-carrying protein in blood, and thus reduces the blood's capacity for carrying oxygen to the heart, brain, and other parts of the body. At high concentrations, CO can cause heart difficulties in people with chronic diseases, and can impair mental abilities. Exposure to elevated CO levels is associated with visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, difficulty performing complex tasks, and possible death.

Nitrogen Oxides

NOX are a family of highly reactive gases that are a primary precursor to the formation of ground-level ozone, and react in the atmosphere to form acid rain. NOX is emitted from the use of solvents and combustion processes in which fuel is burned at high temperatures, principally from motor vehicle exhaust and stationary sources such as electric utilities and industrial boilers.

NOX Health Effects

NOX can irritate the lungs, cause lung damage, and lower resistance to respiratory infections such as influenza. The effects of short-term exposure are still unclear, but continued or frequent exposure to concentrations that are typically much higher than those normally found in the ambient air may cause increased incidence of acute respiratory illness in children. Health effects associated with NOX are an increase in the incidence of chronic bronchitis and lung irritation. Chronic exposure to NOX may lead to eye and mucus membrane aggravation, along with pulmonary dysfunction.

Particulate Matter (PM)

Particulate matter pollution consists of very small liquid and solid particles floating in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. PM is a mixture of materials that can include smoke, soot, dust, salt, acids, and metals. PM also forms when gases emitted from motor vehicles and industrial sources undergo chemical reactions in the atmosphere. PM10 refers to particles less than or equal to 10 microns in aerodynamic diameter.

PM2.5 refers to particles less than or equal to 2.5 microns in aerodynamic diameter and are a subset, or portion of PM10. In the Western United States, there are sources of PM10 in both urban and rural areas. PM10 and PM2.5 are emitted from stationary and mobile sources, including diesel trucks and other motor vehicles, power plants, industrial processing, wood burning stoves and fireplaces, wildfires, dust from roads, construction, landfills, agriculture, and fugitive windblown dust. Because particles originate from a variety of sources, their chemical and physical compositions vary widely.

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The sources of PM2.5 include fuel combustion from automobiles, power plants, wood burning, industrial processes, and diesel powered vehicles such as buses and trucks. These fine particles are also formed in the atmosphere when gases such as SO2, NOX, and VOCs (all of which are also products of fuel combustion) are transformed in the air by chemical reactions. Fine particles are of concern because they create risk to both human health and the environment.

PM10 and PM2.5 Health Effects

PM10 and PM2.5 particles are small enough - about 1 tenth the thickness of a human hair - to be inhaled into, and lodge in, the deepest parts of the lung, evading the respiratory system's natural defenses. Acute and chronic health effects associated with high particulate levels include the aggravation of chronic respiratory diseases, heart and lung disease, and coughing, bronchitis, and respiratory illnesses in children. Recent mortality studies have shown a statistically significant direct association between mortality and daily concentrations of particulate matter in the air. PM10 can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. PM10 and PM2.5 can aggravate respiratory disease, and cause lung damage, cancer, and premature death.

Although particulate matter can cause health problems for everyone, certain people are especially vulnerable to adverse health effects of PM10. These "sensitive populations" include children, the elderly, exercising adults, and those suffering from chronic lung disease such as asthma or bronchitis. Of greatest concern are recent studies that link PM10 exposure to the premature death of people who already have heart and lung disease, especially the elderly.

Sulfur Dioxide (SOX)

SOX is a colorless, pungent gas belonging to the family of sulfur oxide gases. SOX, formed primarily by combustion of sulfur-containing fossil fuels (mainly coal and oil), and other industrial processes. SOX can react to form sulfates, which significantly reduce visibility.

SOX Health Effects

The major health concerns associated with exposure to high concentrations of SOX include effects on breathing, respiratory illness, alterations in pulmonary defenses, and aggravation of existing cardiovascular disease. Major subgroups of the population that are most sensitive to SOX include individuals with cardiovascular disease or chronic lung disease (such as bronchitis or emphysema) as well as children and the elderly. SOX is a precursor to particulate matter formation (PM2.5), which is non-attainment in the SJVAPCD.

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Hydrogen Sulfide (H2S)

Hydrogen sulfide (H2S) gas is produced during the anaerobic decomposition of sulfur-containing compounds, including proteins. H2S is colorless, with a characteristic odor of rotten eggs. Atmospheric H2S is primarily oxidized to SO2, which is eventually converted into sulfate, then sulfuric acid.

H2S Health Effects

Exposure to hydrogen sulfide can cause dizziness, irritation to eyes, mucous membranes, and the respiratory tract, nausea, and headaches at low concentrations. Exposure to higher concentrations (above 100 parts per million [ppm]), can cause olfactory fatigue, respiratory paralysis, and death. H2S can be detected by the nose at extremely low concentrations, as low as 1/400 the threshold for harmful human health effects. H2S does not accumulate in the body, but is quickly excreted at nominal exposure concentrations. Acute health effects don't occur until the exposure is greater than the body's ability to excrete the excess sulfur.

Toxic Air Contaminants (TAC)

According to Section 39655 of the California Health and Safety Code, a toxic air contaminant is "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health." In addition, 189 substances which have been listed as federal hazardous air pollutants (HAPs) pursuant to Section 7412 of Title 42 of the United States Code are TACs under the state's air toxics program pursuant to Section 39657 (b) of the California Health and Safety Code.

TACs Health Effects

TACs can cause various cancers depending on the particular chemicals, type and duration of exposure. Additionally, some TACs may cause short- and long-term non-cancer health effects. The ten TACs posing the greatest health risk in California are acetaldehyde, benzene, 1-3 butadiene, carbon tetrachloride, hexavalent chrome, para-dichlorobezene, formaldehyde, methylene chloride, perchloroethylene, and diesel particulate matter. Health risk guidelines are developed by the California Air Pollution Control Officers Association (CAPCOA) for the list of chemicals regulated as toxic.

4.3.3 Regulatory Setting

4.3.3.1 Local

Kern County General Plan

The policies, goals, and implementation measures in the Kern County General Plan applicable to air quality as related to the proposed Project are provided below. The Kern County General Plan

contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below, but, as stated in Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

1.10.2 Air Quality (General Provisions)

Policies

Policy 18. The air quality implications of new discretionary land use proposals shall be considered in approval of major developments. Special emphasis will be placed on minimizing air quality degradation in the desert to enable effective military operations and in the valley region to meet attainment goals.

Policy 19. In considering discretionary projects for which an Environmental Impact Report must be prepared pursuant to the CEQA, the appropriate decision-making body, as part of its deliberations, will ensure that:

All feasible mitigation to reduce significant adverse air quality impacts have been adopted; and

The benefits of the proposed project outweigh any unavoidable significant adverse effects on air quality found to exist after inclusion of all feasible mitigation. This finding shall be made in a statement of overriding considerations and shall be supported by factual evidence to the extent that such a statement is required pursuant to the CEQA.

Policy 20. The County shall include fugitive dust control measures as a requirement for discretionary projects and as required by the adopted rules and regulations of the SJVUAPCD and the Kern County Air Pollution Control District (KCAPCD) on ministerial permits.

Policy 21. The County shall support air districts' efforts to reduce PM10 and PM2.5 emissions.

Policy 23. The County shall continue to implement the local government control measures in coordination with the Kern Council of Governments and the SJVUAPCD.

Implementation Measures

Implementation Measure F. All discretionary permits shall be referred to the appropriate air district for review and comment.

Implementation Measure G. Discretionary development projects involving the use of tractor-trailer rigs shall incorporate diesel exhaust reduction strategies including, but not limited to:

a. Minimizing idling time.

b. Electrical overnight plug-ins.

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Implementation Measure J. The County should include PM10 control measures as conditions of approval for subdivision maps, site plans, and grading permits.

Guidelines for Preparing an Air Quality Assessment for Use in Environmental Impact Reports

The Kern County Planning Department has developed the Kern County Guidelines for Preparing an Air Quality Assessment for Use in Environmental Impact Reports to assist with the preparation of air quality assessments for proposed projects (Kern County Planning Department 2007). The guidelines are intended to ensure that the assumptions and methodology used in environmental documents are uniform from one project to the next to facilitate the comparison of air quality environmental effects.

San Joaquin Valley Air Pollution Control District (SJVAPCD)

Guidelines for Implementation of the California Environmental Quality Act

SJVAPCD implements air quality programs required by state and federal mandates, enforces rules and regulations based on air pollution laws, and educates businesses and residents about their role in protecting air quality. The SJVAPCD is also responsible for permitting existing, new, and modified sources of air emissions within their jurisdiction to ensure conformance with federal, state, and local standards for air quality.

The SJVAPCD adopted the Air Quality Attainment Plan in 1991, which includes a control measure for an enhanced CEQA review program. The program requires SJVAPCD to provide technical assistance to Lead Agencies in addressing air quality issues in environmental documents and to comment on project air quality impacts; and authorizes the SJVAPCD to suggest mitigation measures to reduce air quality impacts of development projects. The SJVAPCD adopted in 1998 and revised in 2002, the Guide for Assessing and Mitigating Air Quality Impacts, which acts as an advisory document providing Lead Agencies, consultants, and project applicants with uniform procedures for addressing air quality in environmental documents.

Rules and Regulations

The SJVAPCD has established rules and regulations to ensure compliance with local, state, and federal air quality regulations and to achieve attainment of the state and federal ambient air quality standards. Those potentially applicable to the proposed Project include:

Regulation II, Rule 2010 - Permits Required. The purpose of this rule is to require any person constructing, altering, replacing, or operating any source operation which emits, may emit, or may reduce emissions to obtain an Authority to Construct or a Permit to Operate, unless exempted by Rule 2020

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Regulation II, Rule 2092 - Standards for Permits to Operate. The purpose of this rule is to define the conditions which must be met in order for an Air Pollution Control Officer (APCO) to issue a Permit to Operate.

Regulation II, Rule 2201 - New and Modified Stationary Source Review. The purpose of this rule is to provide for:

a) The review of new and modified Stationary Sources of air pollution and to provide the mechanisms including emission trade-offs by which Authorities to Construct such sources may be granted, without interfering with the attainment or maintenance of Ambient Air Quality Standards; and

b) No net increase in emissions above specified threshold from new and modified Stationary Sources of all non-attainment pollutants and their precursors.

Regulation II, Rule 2250 - Permit-Exempt Equipment Registration. The purpose of this rule is to provide affected sources and the District with the necessary administrative mechanisms to determine compliance of permit-exempt equipment with applicable rules and regulations.

Regulation II, Rule 2280 - Portable Equipment Registration. The purpose of this rule is to provide an administrative mechanism and establish standards for registration of certain portable emissions units for operation at participating districts though out the State of California.

Regulation II, Rule 2520 – Federally Mandated Operating Permits. The purpose of this rule is to provide for the following:

- An administrative mechanism for issuing operating permits for new and modified sources of air contaminants in accordance with requirements of 40 CFR Part 70.
- An administrative mechanism for issuing renewed operating permits for sources of air contaminants in accordance with requirements of 40 CFR Part 70.
- An administrative mechanism for revising, reopening, revoking, and terminating operating permits for sources of air contaminants in accordance with requirements of 40 CFR Part 70.
- An administrative mechanism for incorporating requirements authorized by pre-construction permits issued under District Rule 2201 (New and Modified Stationary Source Review) in a Part 70 permit as administrative amendments, provided that such permits meet procedural requirements substantially equivalent to the requirements of 40 CFR 70.7 and 70.8 and compliance requirements substantially equivalent to those contained in 40 CFR 70.6.
- The applicable federal and local requirements to appear on a single permit.

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Regulation II, Rule 2530 – Federally Enforceable Potential to Emit. The purpose of this rule is to restrict the potential to emit of a stationary source so that the source may be exempt from the requirements of Rule 2520 (Federally Mandated Operating Permits).

Regulation II, Rule 2550 – Federally Mandated Preconstruction Review for Major Sources of Air Toxics. The purpose of this rule is to provide an administrative mechanism for implementing the preconstruction review requirements for 40 CFR 63.44 at major air toxic sources. The provisions of this rule shall apply to applications to construct or reconstruct a major air toxics source with Authority to Construct, issued on or after 28 June 1998.

Regulation III – Permit Fees. This rule identifies fees that are applicable to permit modifications, new facilities, and permitted emissions.

Regulation IV, Rule 4001 – New Source Performance Standards. This rule incorporates the New Source Performance Standards from Part 60, Chapter 1, of 40 CFR. All new sources of air pollution and modification of existing sources of air pollution shall comply with the standards, criteria, and requirements set forth therein.

Regulation IV, Rule 4002 – National Emission Standards for Hazardous Air Pollutants. This rule incorporates the National Emission Standards for Hazardous Air Pollutants (HAPs) from Part 61, Chapter 1, Subchapter C of 40 CFR and the National Emission Standards for HAPs for Source Categories from Part 63, Chapter 1, Subchapter C, of 40 CFR.

Regulation IV, Rule 4101 – Visible Emissions. The purpose of this rule is to prohibit the emission of visible air contaminants to the atmosphere. The provisions of this rule shall apply to any source operations which emits or may emit air contaminants.

Regulation IV, Rule 4102 - Nuisance. The purpose of this rule is to protect the health and safety of the public. This rule shall apply to any source operation which emits or may emit air contaminants or other materials.

Regulation IV, Rule 4201 – Particulate Matter Concentration. The purpose of this rule is to protect the ambient air quality by establishing a particulate matter emission standard. This rule applies to any source operation which emits or may emit dust, fumes, or total suspended particulate matter.

Regulation IV, Rule 4202 – Particulate Matter Emission Rate. The purpose of this rule is to limit particulate matter emissions by establishing allowable emission rates. This rule applies to any source operation which emits or may emit particulate matter.

Regulation IV, Rule 4301 – Fuel Burning Equipment. The purpose of this rule is to limit the emission of air contaminants from fuel burning equipment. This rule limits the concentration of

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combustion contaminants and specifies maximum emission rates for SO2, NOX, and combustion contaminant emissions.

Regulation IV, Rule 4304 – Equipment Tuning Procedure for Boilers, Steam Generators, and Process Heaters. The purpose of this rule is to provide an equipment tuning procedure for boilers, steam generators, and process heaters to control visible emissions and emissions of both NOX, and CO.

Regulation IV, Rule 4305-4308 – Boilers, Steam Generators, and Process Heaters. The purpose of these rules is to limit emissions of NOX, CO, SOX, and PM10 from boilers, steam generators, process heaters, and water heaters. These rules apply to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a rated heat input greater than 5 million British Thermal Units (BTU) per hour.

Regulation IV, Rule 4311 - Flares. The purpose of this rule is to limit the emission of VOCs, NOX, and SOX from the operation of flares.

Regulation IV, Rule 4320, Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBTU/HR. The purpose of this rule is to limit emissions of NOX, CO, SOX, and PM10 from boilers, steam generators, and process heaters. This rule applies to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input greater than 5 million BTU per hour.

Regulation IV, Rule 4501, Alternative Compliance for Best Available Retrofit Control Technology (BARCT). The purposes of this rule are to:

1.1 Provide an administrative mechanism for sources to retire emission reduction credits (ERC) in lieu of compliance with emission requirements of BARCT rules.

1.2 Ensure that equivalent emission reductions are achieved according to the applicable air quality attainment plan. This rule and the provisions herein are subject to revision or repeal by the District Governing Board, in consideration of air quality conditions and/or projections, and in accordance with Rule 2301 (Emission Reduction Credit Banking).

1.3 Define administrative calculation procedures to determine the amount of BARCT offsets required.

Regulation IV, Rule 4701 – Internal Combustion Engines – Phase 1. The purpose of this rule is to limit the emissions of NOX, CO, and VOCs from internal combustion engines. Except as provided in Section 4.0 of the rule, the provisions of this rule apply to any internal combustion engine, rated greater than 50 brake horsepower (BHP) that requires a Permit to Operate.

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Regulation IV, Rule 4702 – Internal Combustion Engines – Phase 2. The purpose of this rule is to limit the emissions of NOX, CO, and VOCs from internal combustion engines. This rule applies to any internal combustion engine with a rated BHP greater than 50.

Regulation IV, Rule 4801 - Sulfur Compounds. The purpose of this rule is to limit the emissions of sulfur compounds. A maximum concentration and test method are specified.

Regulation VIII – General Requirements. The purpose of this regulation is to reduce ambient concentrations of PM10 by requiring actions to prevent, reduce or mitigate anthropogenic fugitive dust emissions. The Rules contained in this Regulation have been developed pursuant to U.S. EPA guidance for Serious PM10 Non-attainment Areas. The rules are applicable to specified anthropogenic fugitive dust sources. Fugitive dust contains PM10 and particles larger then PM10. Controlling fugitive dust emissions when visible emissions are detected will not prevent all PM10 emissions, but will substantially reduce them.

Regulation IX – General Requirements. The purpose of this regulation is to specify the criteria and procedures for determining the conformity of federal actions with the SJVAPCD's air quality implementation plan.

4.3.3.2 State

In 1988, the California CAA was adopted and led to the establishment of CAAQS for the same major pollutants as the NAAQS and to standards for visibility reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. There are currently no NAAQS for these latter pollutants. The CARB is responsible for enforcing air pollution regulations in California. The California CAA was amended in 1992, to outline a program to attain the CAAQS for these same pollutants by the earliest practical date. The California CAA requires all air-pollution control districts in California to endeavor to achieve and maintain state ambient air-quality standards by the earliest practicable date and to develop plans and regulations specifying how they will meet this goal. The CAAQS are generally more stringent than the NAAQS for the same pollutants.

The CARB divides California into air basins that are designated to attain and maintain both the NAAQS and CAAQS within their region. CARB coordinates and oversees state air quality management and air pollution control districts. CARB has retained authority over mobile sources but has delegated much of the control of stationary sources to location agencies.

4.3.3.3 Federal

Air quality is federally protected by the CAA and its amendments. Under the CAA, the EPA developed the primary and secondary NAAQS for the six criteria air pollutants including O3, PM10, PM2.5, CO, NO2, SO2, and lead, discussed above. Proposed projects in or near non-attainment areas could be subject to more stringent air-permitting requirements than projects in attainment areas. Projects that emit non-attainment pollutants are subject to New Source Review (NSR) regulations and

projects that emit attainment pollutants may be subject to Prevention of Significant Deterioration (PSD) and NSR regulations. The CAA requires each state to prepare a State Implementation Plan (SIP) to demonstrate how it will attain the NAAQS within the federally imposed deadlines. Local air quality management districts' prepare local air quality plans that become part of the SIP. The EPA has designated enforcement of air pollution control regulations to the individual states.

4.3.4 Impacts and Mitigation Measures

4.3.4.1 Methodology

To determine the significance of potential air quality impacts from the implementation of the proposed Project, the net increase in air pollutants associated with the implementation of the proposed Project were quantified and compared with applicable CEQA and SJVAPCD significance thresholds.

4.3.4.2 Thresholds of Significance

A CEQA significant adverse impact is determined to occur if potentially significant CEQA impacts, as identified in CEQA Appendix G, cannot be mitigated through the adoption of enforceable conditions. Specifically, health based ambient standards (AAQS) established by the ARB and the U.S. EPA, and enforced in this instance by the SJVAPCD, are utilized as a basis for determining whether the Project's emissions will cause a significant adverse impact under CEQA. The CEQA Guidelines and Kern County CEQA Implementation Document state that a project would have a significant impact on air quality if it would:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors). Specifically, implementation of the project would have a significant impact on air quality if it would exceed any of the following SJVAPCD adopted thresholds:
    - Operational[3] and Area Sources:

      ROG – 10 tons per year.

      NOX – 10 tons per year.

      PM10 – 15 tons per year.

[3] Operational – Sources of emissions that occur from a project after it has been constructed.

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- Stationary[4] Sources:

  Extreme Non-attainment – 10 tons per year (NOX and ROG).

  PM10 – 15 tons per year.

- Violate any air quality standard as established by the EPA or air district or contribute substantially to an existing or projected air quality violation;
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

4.3.4.3 Project Impacts

IMPACT AQ-1 Conflict with or Obstruct Implementation of an Applicable Air Quality Plan

The SJVAPCD is a non-attainment area for the NAAQS for ozone and PM10 and has adopted plans to demonstrate attainment of those standards. On February 16, 2006, the SJVAPCD Governing Board adopted the 2006 PM10 Plan, to show how the federal PM10 standard will be attained in the San Joaquin Valley. On April 30, 2007, the District Governing Board adopted the District's 2007 Ozone Plan, to show how the District would attain the federal 8-hour ozone standard through the San Joaquin Valley. The plans include existing and proposed rules to reduce emissions from emission sources and operations subject to the jurisdiction of the SJVAPCD.

Each of these plans anticipates that new stationary sources will move within the SJVAPCD in future years (and that existing sources would want to expand operations) and seek authority to emit air pollutants under SJVAPCD's Rule 2201 (New and Modified Stationary Source Review Rule). To allow for such future economic growth, both the 2006 PM10 Plan and the 2007 Ozone Plan anticipate that stationary sources, such as those included in the proposed Project, would seek approval from the SJVAPCD and would be required to install Best Available Control Technology on new and modified equipment and provide emission reduction credits (ERCs) to offset (or mitigate) emission increases from permitted equipment.

OEHI will obtain an Authority to Construct for all stationary source equipment required under District Rule 2201. In addition, Project equipment and operations will comply with all applicable rules of the SJVAPCD. Emissions from other activities that are not subject to District permit requirements are included as growth in Air District plans. Air District plans take into account established land use designations and the maximum development permitted in any given designation. Moreover, triennial updates of the plans ensure that population, employment, transportation trends in the region are taken

[4] Stationary – Sources of emissions that occur from an emissions unit that is located in a permanent fixed position (e.g., not mobile). Stationary emissions sources are typically associated with the operational phase of the project.

into account. The Project will comply with SJVAPCD rules and regulations and is consistent with existing general plan and zoning designations. Consequently, the emissions from the project have been accounted for and will not conflict with or obstruct the implementation of SJVAPCD's adopted air quality plans. Therefore, Project impacts will be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT AQ-2 Result in a Cumulatively Considerable Net Increase of any Criteria Pollutant for which the Region is Non-attainment for Federal or State Standards

Emissions estimates for the construction and operational phases of projects are analyzed separately due to the difference in the duration of emissions sources (short- versus long-term); the types of environmental effects caused by the activities; and mitigation techniques available for minimizing such effects. Consistent with the procedures recommended by Kern County Planning and the SJVAPCD, the environmental effects from construction and operation are considered separately as discussed below.

Operational Emissions Sources

Operational air pollutant emissions will occur from three general categories: permitted stationary sources, other stationary source activities, and mobile sources.

Permitted Stationary Emissions

Permitted emissions include emissions from new equipment installed for the purpose of CO2 EOR and will include process heaters, tanks, fugitive ROG emissions from permitted equipment (CTB, RCF, CRP), and emissions from maintenance activities conducted on emergency use only equipment (i.e. diesel engines used for fire pumps). Permitted engine emissions allow for 12 hours per year of maintenance operation per engine. The emergency use only flares do not include maintenance allowance since the flares have to be removed from service in order to conduct such maintenance. The methodology for calculating emissions from these sources and the predicted emissions and assumptions are presented in Appendix A.

Other Stationary Source Activities

The criteria pollutant emissions from stationary source activities not otherwise included in the "permitted emissions" are accounted for as operational emissions from other "stationary source activities". These emissions primarily consist of combustion emissions from the emergency use only flare, ROG emissions from production activities (e.g., well maintenance activities, pipeline

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blowdowns, plant turnarounds, and other fugitive sources), and fugitive dust. The methodology for calculating emissions from these sources and the predicted emissions and assumptions are presented in Appendix A.

Mobile Source Emissions

Mobile source emissions are limited to on-road vehicle emissions from operational phase employees transiting between area residences and the Project Site. Emissions were calculated using the factors for "Light Duty Autos" (LDA) for year 2015 within CARB's EMFAC 2007. The calculations assume that the EOR Project will require 25 full time employees (50 one way trips) with a travel distance of 30 mile per one way trip. It was assumed that the EOR-Project would be "manned" 365 days per year (i.e. 1,500 miles per day x 365 days per year).

TABLE 4.3-10 ESTIMATED ANNUAL PROJECT OPERATION EMISSIONS

Component	NOX (tons)	Total Exceed NOX Threshold?	ROG (tons)	Total Exceed ROG Threshold?	CO (tons)	PM10 (tons)	Total Exceed PM10 Threshold?	SOX (tons)
Stationary Sources	7.20	**No**	22.63	**Yes**	31.98	2.90	**No**	1.05
Mobile Sources	0.12		0.03		0.98	0.02		0.00
Total	**7.32**		**22.67**		**32.96**	**2.92**		**1.06**

NOTE: For purposes of this analysis, operational emissions for the entire Project were assumed to begin in 2016 and occur throughout the Project lifespan.

TABLE 4.3-11 ESTIMATED EMISSION REDUCTION CREDITS

	NOX (tons/year)	ROG (tons/year)	CO (tons/year)	PM10 (tons/year)	SOX (tons/year)
Total Operational Emissions	7.32	22.67	32.96	2.92	1.06
Annual Emissions Subject to Rule 2201	3.52	13.29	15.21	2.53	0.93
ERCs Required	5.28	19.93	22.82	3.80	1.40
Net Increase	2.04	2.74	10.14	-0.88	-0.34
Threshold Allowance	10.00	10.00	Not Applicable	15.00	Not Applicable
Adverse Effect	No	No	No	No	No

NOTE: ERCs calculated pursuant to SJVAPCD Rule 2201. It is assumed that PM emissions will be offset using SOX ERCs.

As shown in Table 4.3-10, estimated emissions resulting from Project operation will not exceed the SJVAPCD significance thresholds for NOX or PM10 and are therefore not expected to result in a

significant air quality impact. However, the estimated operational emissions would exceed the SJVAPCD significance criteria for ROG. This is a potentially significant air quality impact. The significance of this impact will be reduced by implementing Mitigation Measure AQ-1 identified below. This mitigation includes implementing Best Available Control Technology (BACT) on permitted emissions sources with any emissions, and the provision of ERCs to offset emission increases from permitted emissions sources as required by SJVAPCD Rule 2201. Fugitive ROG emissions will be reduced by the implementation of leak detection and repair requirements pursuant to SJVAPCD Regulation IV.

As shown in Table 4.3-11 (Estimated Emission Reduction Credits), an estimated 13.29 tons of ROG will be offset using 19.93 ERCs in compliance with SJVAPCD Rule 2201. The Project ROG emissions will correspondingly result in 2.74 tons/year after the application of required ERCs. As the increase in ROG emissions after the application of ERCs is below the SJVAPCD threshold of 10 tons/year, this is a less than significant impact after mitigation.

Construction Emissions Sources

The primary emission sources during construction will include heavy construction equipment, construction personnel vehicle use, and fugitive dust from disturbed areas due to grading, excavating, and construction of Project facilities. Different areas within the Project Site will be disturbed at different times during the 20 year construction phase of the proposed Project. Estimated land disturbances for major construction activities as well as construction personnel requirements are summarized in Chapter 3 (Project Description Addendum).

Vehicle emissions were calculated using emissions factors for "Light Duty Autos" (LDA) and "Heavy-Duty Trucks" (HDD) obtained from CARB's EMFAC 2007 and are specific to each construction year and vehicles within the Kern County inventory. The Emissions factors associated with construction equipment were obtained from CARB's OFFROAD 2007 model. For each of the 20-years where construction will be occurring, projected activity levels were determined and these emissions factors were then applied to the anticipated number of internal combustion engines, brake-horsepower, engine load factor, daily operating hours, and operational days per year. Fugitive dust emissions were calculated using emissions factors from AP-42 and assumptions for the silt content of disturbed soils and mean vehicle/equipment weights.

A summary of construction emissions (construction equipment/vehicle exhaust and fugitive dust) is presented below in Table 4.3-12 (Estimated Annual Project Construction Emissions). Detailed construction emissions and assumptions used in the calculations are included in Appendix A.

4.3 AIR QUALITY

TABLE 4.3-12 ESTIMATED ANNUAL PROJECT CONSTRUCTION EMISSIONS					
Year	NOX (tons)	ROG (tons)	CO (tons)	PM10 (tons)	SOX (tons)
2014	7.24	1.11	8.71	4.66	0.02
2015	10.24	1.58	13.61	6.84	0.03
2016	14.01	1.93	10.59	3.57	0.03
2017	9.76	1.45	11.09	4.56	0.03
2018	6.43	1.00	8.57	4.74	0.02
2019	7.14	1.12	10.60	2.50	0.03
2020	5.91	0.87	4.96	0.57	0.01
2021	5.81	0.89	6.16	0.99	0.02
2022	4.97	0.73	3.65	0.21	0.01
2023	8.97	1.30	7.45	1.00	0.02
2024	5.26	0.84	6.12	1.01	0.02
2025	7.45	1.12	7.27	1.35	0.02
2026	4.96	0.80	5.55	0.86	0.01
2027	5.21	0.85	6.32	2.13	0.02
2028	5.18	0.85	6.71	1.43	0.02
2029	6.96	1.11	7.41	0.74	0.02
2030	4.46	0.73	4.99	0.59	0.01
2031	5.98	0.94	5.45	0.60	0.02
2032	3.49	0.55	2.84	0.26	0.01
2033	7.06	1.20	8.49	0.96	0.03
Annual Average	**6.83**	**1.05**	**7.33**	**1.98**	**0.02**

4.3 AIR QUALITY

Although OEHI has quantified estimated emissions that could result from Project construction, the SJVAPCD's approach to CEQA analyses of construction impacts focuses on PM10 which is of greatest concern to the SJVAPDCD. The SJVAPCD has determined that compliance with Regulation VIII for all sites and implementation of all applicable control measures presented in SJVAPCD's *Guide for Assessing and Mitigating Air Quality Impacts* will constitute sufficient mitigation to reduce PM10 impacts to a level considered less than significant.

The SJVAPCD requires implementation of fugitive dust control measures for any construction, demolition, excavation, extraction, and other earthmoving activities. As such, the Mitigation Measure AQ-2 has been incorporated into the proposed Project design to reduce fugitive dust emissions to the degree feasible in compliance with SJVAPCD's Rule 8021 and Guide for Assessing and Mitigating Air Quality Impacts. These measures are projected to reduce fugitive dust emissions by 80 percent as assumed by the SJVAPCD. The mitigated 80 percent reduction in fugitive dust has already been accounted for in the PM10 emissions shown in Table 4.3-12. With the SJVAPCD recommended mitigation measures, PM10 emissions are less than significant.

As shown in Table 4.3-12, average annual construction emissions of non-attainment pollutants will be well below the SJVAPCD significance criteria that are used to assess the significance of operational impacts. However, the estimated NOX emissions from construction activities in 2015 (10.24 tons) and 2016 (14.01 tons) are above the threshold of 10 tons/year. For purposes of this analysis, total annual construction emissions have been compared to the SJVAPCD criteria used to assess significant effects. Considering the above, construction emissions of NOX in 2015 and 2016 are considered significant.

Mitigation Measures

Mitigation Measure AQ-1 OEHI shall reduce operational emissions from stationary source activities by implementing the following mitigation measures:

a. All permitted equipment with any emissions will include BACT and will comply with all applicable SJVAPCD rules and regulations;

b. Fugitive ROG emissions will be mitigated by complying with leak detection and repair (LDAR) requirements contained in SJVAPCD Rule 4409;

c. Fugitive dust emissions will be mitigated through implementation of the dust control mitigation measures outlined in Mitigation Measure AQ-2; and

d. Emissions from operational activities will be mitigated by providing emission reduction credits (ERC) to offset emission increases from permitted equipment, as required by District Rule 2201. The required amount of ERC will be determined at the time of permit review.

4.3 AIR QUALITY

Mitigation Measure AQ-2 OEHI shall reduce fugitive dust emissions during construction by implementing the following measures:

a. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, covered with a tarp or other suitable cover or vegetative ground cover;

b. All on-site unpaved roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant;

c. All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking;

d. When potential dust generating materials are transported off-site, all such material shall be covered, or effectively wetted to limit visible dust emissions, and at least six inches of freeboard space from the top of the container shall be maintained;

e. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions). (Use of blower devices is expressly forbidden);

f. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/suppressant;

g. Any site with 150 or more vehicle trips per day shall prevent carryout and trackout;

h. Limit traffic speeds on unpaved roads to 15 mph;

i. Suspend excavation and grading activity when winds exceed 20 mph; and

j. Limit area subject to excavation, grading, and other construction activity at any one time.

Mitigation Measure AQ-3 OEHI shall reduce exhaust emissions during construction when using construction equipment and vehicles by implementing the following measures:

a. Prohibit the use of heavy-equipment during first- or second-stage smog alerts and suspend all construction activities during second-stage smog alerts;

b. Maintain equipment engines in proper working order;

c. Limit the hours of operation of heavy-duty equipment and/or the amount of equipment in use to the extent feasible;

d. Require that all diesel engines be shut-off when not in use to reduce emissions from idling;

e. Require that trucks and vehicles in loading or unloading queues have their engines turned-off when not in use; and

f. Emissions from off-road mobile source construction equipment will be mitigated by requiring that all contractors comply with the California Air Resources Board off-road mobile source regulations.

Level of Significance after Mitigation

The Project will comply with all applicable LORS and has incorporated mitigation measures (AQ-1 through AQ-3) to reduce operational and construction emissions of non-attainment criteria air pollutants to the extent feasible. Impacts resulting after adherence to applicable LORS and incorporated mitigation measures are therefore less than significant.

IMPACT AQ-3 Violate Any Air Quality Standards or Contribute Substantially to an Existing or Projected Air Quality Violation

The annual emissions of criteria air pollutants summarized in Tables 4.3-10 and 4.3-12 represent total emissions that are projected to occur across the entire project Site which occupies a large geographic area (e.g., the EHOF occupies approximately 75 square miles). Many of the stationary sources and sources of construction emissions will have large separation distances. In addition, the elevation of the EHOF is expected to contribute to air pollutant dispersion compared to the surrounding topography and receptors. Pursuant to SJVAPCD Rule 2201, in order to receive an Authority to Construct, new or modified stationary sources must demonstrate that their emissions will not cause or make worse the violation of an Ambient Air Quality Standard.

Considering the above, the proposed Project is not expected to violate any air quality standards or contribute substantially to an existing or projected air quality violation. Furthermore, implementation of mitigation measures AQ-1 through AQ-3 for Project construction is expected to further reduce emissions of criteria pollutants. This is a less than significant impact.

Mitigation Measures

Impacts will be reduced by implementing Mitigation Measures AQ-1 through AQ-3 outlined above.

Level of Significance after Mitigation

Impacts would be less than significant.

4.3 AIR QUALITY

IMPACT AQ-4 Expose Sensitive Receptors to Substantial Pollutant Concentrations

Sensitive receptors are persons who may be particularly sensitive to air pollution because they are ill, elderly, or have lungs that are not fully developed. Locations where such persons reside, spend considerable amounts of time, or engage in strenuous activities are also referred to as "sensitive receptors." Typical sensitive receptors include inhabitants of long-term healthcare facilities, rehabilitation centers, convalescent centers, retirement homes, residences, schools, playgrounds, childcare centers, and athletic facilities.

Construction

The construction phase of the proposed Project will result in emissions of toxic air contaminants/hazardous air pollutants in the form of diesel particulate matter emissions from the operation of diesel-fueled internal combustion engines. As shown in Table 4.3-12, PM10 emissions from construction activities (a fraction of which includes emissions from diesel particulate matter) are below the established SJVAPCD annual mass significance criteria for all years of the Project. Because equipment used during the construction phase of the proposed Project are generally mobile in nature and/or will be operated throughout a large area of the EHOF, pollutant concentrations of diesel particulate matter are expected to be dispersed across the Project Site. In addition, the closest sensitive receptors to the proposed Project Site are residences and a school located in Tupman, approximately 1.5 miles northeast of the proposed CO2 EOR Processing Facility. Considering the above, construction-related-emissions of hazardous air pollutants are not expected to expose sensitive receptors to substantial pollutant concentrations. This is a less than significant impact.

Operations

Estimated Project operational emissions of listed air toxic substances were screened to prioritize risks using the California Air Pollution Control Officers Association (CAPCOA) Toxics Committee - Air Toxics "Hot Spots" Program, Facility Prioritization Guidelines (July 1990). Preliminary screening was conducted using the "Dispersion Adjustment Procedure" from the guidelines. Estimated Project operational emissions in pounds per year for known carcinogenic compounds and pounds per hour for non-carcinogenic compounds were used for listed substances (CAPCOA, 1990, Appendix B). Unit risk factors were obtained from the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values.

Formulas for the "Dispersion Adjustment Procedure" were entered into a spreadsheet and a risk prioritization score was calculated for carcinogenic risk and acute and chronic risk. The prioritization scores provide a relative rating to evaluate the need for a human health risk assessment under the California air toxics "Hot Spot" program (AB2588). A prioritization score less than 1.0 is representative of a low risk facility. A prioritization score greater than 10 may indicate a high risk facility. A prioritization score 1.0 and 10 indicates an intermediate priority and additional evaluation is recommended.

4.3 AIR QUALITY

Preliminary screening of the Project's estimated emissions indicates a low priority for carcinogen substances and for non-carcinogen substances. The screening analysis output is included in Appendix A.

The risk prioritization was conducted using a worst-case scenario where it was assumed that all potential sources of toxic air contaminates operate simultaneously. However, the facility is not predicted to result in a risk, because the nearest sensitive receptor is located 1.5 miles away.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT AQ-5: Create Objectionable Odors Affecting a Substantial Number of People

While offensive odors rarely cause any physical harm, they can be very unpleasant, leading to considerable distress among the public and often generating citizen complaints to local governments and the SJVAPCD. Any project with the potential to frequently expose members of the public to objectionable odors will be deemed to have a significant impact. Odor impacts on residential areas and other sensitive receptors, such as hospitals, day-care centers, schools, etc., warrant the closest scrutiny, but consideration should also be given to other land uses where people may congregate, such as recreational facilities, worksites, and commercial areas (SJVAPD, 2002). Analysis of potential odor impacts is typically evaluated on the basis of a project's potential to generate odors and/or receive odors from surrounding land uses.

The proposed Project does not include any component that has the potential to introduce new sources of potentially objectionable odors that don't already exist as part of existing oil field operations. Furthermore, EOR facilities are not included in SJVAPCD's list of common facilities with odor concerns. Current surrounding land uses do not generate odors that might impact the Project. Considering the above, as well as the approximate 1.5 mile distance of the nearest sensitive receptor to the Project Site, potential odor impacts are expected to be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.3 AIR QUALITY

4.3.5 Cumulative Impacts

The Project would have cumulatively considerable effects if the increase in ambient concentration from project emissions, when considered in conjunction with the change in ambient concentration caused by past, present, and reasonably foreseeable future similar projects, would cause an exceedance of an ambient air quality standard. Factors considered in determining whether such exceedances are substantial include:

1. the duration of the activity causing air quality impacts;
2. the magnitude of the project emissions, and their contribution to the air basin's emission inventory and future emission budgets established to maintain or attain compliance with AAQS.
3. the location of the project site, i.e., whether it is located in an area with generally good air quality where non-attainment of any ambient air quality standard is primarily or solely due to pollutant transport from other air basins;
4. the meteorological conditions and timing of the project impacts, i.e., do the project's maximum modeled pollutant impacts occur when ambient concentrations are high (such as during high wind periods, or seasonally);
5. the modeling methods, and how refined or conservative the impact analysis modeling methods and assumptions were and how that may affect the determined adverse impacts;
6. the project site location and nearest receptor locations; and whether the identified adverse impacts would also occur at the maximum impacted receptor location; and
7. the potential for future cumulative impacts; and whether appropriate mitigation is being recommended to address the potential for impacts associated with likely future projects.

For construction emissions, the mitigation that is considered is limited to controlling both construction equipment exhaust emissions and fugitive dust emissions to the maximum extent feasible. For operating emissions, the mitigation considered includes both feasible emission controls (BACT) and the use of emission reduction credits to offset emissions of nonattainment criteria pollutants and their precursors.

Because Project construction and operation would result in emissions of ozone precursors (ROGs and NOX) and PM10, and could result in the cumulative net increase in these pollutants impacts could be cumulatively significant. However, as discussed above, the proposed Project is not expected to result in a significant net increase of any criteria pollutant for which the region is nonattainment for federal or state Standards with the exception of NOX construction emissions in 2015 and 2016 (IMPACT AQ-2) or violate any air quality standards or contribute substantially to an existing or projected air

quality violation (IMPACT AQ-3). Following is a brief analysis of the Project's potential construction and operational cumulative air quality impact.

Cumulative Construction Air Quality Impact

As mentioned in IMPACT AQ-1, construction related emissions are already included as growth in applicable SJVAPCD plans and are therefore considered consistent with adopted plans. Mitigation measure AQ-2 will reduce fugitive dust emissions from construction activities and mitigation measure AQ-3 will reduce emissions from construction equipment. In addition, off-road equipment are subject to CARB's off-road mobile source program which will reduce emissions from construction equipment over time as the requirements for cleaner engines and add on controls are phased in. Considering the above, cumulative construction air quality impacts will be less than significant.

Cumulative Operation Air Quality Impact

As discussed in IMPACT AQ-2, net increases in emissions from permitted sources will be offset using ERCs. The potential for cumulative operational air quality impacts is further minimized as the Project is not expected to exceed the annual mass emissions thresholds established by the SJVAPCD. As the SJVAPCD significance criteria have been established amongst other things, to prevent cumulative air quality impacts from occurring, operation of the proposed Project is not expected to result in a cumulatively considerable air quality impact. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required (beyond those proposed for Project-specific impacts).

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.4 BIOLOGICAL RESOURCES

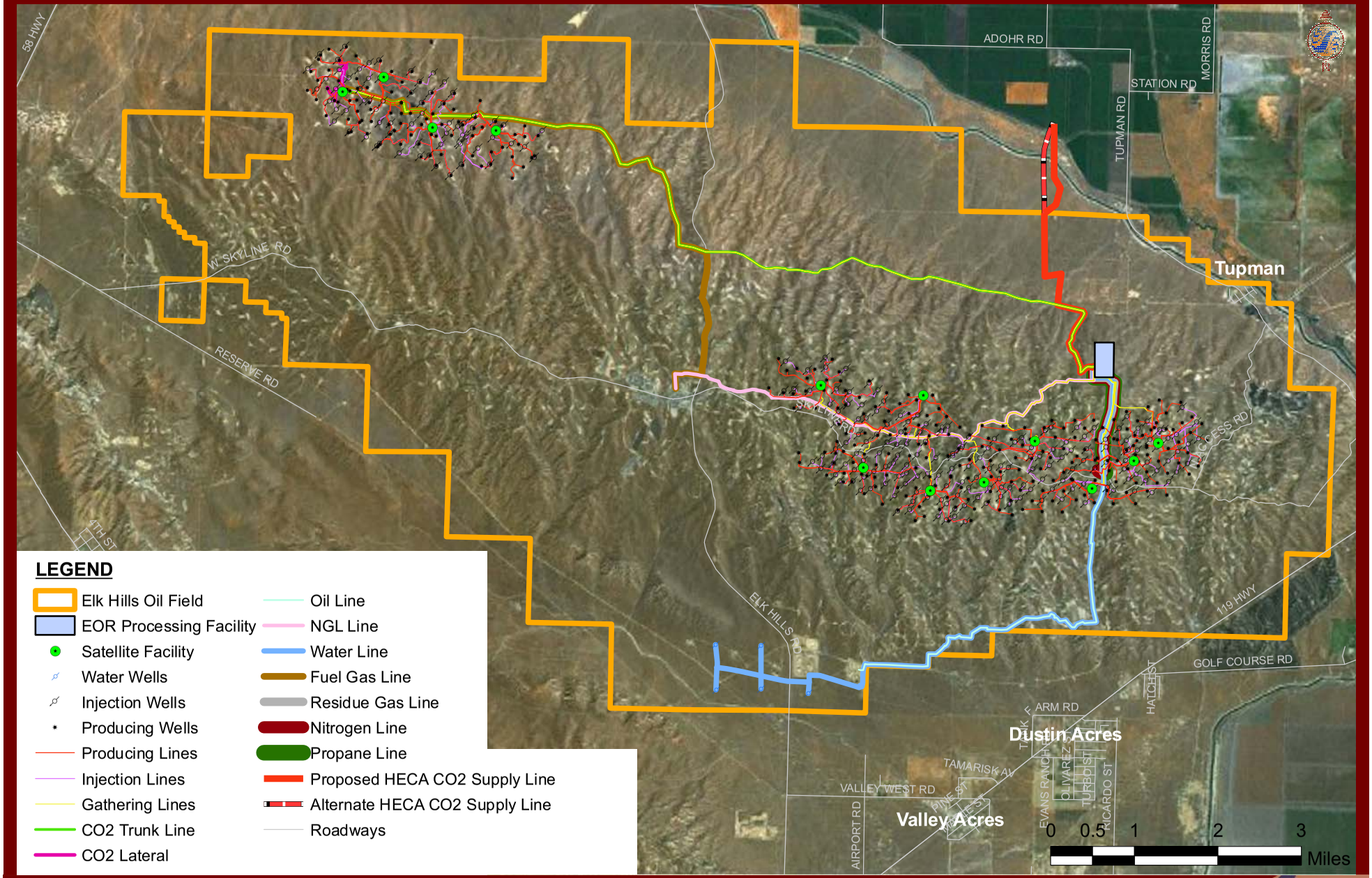
4.4 Biological Resources

4.4.1 Introduction

This section has been prepared in order to identify potential biological issues and evaluate potential impacts to biological resources from implementation of the proposed Project. These evaluations are to ensure that potentially significant environmental impacts are accurately assessed and mitigated. The proposed CO2 EOR Project will be located primarily in the high producing area of EHOF which is poor habitat.

This section describes the effects of the proposed CO2 EOR Project on the EHOF in regards to biological resources. HECA will supply CO2 to OEHI. The Project would become part of the OEHI operations and proceed with a projected 20-year life cycle. Proposed Project facilities to be built on the EHOF include: EOR Processing Facility, 13 satellite distribution facilities, the construction of approximately 150 new injection and production wells, the construction of new water distribution lines, and approximately 652 miles of support producing and injection lines (see Figure 4.4.1 [Project Site Map]). These activities will occur on a combination of disturbed, previously disturbed, and currently undisturbed habitat over the lifetime of the proposed Project. Total new permanent disturbance is projected to be approximately 261.6 acres, while total temporary disturbance is projected to be approximately 1,447 acres.

The 1997 SEIS/PEIR considered the future of the maximum economic development of NPR-1 (now EHOF), including, among other EOR techniques, the use of CO2 to enhance oil production.



LEGEND

- Elk Hills Oil Field
- EOR Processing Facility
- Satellite Facility
- Water Wells
- Injection Wells
- Producing Wells
- Producing Lines
- Injection Lines
- Gathering Lines
- CO2 Trunk Line
- CO2 Lateral
- Oil Line
- NGL Line
- Water Line
- Fuel Gas Line
- Residue Gas Line
- Nitrogen Line
- Propane Line
- Proposed HECA CO2 Supply Line
- Alternate HECA CO2 Supply Line
- Roadways

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Fig. 4.4-1

Project Site Map

OEHI CO2 EOR Project - Supplemental Environmental Information

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Project # 185802314

4.4 BIOLOGICAL RESOURCES

To evaluate the sensitive biological resources impacts by the proposed Project, literature and database reviews were completed to determine documented or potential presence of special-status plant and wildlife species in the Project vicinity. Numerous comprehensive technical biological assessment (BA) studies have been conducted within the EHOF and surrounding properties. The most recent and comprehensive resource document that describes sensitive biological resources within the Project Area is the Draft Habitat Conservation Plan for the Elk Hills Oil Field (2006). The HCP was prepared to obtain incidental take authorization for state and federally listed or potential protected species that may be affected with the covered activities (HCP Section 2.3). The HCP describes in extensive detail the sensitive species descriptions, their habitats, biological data including distribution of these species within the EHOF and includes a 2-mile buffer (HCP Sections 3.2 and 3.3), impacts to sensitive species by oil field related activities (HCP Section 4.4) and mitigation and minimization measures to reduce those impacts (Sections 5, 6, 7, and 8). The Hydrogen Energy California Biological Assessment (URS, 2010) describes in extensive detail sensitive biological resources that the HECA Plant and ancillary components may affect. Other comprehensive source documents describing the Project or detailing impacts to sensitive species and their habitats include: Preliminary Project Description (Pre-Feed Stage) CO2 EOR at the Elk Hills Oil Field (ManageTech, 2010), California Endangered Species Act Memorandum of Understanding and Take Authorization (1997, 1999 MOU Amendment, and 2010 MOU Second Amendment by and between OEHI and the CDFG), the Biological Opinion prepared for Elk Hills (USFWS 1995), California Incidental Take Permit Application for the Elk Hills Oil and Gas Field Habitat Conservation Plan (OEHI, 2009), and the Final Supplemental Environmental Impact Statement/Program Environmental Impact Report for the Sale of Naval Petroleum Reserve No.1 (Elk Hills) (DOE and County of Kern1997). The 2010 MOU Second Amendment between OEHI and CDFG extends the California Incidental Take Permit term to 2014. OEHI is currently applying for a California Incidental Take Permit that would modify and update the earlier CESA MOU and authorize incidental take of CESA-listed species associated with continued oil and gas production activities by OEHI at the EHOF for a 50-year term.

Until the HCP is fully adopted by the California Department of Fish and Game (CDFG) and United States Fish and Wildlife Service (USFWS), all oilfield operations within the existing boundaries of the Project Area regarding incidental take of federal and/or state special status species are permitted according to the conservation measures, terms and conditions outlined in the Biological Opinion (BO) issued by the USFWS under Section10 of the federal Endangered Species Act (FESA) and by the state Memorandum of Understanding issued by the California Fish and Game Department under Section 2081(b) of the California Endangered Species Act (CESA). Though CO2 use for the Project is not specifically mentioned in the HCP or the BO, existing EOR activities within the EHOF including the construction of new production and injection lines, EOR Processing Facility, injection and supply well pads, compressor stations, etc., are considered to be covered as general oilfield operations outlined in the state and federal agency take permits (HCP Section 2.3 and BO 1995). Most of the planned facilities associated with the proposed Project and associated development occurs on habitat described to be of moderate multispecies habitat value (HCP Section 5 Figure 5.1).

4.4 BIOLOGICAL RESOURCES

Extensive biological monitoring has occurred on the Project Area as part of the terms and conditions described in the BO from 1979 until the sale to OEHI in 1998 (19 years). OEHI has continued a monitoring program since the 1998 acquisition, as prescribed by the Conservation Management Agreement/Declaration of Restrictions for the EHOF that was approved by the CDFG and USFWS on November 6, 1998. This information is provided to the wildlife agencies as required in the EHOF HCP semi-annual and annual reports. This has resulted in the development of a very extensive data set on biological resources at EHOF.

As an example, focused surveys for Swainson's hawk nests have not been performed for the CO2 EOR project. As required by the EHOF HCP, biological pre-activity surveys are conducted by qualified biologists prior to ground disturbance activities. Biological data associated with Swainson's hawk and nests are included in the EHOF HCP semi-annual and annual reports provided to the wildlife agencies.

4.4.2 Environmental Setting

General Setting

The Project Site is confined to the EHOF which is located on a narrow ridge orientated generally east to west, approximately 16 miles long and 6 miles wide covering an area of approximately 74 square miles. This approximately 48,000 acre tract of land is located along the southwest edge of the San Joaquin Valley approximately 26 miles southwest of Bakersfield in western Kern County, California. Elevations across the Project Site range from approximately 300 to 1551 feet above mean sea level (msl). Steep draws and dry stream channels are generally found in the interior of the Project Site. Flat valleys and alluvial plains are found on the perimeter of the Project Site. Dominant vegetation includes non-native Grasslands, Valley Saltbrush Scrub and Sink Scrub. Soils types are mostly characterized by fine to coarse sandy loams which are very friable. Typical climate conditions within the Project Area are hot with little precipitation in the summer months and cool and wet with frequent fog in the winter months. Annual precipitation is approximately 5.75 inches per year.

Existing Level of Disturbance

The Project Site is located on the EHOF, an area of disturbed and non-disturbed natural lands, and sections of surrounding lands used for agriculture. The EHOF is a high production oil field with significant disturbance in high production areas. The existing environmental plan, as outlined in the Elk Hills HCP states that to the extent possible, new construction will be limited to disturbed areas. Current plans for construction of the proposed Project involve placing the majority of the proposed Project components (new wells, ancillary pipeline, satellite stations) in high oil production areas. These areas, as outlined in Figure 4.4-3 (Oil Production Density) are mostly located in the upland grassland areas of the EHOF and are currently heavily disturbed as a result of historical oil extraction. Construction will be limited, to the extent feasible, to areas of previous disturbance. Extensive habitat assessment within the Project Site has been performed by multiple biological consulting firms. Figure 4.4-2 (Multispecies Habitat Value) shows the results of much of that

assessment. As mentioned previously, a majority of the proposed Project components are scheduled to be installed in areas of low to moderate multispecies habitat potential.

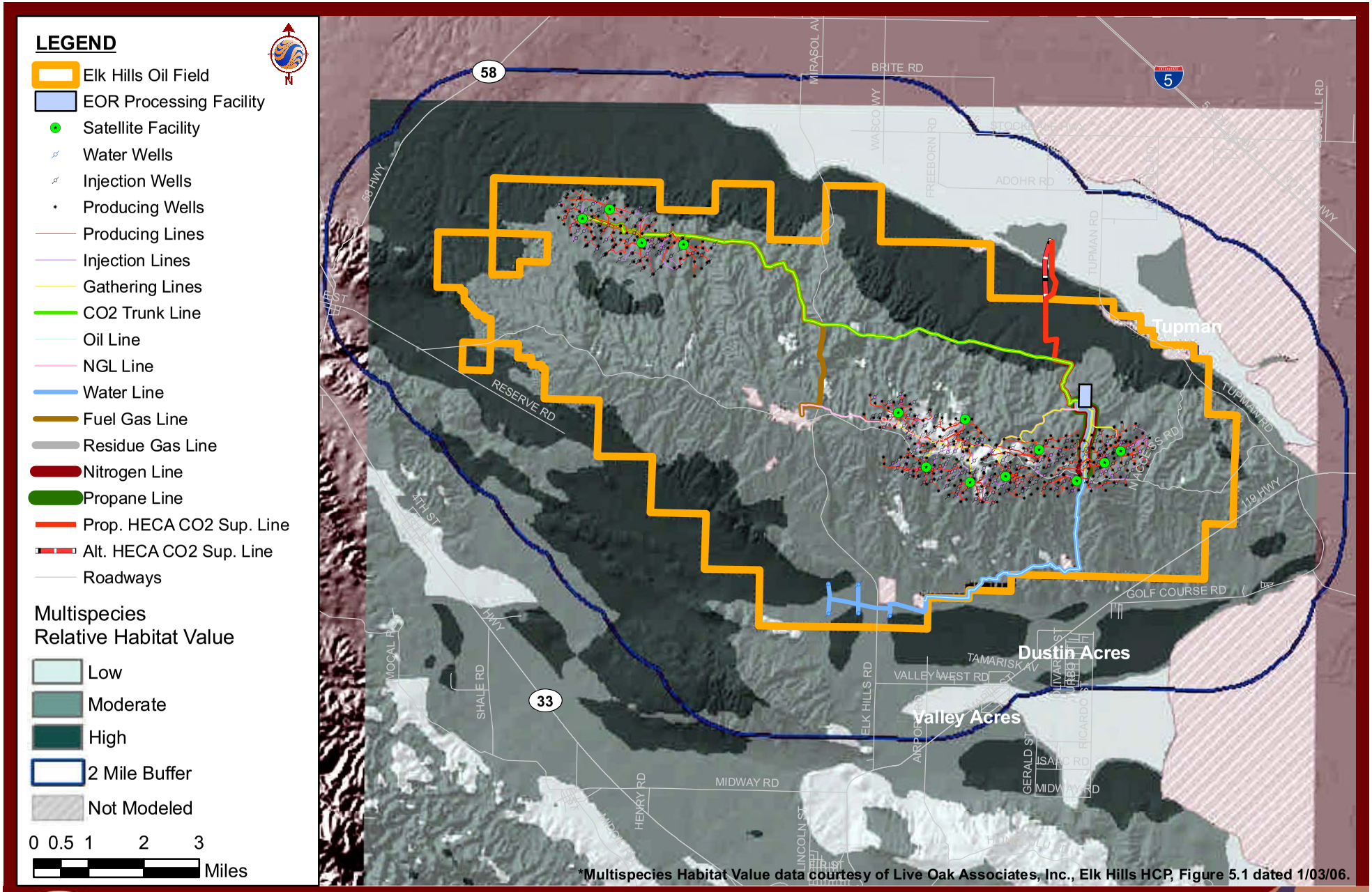

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Fig. 4.4-2

Multispecies Habitat Value

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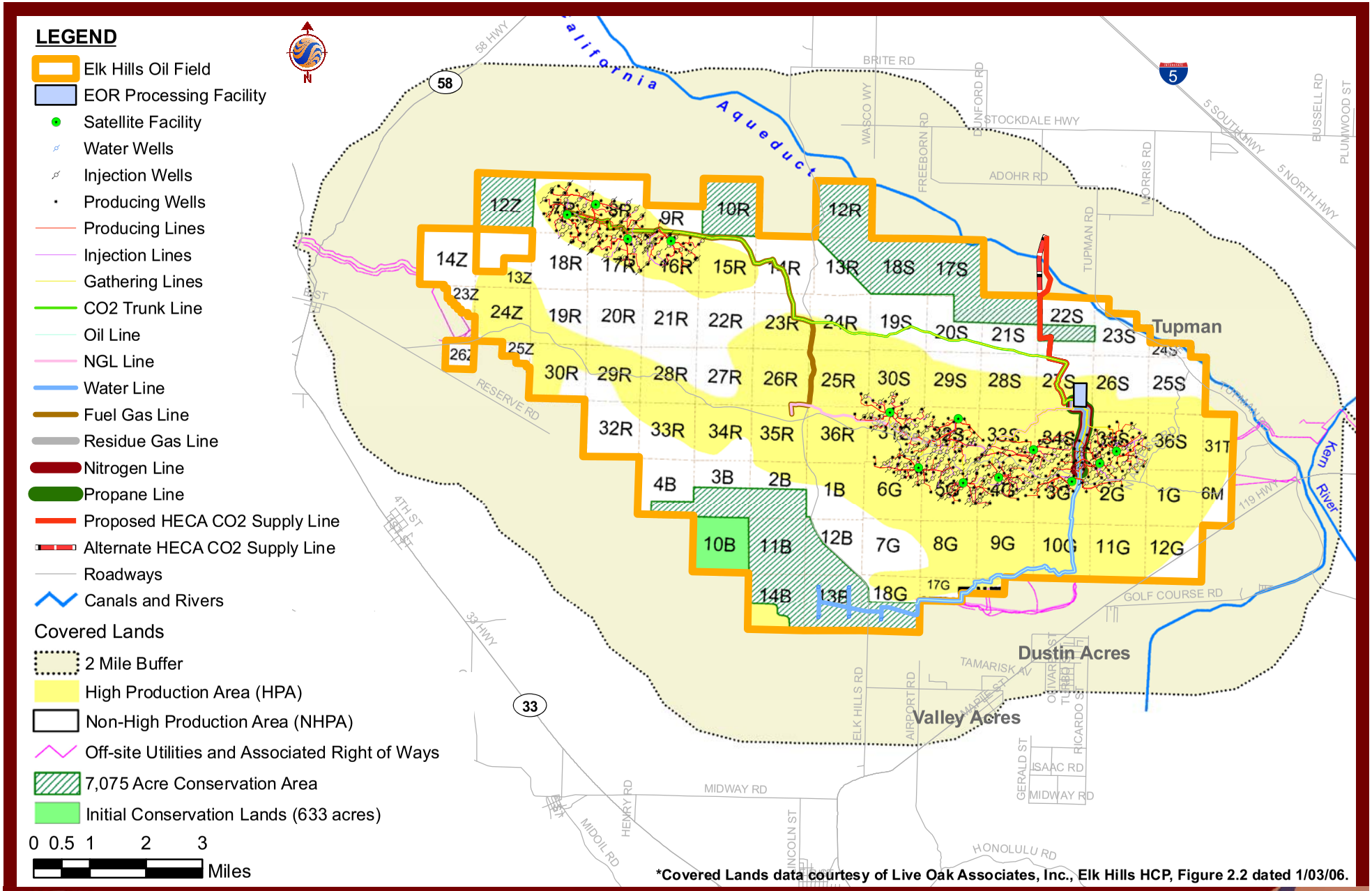

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Fig. 4.4-3

Oil Production Density

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4.4 BIOLOGICAL RESOURCES

Other Project components including the proposed CO2 EOR Processing Facility, some satellite facilities, and modifications to existing injection and recovery wells will be built in undisturbed areas when necessary.

Vegetation (Plants)

Vegetation communities found in the proposed Project Site are typical of those found throughout this region of Kern County. In particular, vegetation found within the Project Site is largely dominated by Non-native grassland. This community is characterized by introduced grasses and forbs, most commonly of European origin. Occasional shrubs and sub-shrubs species can be observed including desert saltbush, and buckwheat. Common grass species found within this type of community include red brome, ripgut brome, soft chess, rattail fescue, and wild oats. Common forbs include red-stem filaree, lupines, and fireweed. Originally found in ruderal areas, this community type can now be found throughout the state of California as a dominant vegetation community in a variety of habitats.

Introduced grasses have replaced native grasslands in areas of low seasonal rainfall throughout much of the California floristic province. Within the proposed Project Area, non-native grassland is present at higher elevations and on hill slopes, and then transitions into scrub habitat at lower elevations. A large proportion of Project components are scheduled to be constructed in the higher elevation foothills in areas of high oil production. These areas are typically composed of non-native grasslands and other plant species typically found in ruderal habitats.

Two other communities common to the western Kern County and surrounding areas are also found within the Project Site. Two similar scrub communities; Valley Saltbush Scrub, and Valley Sink Scrub are found in the more gently sloped and lower elevation sections of the Project Site.

Valley Saltbush Scrub is characterized by blue-green or grayish chenopod shrubs and consists of mostly alkaline soils. Traditionally, open spaces within the canopy were occupied by bare ground, or native forbs and grasses. With the introduction of non-native grasses and forbs, areas of the open canopy are typically dominated by introduced species described above. Within the Project Site, Valley Saltbush Scrub is dominated by desert saltbush, spiny saltbush, cheesebush, and matchweed.

Valley Sink Scrub is extremely limited throughout the Project Site, but where present consists of low lying arroyos and sandy washes surrounded by marginal Valley Saltbush Scrub habitat. Though water may flow through or occupy low lying areas during heavy rainfall, Sink Scrub habitats are dry throughout much of the year. Species within Sink Scrub habitat are typically similar to surrounding scrub habitats.

In general the non-native grassland is present throughout the southern portion of the proposed Project site, including those areas classified as other vegetation communities.

Botanical surveys (following CDFG 2009 survey guidelines) over the direct impact area of Elk Hills have not been conducted for the CO2 EOR Project.

4.4 BIOLOGICAL RESOURCES

Special Status Plants Species

A records search of the California Natural Diversity Database CNDDB (CDFG, 2010) for the 7.5-minute Tupman, East Elk Hills, West Elk Hills, Lokern, Buttonwillow, Rio Bravo, Taft, and Fellows quadrangles was conducted with habitat and environmental conditions similar to those found within the proposed Project Area. These records searches indicated that 19 Special Status plants have been reported in these listed quadrangles (refer to Table 4.4-1 below). Sources of information for this table included The Jepson Manual: Higher Plants of California (Hickman, 1993); and the California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants of California (2010) Suitable habitat for many of these species is present within the project site, though the majority construction is scheduled to occur on previously disturbed or poor habitat. Table 4.4-1 lists the special status plants including their federal and state protection, habitat, and an assessment of potential presence by a Stantec Botanist. In addition to the above sources, OEHI completed a comprehensive floristic survey over the entire EHOF in 2001 as required by the BO (2001, Special- Status Plant Species Survey Results at Elk Hills Oil Field, Kern County, California).

TABLE 4.4-1: CNDDB SENSITIVE PLAN SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

Plant Species	Status	Habitat	Assessment
California jewelflower (*Caulanthus californicus*)	FE, SE, CNPS 1B.1	Inhabits flats, gentle slopes generally in non-alkaline grassland. Also found in open juniper woodland from 70-1000 m. Found in southern San Joaquin Valley.	Though potential habitat exists, no observations have occurred within the EHOF. **Low Potential**
Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*)	CNPS 1B.1	Inhabits saline places and vernal pools below 1000 m. Found in Tehachapi, southern Outer South Coast Ranges, South Coast, Peninsular Ranges and western Mojave Desert.	Suitable habitat may exist within EHOF but no suitable saline or vernal pool habitats were observed in any project location. This species has never been recorded within the EHOF. **Low Potential**
Heartscale (*Atriplex cordulata*)	CNPS 1B.2	Inhabits saline or alkaline soils below 200 m. Found in Sacramento and San Joaquin Valleys.	Though potential habitat exists, no observations have occurred within the EHOF. **Moderate Potential**
Horn's milk vetch (*Astragalus hornii var. hornii*)	CNPS 1B.1	Inhabits salty flats and lake shores from 60-150 m. Found in southern San Joaquin Valley, Western Tranverse Range and the western edge of the Mojave Desert.	Unlikely to occur within the EHOF. **Low Potential**
Hoover's eriastrum (*Eriastrum hooveri*)	CNPS 4.2	Inhabits drying grassy areas below 170 m. Found in	This species has been recorded in 66 sections throughout the EHOF.

4.4 BIOLOGICAL RESOURCES

TABLE 4.4-1: CNDDB SENSITIVE PLAN SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

		southern and eastern South Coast Range.	**Moderate Potential**
Jared's pepper-grass (*Lepidium jaredii* ssp. *jaredii*)	CNPS 1B.2	Inhabits alkali bottoms, slopes and washes below 500 m. Found in South Coast Interior Range and San Joaquin Valley.	Though potential habitat exists, no observations have occurred within the EHOF. **Low Potential**
Kern mallow (*Eremalche kernensis*)	FE, CNPS 1B.1	Found in Kern and San Luis Obispo Counties on eroded hillsides and alkali flats with shadscale from 100-1000 m.	Though potential habitat exists, no observations have occurred within the EHOF. **Low Potential**
Lemmon's jewelflower (*Caulanthus coulteri* var. *lemmonii*)	CNPS 1B.2	Inhabits dry, exposed slopes from 80-2000 m. Found in San Joaquin Valley, San Francisco Bay, and South Coast Ranges.	Though potential habitat exists, no observations have occurred within the EHOF. **Low Potential**
Lost Hills crownscale (*Atriplex vallicola*)	CNPS 1B.2	Inhabits dried ponds and alkaline soils below 200 m. Found in San Joaquin Valley.	Existence is known in EHOF and could occur within the 2 mile buffer area. **Moderate Potential**
Munz's tidy-tips (*Layia munzii*)	CNPS 1B.2	Inhabits alkaline clay soils below 700 m. Found in San Joaquin Valley.	Suitable habitat exists within EHOF and surrounding buffer area. **Moderate Potential**
Oil neststraw (*Stylocline citroleum*)	CNPS 1B.1	Inhabits flats and clay soils in oil-producing areas from 50-400 m. Found in southern San Joaquin Valley and San Diego county.	Known populations occur within EHOF. Could occur in project areas within saltbush scrub communities. **High Potential**
Pale-yellow layia (*Layia heterotricha*)	CNPS 1B.1	Inhabits open, clay soils below 1600 m. Found in southern Tehachapi, western San Joaquin Valley, and South Coast and Western Tranverse Ranges.	Suitable habitat exists within EHOF and surrounding buffer areas. **Moderate Potential**
Recurved larkspur (*Delphinium recurvatum*)	CNPS 1B.2	Inhabits poorly drained, fine, alkaline soils in grassland and *Atriplex* scrub from 30-600 m. Found in Sacramento and San Joaquin Valleys.	CNDDB shows occurrences near proposed Project area. **Moderate Potential**
San Joaquin bluecurls (*Trichostema ovatum*)	CNPS 4.2	Inhabits valley and foothill grasslands from 65-300 m. Found in southwestern San	Suitable habitat within project areas. **Moderate Potential**

4.4 BIOLOGICAL RESOURCES

TABLE 4.4-1: CNDDB SENSITIVE PLAN SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

		Joaquin Valley.	
San Joaquin woolly-threads (Lembertia [*Monolopia*] *congdonii*)	FE, CNPS 1B.2	Inhabits sandy grasslands and alkali sink from 90-700 m. Found in southwestern San Joaquin Valley.	Not known to occur within EHOF, though may occur within 2 mile buffer area. **Moderate Potential**
Subtle orache (*Atriplex subtilis*)	1B.2	Inhabits valley and foothill grasslands.	Suitable habitat exists within EHOF and surrounding buffer area. **Moderate Potential**
Tejon poppy (*Eschscholzia lemmonii* ssp. *kernensis*)	CNPS 1B.1	Inhabits grassy, open areas from 0-2000 m. Found in southwestern Tehachapi, and the northern portion of the Western Transverse Ranges.	CNDDB records and floristic survey data show occurrences near proposed ProjectSite. **High Potential**
Temblor buckwheat (*Eriogonum temblorense*)	CNPS 1B.2	Inhabits barren clay in grassland and sandstone outcrops from 300–1000 m. Found in east Monterey, east San Luis Obispo and West Kern Counties.	This species was not observed during botanical surveys; however, habitat is marginally suitable for the species to be present. **Low Potential**

LISTING STATUS	
FE = Federally listed Endangered FT = Federally listed Threatened FC = Federal Candidate FD = Federally de-listed CNPS 1B = Plants considered by CNPS to be rare, threatened, or endangered in California, and elsewhere CNPS 4= Plants considered by CNPS to have limited distribution. CNPS .1= seriously threatened in California. CNPS .2= fairly threatened in California.	SE = State listed Endangered ST = State Listed Threatened SP = State Protected Species CSC = California Species of Special Concern

4.4 BIOLOGICAL RESOURCES

Federal and State Listed Plant Species

The Elk Hills HCP covers six sensitive plant species known to occur within the proposed Project Site including a two-mile buffer area. These plants include both federal and state endangered and threatened species as well as CNPS listed species that may be proposed for federal or state listing under either FESA or CESA.

Life histories and documentation on distribution of species covered under the HCP within the EHOF and surrounding areas of federal and state listed species can be found in Section 3.3.2 of the Elk Hills HCP.

California Jewelflower California jewelflower *(Caulanthus californicus)* is federally and state listed as Endangered. This species is found in several plant communities, including Non-native grassland, Upper Sonoran Subshrub Scrub, and Cismontane Juniper Woodland and Scrub. Historical records indicate that this species also occurred in the Valley Saltbush Scrub community. Herbaceous cover is dense at most California jewelflower sites. At many of the observed locations over the past several years, native plant species, such as annual fescue (Vulpia microstachys), clovers (Trifolium spp.), red maids (Calandrinia ciliata), and goldfields (Lasthenia californica) comprised a high proportion of the vegetative habitat associated with California jewelflower populations. California jewelflower has been reported from elevations ranging from approximately 75 to 900 meters (246 to 2953 feet) and from level terrain to 25 percent slopes. Primary soil types at known populations are subalkaline, sandy loams.

California jewelflower is an annual plant belonging to the mustard family. As is typical of annuals, both plant size and population size in California jewelflower can vary dramatically, depending on site and weather conditions. The stems are hairless and often branching. The upper leaves are egg-shaped and clasp the stem, unlike the leaves at the base of the plant, which are oblong. The maroon buds are clustered at the tip of the stem and contrast with the translucent, white flowers below. California jewelflower has elongated fruits that are flattened in cross-section.

Currently, known populations of California jewelflower are confined to three areas in hilly terrain west of the San Joaquin Valley: the Carrizo Plain, Santa Barbara Canyon (adjacent to the Cuyama Valley in Santa Barbara County), and the Kreyenhagen Hills (Fresno County). Additional populations of California jewelflower may persist in the foothills of Fresno, Kern, and Kings Counties, where potential suitable habitat remains in private rangeland. However, access to historical sites in these areas has been restricted, so the presence of the species has not been verified in over 50 years.

The primary reason for the decline of California jewelflower is suitable habitat destruction. Conversion to agriculture accounted for the loss of most populations, but those closest to Bakersfield and Fresno were lost due to urbanization. Oilfield activity has or has the potential to eliminate unknown populations in the foothills at the western margin of the San Joaquin Valley. Potential threats to the remaining populations include competition from introduced plant species, pesticide

effects on pollinators, and small population size. Although potential habitat exists, California jewelflower has never been observed within the EHOF.

Heartscale

Heartscale *(Atriplex cordulata)* is not known to occur within the Project Area, although it could possibly occur within the 2 mile buffer area.

For a complete description of heartscale and its distribution and life history see the Elk Hills HCP (Section 3.3.2.5).

Kern Mallow

Kern mallow *(Eremalche kernensis)* is federally listed as Endangered and is listed with the CNPS with a 1B.1 rating. Kern mallow typically occurs in the Valley Saltbush Scrub natural community, where it grows under and around spiny and common saltbushes and in patches with other herbaceous plants, rather than in the intervening alkali scalds. Associated herbs include red brome, red-stemmed filaree (Erodium cicutarium), woolly goldfields (Lasthenia minor), and white Sierran layia (Layia pentachaeta ssp. albida). Kern mallow typically grows in areas where shrub cover is less than 25 percent. The most recently-published treatments assign Kern mallow the name Eremalche parryi ssp. kernensis. However, the taxonomy of Kern mallow remains controversial in terms of its rank and its relationship to Parrys mallow (Eremalche parryi ssp. parryi). Most local botanists continue to use the scientific name Eremalche kernensis for this member of the mallow family (Malvaceae).

The height and habit of Kern mallow vary depending on seasonal precipitation. The form can vary from single-stemmed to multiple-stemmed, with the central stem erect and the lateral stems trailing along the ground. Stem lengths at flowering may range from less than 2.5 centimeters (1 inch) to nearly 50 centimeters (20 inches). The flowers have five petals, and the wheel-shaped fruits are divided into single-seeded segments.

The loss and degradation of suitable habitat in the Lokern area, of which the Project Site is located, have been responsible for the decline of Kern mallow. Approximately 85 percent of suitable Kern mallow habitat in the Lokern area is privately owned and thus is vulnerable to development for many potential uses (CDFG 1995, Taylor and Davilla 1986, Presley 1994). Although the current level of petroleum production does not seem to pose a threat to the portion of the metapopulation that remains, increased production levels could cause further fragmentation and loss of localized colonies.

Kern Mallow is not known to occur within the Project Site but does occur within the 2-mile buffer zone surrounding the field.

For an analysis of the distribution of Kern Mallow on the EHOF and surrounding areas see the attached Elk Hills HCP (section 3.3.2.3).

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Lost Hills Saltbush

Lost Hills Saltbush has been detected within the Project Area and has been historically know from and could occur within the 2-mile buffer area.

For a complete description of Lost Hills Saltbush life history and distribution within Elk Hills see the attached Elk Hills HCP (section 3.3.2.6)

Oil Nestraw

The Oil Nestraw (Stylocline citroleum) occurs within the Project Area and was observed regularly during 1995-2001 floristic surveys.

For a complete description of the life history and distribution of Oil Nestraw see the attached Elk Hills HCP (section 3.3.2.2)

San Joaquin Woolly-threads

San Joaquin woolly-threads (Lembertia [Monolopia] congdonii) is a Federally Endangered Species. This species occurs in Non-native Grassland, Valley Saltbush Scrub, Interior Coast Range Saltbush Scrub, and Upper Sonoran Subshrub Scrub. San Joaquin woolly-threads typically occupy microhabitats with less than 10 percent shrub cover, although herbaceous cover may be either sparse or dense. Plant species that often occur with San Joaquin woolly-threads include red brome (Bromus madritensis ssp. rubens), red-stemmed filaree (Erodium cicutarium), goldfields (Lasthenia spp.), Arabian grass (Schismus spp.), and mouse-tail fescue (Vulpia myuros). This species occurs on sandy, sandy loam, or silty soils with neutral to subalkaline pH that were deposited in geologic times by flowing water. Occurrences have been reported at elevations ranging from approximately 60 to 800 m (197 to 2,625 ft).

San Joaquin woolly-threads is an annual herb and the sole species in the genus Lembertia. The common name "woolly-threads" is derived from the many long (up to 45 cm; 18 inches) trailing stems covered with tangled hairs. However, the growth habit varies; San Joaquin woolly-threads plants also can be tiny (<7 cm; <3 inches) and erect with a single stem. The tiny, yellow flowers are clustered at the tips of the stems and branches. Each flower head is approximately 6 mm (0.25 inches) long and contains two types of florets (the tiny flowers characteristic of the aster family); the four to seven outer florets differ in shape from the numerous inner florets. The two types of florets produce achenes (tiny, one-seeded fruits) that also differ in shape.

Historically, San Joaquin woolly-threads occurred primarily in the San Joaquin Valley, with a few occurrences in the hills to the west and in the Cuyama Valley of San Luis Obispo and Santa Barbara counties. New occurrences of San Joaquin woolly-threads have been discovered since 1986, primarily in the hills and plateaus west of the San Joaquin Valley. These constitute four metapopulations (scattered groups of plants that may function as a single population due to occasional interbreeding) and several small, isolated populations. The largest extant metapopulation

4.4 BIOLOGICAL RESOURCES

occurs on the Carrizo Plain Natural Area in San Luis Obispo County. Smaller metapopulations are found in Kern County near Lost Hills, in the Kettleman Hills of Fresno and Kings Counties, and in the Jacalitos Hills of Fresno County. Isolated occurrences are known in the Panoche Hills in Fresno and San Benito counties, the Bakersfield vicinity in Kern County, and the Cuyama Valley.

Habitat loss was responsible for the decline of San Joaquin woolly-threads. The majority of the occurrences in the San Joaquin and Cuyama valleys were extirpated by intensive agriculture. In addition, several sites in and around Bakersfield were eliminated by urban and intensive oilfield development. Current threats to San Joaquin woolly-threads include commercial and agricultural development, increased intensity of land use in oilfields or pastures, and competition from introduced plants.

San Joaquin Woolly-threads is not known to occur within the Project Area although suitable habitat is present and it could possibly occur near the 2 mile buffer area.

Tejon Poppy

Tejon Poppy (Eschscholzia lemmonii ssp. kernensis) is known to occur within the Project Area, although it is relatively uncommon. For a complete description of life history and distribution see the attached Elk Hills HCP (section 3.3.2.1).

CNPS 1A and 1B Listed Species

Species descriptions for CNPS listed 1A or 1B species not covered by the Elk Hills HCP are not included. Whereas federal or state listed threatened or endangered species are afforded legal protection under Federal Endangered Species Act (FESA) or the California Endangered Species Act (CESA), the classifications, CNPS 1B or others, do not afford any legal protection. From the federal standpoint, CNPS classification is an informal term that refers to those species believed to be declining or to be in need of concentrated conservation actions to prevent decline. These species receive no legal protection under FESA or CESA and the use of the term does not mean that they will eventually be proposed for listing. At one extreme, it may only be necessary to monitor the health of a species and its habitat. At the other extreme, the species may eventually require listing as threatened or endangered. CNPS listed species not included in the Elk Hills HCP are not included in this discussion

Wildlife (Animals)

The proposed Project Site is located in the south-western San Joaquin Valley which was historically comprised of millions of acres of wetlands (CERES 2010), Valley Saltbush Scrub, Valley Sink Scrub, and native grasslands that supported diverse populations of wildlife. Development has eliminated a large portion of the wildlife communities associated with those communities.

The proposed Project Site is expected to provide habitat for common and sensitive species associated with Valley Saltbush Scrub, Valley Sink Scrub, and valley and foothill grasslands. The project site

4.4 BIOLOGICAL RESOURCES

does not support any significant wetland or riparian habitats, though canals and other irrigation features on the northern portion of the project site have been used by wetland species (CNDDB 2010).

Most components within the proposed Project are scheduled to be constructed in areas previously disturbed by oil extraction activities. Habitat in these high oil production areas is usually classified as poor or moderate due to heavy disturbance. Project components outside of these high production and low habitat value areas include the EOR Processing Facility. These areas are generally considered moderate to good habitat. Potential habitat for a number of listed or otherwise sensitive species exists throughout the low lying areas of the EHOF and surrounding buffer area.

Special Status Wildlife Species

A records search of the CNDDB (CDFG 2010), for the 7.5-minute Tupman, East Elk Hills, West Elk Hills, Lokern, Buttonwillow, Rio bravo, Taft, and Fellows quadrangles was conducted with habitat and environmental conditions similar to those found within the Project Area. These record searches indicate that 14 special status animal species have been reported in these quadrangles (refer to Table 4.4-2 below). Sources of information for this table included the CNDDB (CDFG 2010), and USFWS Species Accounts (USFWS 2010). Suitable habitat for many of these species is present within the Project Site.

No USFWS designated critical habitat would be impacted by the proposed project. The closest critical habitat is located more than 20 miles southwest and is designated for the Buena Vista lake shrew. The B.V. Lake Shrew does appear in CNDDB reports although it is not anticipated that the proposed Project will have any affect as the Project Area contains very little suitable habitat. Only small portions of land on and between the California Aqueduct offer suitable habitat.

Table 4.4-2 lists the special status wildlife species including their federal and state protection, habitat, and an assessment of potential presence by a Stantec biologist.

TABLE 4.4-2 CNDDB SENSITIVE WILDLIFE SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

Species	Listing Status	Habitat Association	Potential within Project Site
BIRDS			
Western burrowing owl (*Athene cunicularia*)	MBTA, CSC	Inhabits open, dry annual or perennial grasslands, desert, and scrublands characterized by low-growing vegetation.	CNDDB records and past surveys/ monitoring show potential for burrowing owl occurrence within the Project Area. **High Potential**
Mountain plover (*Charadrius montanus*)	FC, CSC	Chenopod Scrub and Valley and foothill grasslands.	Wintering migrant found near standing water, not anticipated within Project Area.

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TABLE 4.4-2 CNDDB SENSITIVE WILDLIFE SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

Species	Listing Status	Habitat Association	Potential within Project Site
			Low Potential
Le Conte's thrasher (*Toxostoma lecontei*)	MBTA, CSC	Commonly nests in a dense, spiny shrub or densely branched cactus in desert wash habitat, usually 0.6-2.4m above the ground.	Marginal habitat is present on Project Area. Previous studies indicate species can be found in isolated pockets of *Atriplex sp.*. **Moderate Potential**
Loggerhead shrike (*Lanius ludovicianus*)	MBTA, CSC	Inhabits broken woodlands, savannah, pinyon-juniper, Joshua tree and riparian woodlands, desert oases, scrub and washes.	Marginal habitat is present on Project Area. **Moderate Potential**
MAMMALS			
American badger (*Taxidea taxus*)	CSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils.	Species widespread, though uncommon. Suitable habitat is present throughout EHOF and surrounding buffer areas. **Moderate Potential**
Giant kangaroo rat (*Dipodomys ingens*)	FE, SE	Inhabits annual grasslands on the western side of the San Joaquin Valley, marginal habitat in alkali scrub.	Suitable habitat is present in project areas comprised of low lying or gently sloped terrain. **High Potential**
San Joaquin antelope squirrel (*Ammospermophilus nelsoni*)	ST	Found on the western San Joaquin Valley from 50-350m elevation on dry, sparsely vegetated loam soils.	Suitable habitat is present within proposed Projectareas located on low lying or gently sloped terrain. Several occurrences in CNDDB near Project Area. **High Potential**
San Joaquin kit fox (*Vulpes macrotis mutica*)	FE, ST	Inhabits annual grasslands or grassy open stages with scattered shrubby vegetation.	Suitable habitat is present throughout EHOF and surrounding buffer areas. **High Potential**
Short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*)	CSC	Found on the western side of San Joaquin Valley in grassland and desert scrub associations, especially *Atriplex*.	Potential habitat occurs within Project Area. **High Potential**

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TABLE 4.4-2 CNDDB SENSITIVE WILDLIFE SPECIES POTENTIALLY OCCURRING AT THE PROPOSED PROJECT SITE

Species	Listing Status	Habitat Association	Potential within Project Site
Tipton kangaroo rat (Dipodomys nitratoides nitratoides)	FE, SE	Historically found in the saltbush scrub and sink communities of the southern San Joaquin Valley and Tulare lake basin. Now restricted to scattered isolated areas.	Several sightings recorded in the CNDDB in Project vicinity on the northeast side of the California Aqueduct. **Low Potential**
Tulare grasshopper mouse *(Onychomys torridus tularensis)*	CSC	Inhabits hot, arid valleys and scrub deserts in the Southern San Joaquin Valley.	Potential habitat occurs within EHOF and surrounding areas. **Moderate Potential**
REPTILES			
Blunt-nosed leopard lizard (*Gambelia sila*)	FE, SE, SP	Inhabits sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	Suitable habitat is present on project area. CNDDB occurrences near area and prior protocol level surveys conducted near project showed presence on low lying sparsely vegetated areas usually found on the periphery of EHOF. **High Potential**
San Joaquin whipsnake (*Masticophis flagellum ruddocki*)	CSC	Found in the San Joaquin Valley in open, dry areas with little or no tree cover within grassland and saltbush scrub communities.	Suitable habitat found within the Project Area. **High Potential**
LISTING STATUS			
FE = Federally listed Endangered FT = Federally listed Threatened FC = Federal Candidate FD = Federally de-listed		SE = State listed Endangered ST = State Listed Threatened SP = State Protected Species CSC = California Species of Special Concern MBTA = Migratory Bird Treaty Act	

4.4 BIOLOGICAL RESOURCES

Federal and/or State Listed Wildlife Species

Following is a description of each of the species identified in the records search which has potential to occur within or in the general area of the proposed ProjectArea. Blunt-nosed Leopard Lizard

A complete description of Blunt-nosed leopard lizard (BNLL) life history and its distribution on the EHOF and associated buffer area can be found in the attached Elk Hills HCP.

Buena Vista Lake Shrew

A complete description of Buena Vista Lake Shrew (Sorex ornatus relictus) life history and its distribution on the EHOF and associated buffer area can be found in the attached Elk Hills HCP. Although identified as a species with the potential to occur in the area covered by the record search, this species is not expected to occur within the Project Area.

Giant Kangaroo Rat

A complete description of Giant Kangaroo Rat (Dipodomys ingens) life history and distribution on the EHOF and associated buffer zone can be found in the Elk Hills HCP.

San Joaquin Antelope Squirrel

A complete description of San Joaquin Antelope Squirrel life (Ammospermophilus nelsoni) history and its distribution on the EHOF and associated buffer zone can be found in the Elk Hills HCP.

San Joaquin Kit Fox

A complete description of San Joaquin kit fox (Vulpes macrotis mutica) life history and distribution on the EHOF and associated buffer zone can be found in the Elk Hills HCP

Tipton Kangaroo Rat

A complete description of the Tipton kangaroo rat (Dipodomys nitratoides nitratoides) life history and distribution on the EHOF and associated buffer zone can be found in the Elk Hills HCP. Although identified as a species with the potential to occur in the area covered by the record search, this species is not expected to occur within the Project Site.

California Species of Special Concern

Whereas federal or state listed threatened or endangered species are afforded legal protection under Federal Endangered Species Act (FESA) or the California Endangered Species Act (CESA), the classifications, federal species of concern or California Species of Special Concern (SSC), do not afford any legal protection. From the federal standpoint, species of concern is an informal term that refers to those species believed to be declining or to be in need of concentrated conservation actions to prevent decline. These species receive no legal protection under FESA or CESA and the use of the term does not mean that they will eventually be proposed for listing. At one extreme, it may only be

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necessary to monitor the health of a species and its habitat. At the other extreme, the species may eventually require listing as threatened or endangered.

From the State standpoint, the designation, species of special concern, is intended to result in special consideration for these animals by CDFG, land managers, consulting biologists, and others, and is intended to focus attention on the species to help avert the need for costly listing under federal and state endangered species laws and cumbersome recovery efforts that might ultimately be required. This designation also is intended to stimulate collection of additional information on the biology, distribution, and status of poorly known at-risk species, and focus research and management attention on them. CDFG staff is instructed to consider species of concern during (1) the environmental review process, (2) conservation planning process, (3) the preparation of management plans for CDFG lands, and (4) inventories, surveys, and monitoring conducted either by CDFG or others with whom the CDFG is cooperating.

Following is a description of each of these species which has potential to occur within the proposed Project Site.

American Badger

The American Badger (Taxidea taxus) is currently listed as a state SSC. This badger is found throughout most portions of the state and is most common in open areas of shrub, forest, and herbaceous habitats with friable soils.

Badgers are relatively large mammals weighing from 5.5 – 11 kg (12 – 24 pounds) with stocky bodies and legs and unique black and white striped faces. The white stripe runs from the nose to the neck and continues to the base of the tail. Being primarily a digger, the American badger has short, sturdy legs with heavy foreclaws from 2.5 – 4 cm (1 – 1.5 inches) long. Badgers use these powerful claws to excavate burrows in friable soil for cover and frequently reuse old burrows.

Badgers are predominantly carnivorous and eat a variety of rodents such as rats, mice, chipmunks and particularly ground squirrels and pocket gophers. They may also eat some reptiles, insects, eggs, earthworms, birds and carrion. A female badger can have from one to five young (usually two) which are born early in April and cared for by the mother until late summer.

Threats to the American badger include habitat conversion into agriculture and development, as well as reduction in prey species from similar threats, collisions with vehicles and direct persecution.

Burrowing Owl

The burrowing owl (Athene cunicularia) is currently listed as a state SSC. This small owl often migrates from North America during the winter months into Mexico, Arizona, New Mexico, Texas, Louisiana, and California. This species of owl is also a year-long resident of open, dry grassland and desert habitats throughout the California deserts, Central Valley, and coastal areas.

4.4 BIOLOGICAL RESOURCES

The burrowing owl is approximately 23 cm (9 inches) in length with small, long legs, a white throat, and boldly spotted with a barred pattern on the belly. Primary food sources for the burrowing owl include insects, mice, birds, amphibians, reptiles and carrion. This owl often uses rodent or other burrows for roosting and nesting cover, and is frequently seen by day standing on the ground or on posts near its burrow. Where burrows are scarce, pipes, culverts and nest boxes may be used. The burrowing owl appears to be tolerant of human activity and can adapt to human-altered landscapes. However, non-irrigated grasslands may support up to three times as many owls as irrigated grassland.

The burrowing owl is often considered a sedentary species and many adults have show strong fidelity to their nest site from year to year. Juveniles, however, do not necessarily show the same fidelity, as dispersal distances for juveniles have been shown to be as great as 150 km (93 miles) from the nest site.

The burrowing owls numbers have been markedly reduced in California for at least the past 60 years. Agricultural and urban conversion and ground squirrel poisoning programs have contributed to the decline of this species. As required by the EHOF HCP, biological pre-activity surveys are conducted by qualified biologists prior to ground disturbance activities. Biological data associated with the burrowing owl are included in the EHOF HCP semi-annual and annual reports provided to the wildlife agencies.

Le Conte's Thrasher

LeConte's thrasher (Toxostoma lecontei) is currently listed as a state SSC. This bird can be found in arid areas with gentle to rolling, well-drained slopes with dry washes and common vegetation of saltbush (Atriplex spp). Two disjunct populations of LeConte's thrasher currently exist; one at the northwestern limit of the San Joaquin Valley in California and one at the southwestern limit in central and coastal Baja California.

This thrasher is approximately 26.7 cm (10.5 inches) in length. Similar to California thrasher (Toxostoma redivivum), LeConte's thrasher has a long, downcurved bill. In addition, this species has a gray belly, buffy undertail coverts and dark eyes. Locating LeConte's thrasher can be difficult, as this species is secretive and hard to find. LeConte's thrasher also run swiftly with its tail cocked in open desert or in sandy washes.

LeConte's thrasher forages in well drained areas with a fair amount of bare ground and a well developed litter layer near shrubs. LeConte's thrasher primarily feeds on arthropods but occasionally eats plant seeds, bird eggs and small lizards. They forage mainly by digging into the ground or through leaf litter under and near shrubs. Nesting material consists of thorny twigs and sticks lined with fibers, paper, leaves and rootlets. LeConte's thrasher nests in small trees, saltbush or in dense cactus at 0.3 – 2.4 m (1 – 8 feet) above the ground.

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Degradation to habitat and habitat loss are the primary threats to LeConte's thrasher. Habitat conversion to agriculture appears to be the single biggest factor in reducing the amount of suitable habitat for this species.

Loggerhead Shrike

The loggerhead shrike (Lanius ludovicianus) is currently listed as a state SSC. This species of bird is often found in shrublands or open woodlands with a fair amount of grass cover and areas of bare ground. Loggerhead shrikes are found year round through most of the California range but may also migrate north into Canada.

The loggerhead shrike is approximately 23 cm (9 inches) in length with a thick black mask, slightly hooked bill, and dark gray back contrasts with a whitish colored breast. This species of bird often utilizes tall shrubs, trees, fences and power lines for hunting. Loggerhead shrikes perch and scan the area, taking prey primarily from the ground but occasionally in flight. They are also known for often impaling their prey on barbed-wire fencing or twigs for easier manipulation or for storage for later consumption.

Shrikes build nests out of twigs and bark strips which are placed generally 1 to 2 m (3.3 – 6.6 feet) above the ground in shrubs or trees. Eggs are incubated by the female for just over two weeks and the young leave about three weeks after they have hatched.

Main threats to the loggerhead shrike are believed to be due from habitat loss of oak savannah, coastal scrub and riparian habitats to agriculture and development. Exotic grass and forbs also pose a threat to this species due to increased fire frequency and the resulting conversion from a shrub- to grassland-dominated landscape.

San Joaquin Whipsnake

The San Joaquin whipsnake (also referred to as the San Joaquin coachwhip [Masticophis flagellum ruddocki]) is currently listed as a state SSC. The snake is found in open, dry vegetation associated with little or no tree cover. In the western San Joaquin Valley, it occurs in valley grassland and saltbush scrub habitat and is known to climb bushes such as Atriplex to look for prey and potential predators.

The California whipsnake is a large sized, approximately 90-155 cm snout-to vent length (SVL), smooth-scaled, large-eyed, slender snake with a buffy citrine, tan-yellow or olive brown dorsal color without lengthwise stripes.

Like most of the other sensitive species of the San Joaquin Valley, habitat reduction, fragmentation, and degradation are the principal causes of the decline of the California whipsnake. Most significant is the first time conversion of large areas of valley grassland or shadscale scrub habitat to row crop agriculture in the San Joaquin Valley, particularly cotton, fruits and vegetables. This conversion eliminates the food base that the snake depends on.

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Short-nosed Kangaroo Rat

The short-nosed kangaroo rat (Dipodomys nitratoides brevinasus) is currently listed as a state SSC. This rat is one of three subspecies of, the San Joaquin kangaroo rat (Dipodomys nitratoides), the only four-toed kangaroo rat in the San Joaquin Valley. Short-nosed kangaroo rats are generally found on friable soils on flat or gently rolling terrain in grassland and desert-shrub vegetation. The largest existing population of brevinasus occurs in the Lokern and Elk Hills regions in western Kern County.

The short-nosed kangaroo is approximately 102 mm (4 inches) in body length and weights around 44 grams. Distinguishing the short-nosed kangaroo rat from the other subspecies of San Joaquin kangaroo rat is determined through statistical measurements of a series of individuals using morphologic data. For practical purposes, identification of the subspecies is usually based on the locality of capture.

Kangaroo rats are active year-round and eat a variety of seeds from various grasses and forbs, including non-native grasses such as Avena, Bromus and Hordeum species. Burrows of short-nosed kangaroo rats are found in friable soils in slightly elevated areas such as the berms of roads, canal embankments, railroad beds, and the bases of shrubs and fences where wind-blown soils accumulate above the level of surrounding terrain.

There has been extensive loss of habitat for the short-nosed. The major cause of restriction of the species range and abundance is conversion of native habitats to agricultural use and land development.

Tulare Grasshopper Mouse

The Tulare grasshopper mouse (Onychomys torridus tularensis) is currently listed as a state SSC. Typically, Tulare grasshopper mice inhabit arid shrubland communities in hot, arid grassland and shrubland associations. These include blue oak woodlands at 450 m (1476 feet); upper sonoran subshrub scrub community; alkali sink and mesquite associations on Valley Floor; and grasslands associations on the sloping margins of the San Joaquin Valley and Carrizo Plain region.

The Tulare grasshopper mouse is a subspecies of the southern grasshopper mouse with a stout body, short, club-like tail and a sharply bicolored pattern with the head and upperparts pale brown to gray or pinkish-cinnamon with white underparts. This species tail is usually bicolored with a white tip. The feet of the southern grasshopper mouse have five tubercles (knob-like fleshy bumps) on the sole of each forefoot and four on the hind feet.

The grasshopper mouse is primarily a carnivore, with a particular appetite for small mammals and insects; it also eats other invertebrates and seeds. Southern grasshopper mice are capable of breeding year-round with up to three litters produced per year. They often nest in burrows which have been abandoned by other rodents but may construct their own burrows.

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Like most of the other sensitive species of the San Joaquin Valley, habitat reduction, fragmentation, and degradation are the principal causes of the decline of the Tulare grasshopper mouse. Use of insecticides may have contributed to the extirpation of this species from fragmented habitat on the Valley floor by reducing their main food source and from both direct and indirect poisoning.

4.4.3 Regulatory Setting

As it relates to land use decisions, "biological resources" generally include plant and animal species and the habitats that support such species. Due to the importance of California's native ecological systems from a biological, heritage, and economic standpoint, impacts on such resources – especially those that are rare or those with high ecological values - are considered an adverse environmental impact under CEQA. Individual plant and animal species listed as rare, threatened or endangered under state and federal Endangered Species Acts and the natural communities or habitats that support them, are of particular concern.

The avoidance and mitigation of significant impacts to biological resources under CEQA consistent with, and supplementary to, various local, state, and federal laws/regulations are designed to protect such resources. These regulations often mandate that project applicants obtain permits prior to the commencement of urban development activities, with measures to avoid and/or mitigate impacts required as permit conditions.

Section 4.4.3 Regulatory Setting summarizes pertinent laws and regulations and includes a brief summary of the history of the state and federal permits obtained by OEHI for the ongoing and future operations at EHOF.

4.4.3.1 Local

Kern County General Plan

This regulatory framework identifies the federal, state, and local statutes, ordinances, or policies that govern the conservation and protection of biological resources that must be considered by Kern County (the County) during the decision-making process for projects that have the potential to affect biological resources. The Kern County General Plan includes the following goals related to biological resources.

1.10.5 Threatened and Endangered Species

Policies

Policy 27. Threatened or endangered plant and wildlife species should be protected in accordance with state and federal laws.

Policy 28. The County should work closely with state and federal agencies to assure that discretionary projects avoid or minimize impacts on fish, wildlife, and botanical resources.

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Policy 29. The County will seek cooperative efforts with local, state, and federal agencies to protect listed threatened and endangered plant and wildlife species through the use of conservation plans and other methods promoting management and conservation of habitat lands.

Policy 30. The County will promote public awareness of endangered species laws to help educate property owners and the development community of local, state, and federal programs concerning endangered species conservation issues.

Policy 31. Under the provisions of CEQA, the County, as lead agency, will solicit comments from the CDFG and the USFWS when an environmental document (Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report) is prepared.

Policy 32. Riparian areas will be managed in accordance with the USACE and the CDFG rules and regulations to enhance the drainage, flood control, biological, recreational, and other beneficial uses while acknowledging existing land use patterns.

Implementation Measures

Implementation Measure Q. Discretionary projects shall consider effects to biological resources as required by the CEQA.

Implementation Measure R. Consult and consider the comments from responsible and trustee wildlife agencies when reviewing a discretionary project subject to the CEQA.

Implementation Measure S. Pursue the development and implementation of conservation programs with state and federal wildlife agencies for property owners desiring streamlined endangered species mitigation programs.

4.4.3.2 State of California

California Endangered Species Act of 1984: California Fish and Game Code Sections 2050 – 2098

The California Endangered Species Act (CESA) provides for the protection and management of plant and animal species listed as threatened or endangered, or designated as candidates for such listing. This Act requires consultation between the CDFG and other state agencies to ensure that projects do not jeopardize the continued existence of threatened or endangered species or habitats essential for the continued survival of any threatened or endangered species. Take of listed species is prohibited, unless take authorization is first obtained by the CDFG. Currently, the OEHI EHOF operates incidental take of listed species under CESA pursuant to the section 2081(b) Memorandum of Understanding with the CDFG of 1997 and amended in 1999. OEHI must follow these conditions until the HCP is fully adopted by the CDFG.

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California Species Protection Act of 1970: California Fish and Game Sections 900-903

The California Species Protection Act includes provisions for the protection and enhancement of the birds, mammals, fish, amphibians, and reptiles of California. The administering agency for this Act is the CDFG. As the blunt-nose leopard lizard is designated a fully protected species, the CDFG cannot authorize any permits for take or collection unless it is for scientific research.

Native Plant Protection Act (Fish and Game Code Sections 1900-1913)

California's Native Plant Protection Act (NPPA) requires all state agencies to establish criteria for determining if a species, subspecies, or variety of native plant is endangered or rare.

California Fish and Game Code Section 3503

This code section prohibits the taking and possessing of bird eggs and nests. The administering agency for this is the CDFG.

California Fish and Game Code Section 3511, Section 4700, Section 5050 Section 5515

This code section prohibits the taking of birds, mammals, reptiles, and fish listed as fully protected. The administering agency for these is the CDFG.

Section 1600 of the California State Fish and Game Code

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California are subject to the regulatory authority of the CDFG pursuant to Sections 1600 through 1603 of the Code, and require preparation of a Streambed Alteration Agreement. Pursuant to the Code, a "stream" is defined as a body of water that flows at least periodically, or intermittently, through a bed or channel having banks and supporting fish or other aquatic life. Based on this definition, a watercourse with surface or subsurface flows that support or have supported riparian vegetation is a stream and is subject to CDFG jurisdiction. Altered or artificial waterways valuable to fish and wildlife are subject to CDFG jurisdiction.

OEHI holds a 12 year site-wide streambed alteration maintenance permit as required by 14 CCR Sections 1601 and 1603 of the Fish and Game Code. The current permit for OEHI expires in the year 2020. If it is determined that the activity may substantially adversely affect fish and wildlife resources within state jurisdictional waters, a Lake or Streambed Alteration Agreement will be prepared.

Some activities proposed as part of the CO2 EOR Project could be covered by the Maintenance Streambed Alteration Agreement, could affect drainages not under the jurisdiction of the CDFG, or could necessitate issuance of a Standard Streambed Alteration Agreement. OEHI will comply with the requirements of the CDFG Code, including permitting and reporting.

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4.4.3.3 Federal

Federal Endangered Species Act

The Federal Endangered Species Act (FESA) of 1973 defines species as "endangered" and "threatened" and provides regulatory protection for listed species. The FESA provides a program for conservation and recovery of threatened and endangered species, and conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of these listed species. Section 9 of the federal ESA prohibits the take of species listed by USFWS as threatened or endangered. To take is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct." In recognition that take cannot always be avoided, Section 10(a) of the FESA includes provisions for take that is incidental to, but not the purpose of, otherwise lawful activities. Section 10(a)(1)(B) permits (incidental take permits) may be issued if take is incidental and does not jeopardize the survival and recovery of the species.

To comply with the agreements between USFWS and the Department of Energy regarding provisions for the protection and enhancement for listed species EOHI currently is permitted for incidental take of federally protected species under the BO originally issued in 1995 under Section 7 of the FESA when the Project Site was under federal ownership. The BO describes the conservation measures, mitigation, terms and conditions that transferred to OEHI in 1998. To mitigate adverse affects on federally listed species with the ongoing and future activities of oil and gas development on the EHOF, the BO outlined Mitigation Commitments. These commitments are summarized and are specified in detail in the BO and Elk Hills HCP.

As part of the commitments, OEHI established a 7,075-acre Conservation Area and executed a Conservation Management Agreement/Declaration of Restrictions for the Elk Hills Unit ("Agreement," November 6, 1998) with the USFWS and CDFG. The Agreement requires that OEHI manage this Conservation Area in accordance with a Management Plan approved by the agencies; the parties have over time agreed on certain modifications to the original Management Plan, including some of its monitoring provisions. The Wildlife Management Plan was developed to mitigate effects of routine EHOF operations on endangered species and other wildlife.

Habitat Conservation Plan

The HCP was developed at the transition of ownership in 1998 of the EHOF from the federal government to OEHI. The change in ownership requires the issuance to the new non-federal owner of a Section 10(a)(1)(B) permit under FESA from the USFWS and a Section 2081(b) permit under CESA from the CDFG to allow the new owner to continue operation beyond the limits set by the 1995 BO. The HCP will supersede the existing incidental take permits obtained from both the USFWS and CDFG. Those obligations, terms, and conditions under the BO, MOU and Agreement that are appropriate for continued implementation (e.g., the obligations regarding the 7,075-acre Conservation Area) will be incorporated into the HCP. The overall monitoring program included in the Conservation Strategy portion of the HCP is based largely on the monitoring programs developed

under prior permits and agreements, but with minor changes to reflect improved monitoring techniques, adjustments to certain biological goals, and changes to the list of Covered Species.

The HCP has been developed for incidental take for both state and federally listed species covering EHOF activities for a period of 50-years. The HCP encompasses all of the approximately 48,000 acre EHOF and includes a two-mile buffer around the EHOF for an additional approximate 59,662 acres. If OEHI acquires properties during this period, pending USFWS and CDFG approval, these properties can be added to the HCP.

The Elk Hills direct impact area does not overlap with any existing or proposed conservation lands owned by CDFG per the draft Occidental of Elk Hills HCP.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) makes it unlawful to pursue, capture, kill, or possess any migratory bird or part, nest, or egg of any such bird listed in wildlife protection treaties between the United States, Great Britain, Mexico, Japan, and the countries of the former Soviet Union. Similar to the federal ESA, the MBTA authorizes the Secretary of the Interior to issue permits for incidental take. Due to potential presence of migratory birds on the proposed Project Site, project compliance with the MBTA was considered in this evaluation. Nesting birds and the contents of the nest within the EHOF are afforded protection during the nesting season pursuant to the MBTA. OEHI maintains a depredation permit issued by the U.S. FWS for the EHOF.

Bald and Golden Eagle Protection Act (16 USC Section 668)

The Bald and Golden Eagle Protection Act provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. If compatible with the preservation of bald and golden eagles, the Secretary of the Interior may permit the taking, possession and transportation of bald and golden eagles and nests for scientific or religious purposes, or for the protection of wildlife, agricultural or other interests. The Secretary of the Interior may authorize the take of golden eagle nests, which interfere with resource development or recovery operations. Bald eagles may not be taken for any purpose unless the Secretary issues a permit prior to the taking.

Focused surveys for golden eagle nests have not been performed for the proposed Project. As required by the EHOF HCP, biological pre-activity surveys are conducted by qualified biologists prior to ground disturbance activities. Biological data associated with golden eagles and nests are included in the EHOF HCP semi-annual and annual reports provided to the wildlife agencies.

Section 404 of the Federal Clean Water Act

The U.S. Environmental Protection Agency (EPA) regulates the discharge of dredged or fill material into waters of the United States under Section 404 of the Clean Water Act. If portions of the project may affect wetlands, a permit from the USACE will be required for all discharges of fill material into

waters of the United States, including wetlands, before proceeding with the project. However, the EHOF contains no U.S. Army Corps of Engineers state jurisdictional waters.

Executive Order 11990, Protection of Wetlands (May 24, 1977)

This Executive Order establishes a national policy to avoid adverse impacts on wetlands whenever there is a practicable alternative. On projects with federal actions or approvals, impacts on wetlands must be identified in the environmental document. Alternatives that avoid wetlands must be considered. If wetland impacts cannot be avoided, then all practicable measures to minimize harm to those wetlands must be included. This must be documented in a specific Wetlands Only Practicable Alternative Finding in the final environmental document for a proposed individual improvement project.

4.4.4 Impacts and Mitigation Measures

4.4.4.1 Methodology

To evaluate the sensitive biological resources impacts by the proposed Project, literature and database reviews were completed to determine documented or potential presence of special-status plant and wildlife species in the project areas. Numerous comprehensive technical biological assessment studies have been conducted within the existing EHOF and lands in the vicinity where the project and associated components are located. As previously mentioned in section 4.4.1, Stantec conducted a thorough review of pertinent biological technical documents and studies conducted within the EHOF and studies conducted for the coinciding HECA energy facility. In addition, a biological technical study was conducted on the proposed main CO2 trunkline where additional data was required. As a result, the standing Elk Hills USFWS BO, the draft Elk Hills HCP, HECA Biological Assessment, and CO2 trunkline technical study were used to evaluate potential impacts to sensitive and listed species within the project footprint. For over 20 years, OEHI has operated the EHOF under strict biological monitoring and biological studies guided by the BO.

4.4.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on biological resources, if it would:

- Have a substantial adverse impact, 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 the CDFG or the USFWS;
- Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFG or the USFWS;

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- Have a substantial adverse impact on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, and coastal wetlands), either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Communities Conservation Plan, or other approved local, regional, or state habitat conservation plan.

The following is a summary of impacts to biological resources, mitigation measures to reduce or eliminate affects to these resources, and level of significance of the impacts.

4.4.4.3 Project Impacts

IMPACT BIO-1 Have a Substantial Adverse Impact, 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 the CDFG or the USFWS

Impacts to biological habitats as a result of the implementation of the Project may occur directly due to habitat loss, or a degradation of existing habitat both from development activities and the increased conflicts between human population and biological resources after the Project is fully implemented. An indirect impact is a physical change in the environment which is not immediately related to, but is caused by the Project. This loss will either be "permanent" or "temporary." Permanent development will result in habitat lost for use by covered plant and animal species. To minimize disturbance, Project design of facilities will utilize existing disturbed lands, existing pipeline right-of-ways, existing wells and well pads, and existing roads wherever practical.

Temporary disturbance is a short-term event whose effects are relaxed almost immediately or within a short period after the event and does not result in any permanent loss of habitat. Temporary disturbance may diminish habitat value to plant and animal species for up to two years but is expected to be functionally restored after this time. Examples of a temporary disturbance include clearing of vegetation and the construction of a slope below a well pad. Other types of temporary disturbances include, but are not limited to pipeline installations, pipeline repairs, power pole installations, and emergency response activities. In general, areas that are temporarily disturbed are

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available for re-colonization by special status species (both plants and animals). Areas of biological habitat anticipated to be temporarily disturbed are approximately 1,447 acres.

Permanent disturbance is the loss of habitat available for use by biological resources. Most of the Project related facilities and associated producing and injection lines within the Project Site are going to be located in relatively disturbed areas where past and ongoing oil exploration and production does not provide good long-term habitat for native plant or wildlife species. Permanent loss of habitat by the construction of the EOR Processing Facility, some satellite locations, some new well pad construction, and other associated facilities is projected to be approximately 261.6 acres. More detailed impact analysis for Threatened, Endangered, and Proposed Species listed below can be found in Section 4 of the HCP.

BIO-1A Effects on Wildlife Species Listed as Endangered, Threatened, or Proposed

Blunt-nosed leopard lizard

The CDFG has designated the BNLL as fully protected and take is not permitted under law. They are known to occur in the lower elevations and washes which occur mainly at the perimeter of the EHOF and the 2-mile buffer area. OEHI would be required to implement the mitigation measures below to establish that no impacts will occur.

Direct impacts include temporary habitat loss due to pipeline construction activities. The BNLL has the potential to be directly affected by vehicle strikes, entrapment in trenches and/or entombment in burrows during construction or maintenance activities. Individual lizards may be injured or killed by predators attracted to food trash associated with construction or maintenance activities. They may also be attracted to insects present due to food trash and other waste.

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Indirect impacts including temporary harassment from human presence, noise associated with the project activities and reduction of food sources as a result of habitat disturbance may occur as a result of the project.

San Joaquin kit fox

San Joaquin kit fox can occur throughout the Project Site. The kit fox is mainly nocturnal; therefore, take is unlikely during the daylight hours. Take is more likely during ground disturbance activities.

The San Joaquin kit fox has the potential to be directly affected by vehicle strikes, entrapment in trenches and/or entombment in burrows during construction or maintenance activities. The kit fox may become trapped in producing and injection line sections during construction or may be injured or killed by predators attracted to food trash associated with construction or maintenance activities. OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

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Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Indirect impacts including temporary harassment from human presence, noise associated with the project activities and reduction of food sources as a result of habitat disturbance.

San Joaquin Antelope Squirrel

San Joaquin antelope squirrels are abundant and widespread in the areas of the EHOF and buffer area where grasslands and shrub lands occur. This species is minimally disturbed in areas where oilfield operations are located due to their mobility.

San Joaquin antelope squirrels have the potential to be directly affected by vehicle strikes, entrapment in trenches and/or entombment in burrows during construction or maintenance activities. The San Joaquin antelope squirrel may become trapped in producing or injection lines during construction or may be injured or killed by predators attracted to food trash associated with construction or maintenance activities. OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Indirect impacts to this species include temporary and permanent loss of habitat construction activities in suitable habitat. Although certain construction activities will temporarily disturb habitat for the San Joaquin antelope squirrel, temporary impacts to habitat will be short term, approximately two years following construction over the 20 year period.

Giant kangaroo rat

The GKR occurs throughout the Project Site. The GKR are mainly nocturnal; therefore, take is unlikely during the daylight hours. Take is more likely during ground disturbance activities. OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

The GKR has the potential to be directly affected by vehicle strikes, entrapment in trenches and/or entombment in burrows during construction or maintenance activities. GKR may become trapped in producing or injection lines during construction or may be injured or killed by predators attracted to food trash associated with construction or maintenance activities.

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Indirect impacts including temporary harassment from human presence, noise associated with the Project activities and reduction of food sources as a result of habitat disturbance.

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BIO-1B Effects on Wildlife Species Listed as California Species of Special Concern

As listed in Table 4.4-2, based on literature review and consultation with resources agency staff and experts, nine species listed as California Species of Special Concern were identified as potentially occurring within the Project site. Further detailed analysis of the Project Site from additional survey information and habitat analysis resulted in the determination that eight of these species could be considered present within the Project Site: Western burrowing owl, Le Conte's thrasher, Loggerhead shrike, American badger, short-nosed kangaroo rat, Tulare grasshopper mouse, and San Joaquin whipsnake.

In general, construction and operation of the Project could result in effects to sensitive species due to loss of suitable habitat used by species for foraging and other activities, direct mortality, and displacement of sensitive residents that may affect their survivorship due to human habitation and activities associated with facility construction. These potential impacts are discussed in general in the following sections. The potential for these effects to have a significant adverse impact on each of the special-status species found to occur within the Project Site is then evaluated. Direct and indirect impacts, mitigation measures and levels of impact are discussed for the following species listed below.

Western Burrowing Owl

Burrowing owls are known to occur within the EHOF and surrounding areas. The Project would impact the suitable foraging habitat for this species in the portion of the Project Site designated for permanent disturbance. However, this would not have a significant impact on burrowing owl, as the remaining habitat would provide sufficient foraging habitat. Other potential impacts to Burrowing owls include increased predation from unleashed pets, widening and construction of roadways, increased night-time lighting, and nest abandonment due to noise or other human disturbance.

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Therefore, the Project would not be expected to result in adverse significant impacts on burrowing owl, or to adversely affect the survival and recovery of this species in the wild. Nevertheless, because there is suitable habitat in the Project Site and because this is a sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

Tulare Grasshopper Mouse and Short-nosed Kangaroo Rat

Stantec Biologists identified potential habitat and food source for the Tulare grasshopper mouse and short-nosed kangaroo rat within portions of the saltbush and grassland plant communities near the Project Site. The majority of these areas are located in the lowland portions of the Project which will only experience temporary disturbances from installation of the water line from the Tulare wells.

4.4 BIOLOGICAL RESOURCES

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Therefore, the Project would not be expected to result in significant adverse impacts on the Tulare grasshopper mouse or Short-nosed kangaroo rat. Nevertheless, because there is suitable habitat in the Project Site and these are sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant.

American Badger

The proposed Project would permanently disturb habitat of the American badger; however, this would not have a significant impact on this species, as the remaining habitat would provide sufficient foraging and denning habitat for the minimal American badger population expected to be present at the Project Site.

Inadvertent injury and mortality would be minimized through preconstruction surveys, employee awareness training, and protocols for unanticipated discovery of the species. Therefore, the Project would not be expected to result in significant adverse impacts on American badger. Nevertheless, because there is suitable habitat in the Project Site and this is a sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

Le Conte's Thrasher

The proposed Project would permanently disturb habitat of the Le Conte's Thrasher; however, the majority of these impacts would be located in previously disturbed high oil production areas classified as moderate or poor habitat potential. It is unlikely that project related activities in previously disturbed habitats would have a significant impact. Direct impacts to Le Conte's thrasher include vehicular collision and/or nest abandonment due to noise or close proximity to project related activities. Indirect impacts to Le Conte's thrasher include temporary loss of foraging and nesting activity during construction activities in non-disturbed areas.

Although impacts in suitable habitat may temporarily remove potential habitat, this impact will be short term. Nevertheless, because there is suitable habitat in the Project Site and this is a sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

Loggerhead Shrike

The proposed Project would permanently disturb habitat of the Loggerhead Shrike; however, the majority of these impacts would be located in previously disturbed high oil production areas classified as moderate or poor habitat potential. It is unlikely that project related activities in previously disturbed habitats would have a significant impact. Direct impacts to Loggerhead shrike include vehicular collision and/or nest abandonment due to noise or close proximity to project related activities.

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Indirect impacts to Loggerhead shrike include temporary loss of foraging and nesting activity during construction activities in non-disturbed areas. Although impacts in suitable habitat may temporarily remove potential habitat, this impact will be short term. Nevertheless, because there is suitable habitat in the Project Site and this is a sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

San Joaquin Whipsnake

The proposed Project would permanently disturb habitat of the San Joaquin whipsnake; however, these impacts will be mostly located in areas of previous disturbance. San Joaquin whipsnakes have the potential to be directly affected by vehicle strikes, entrapment in trenches, and/or entombment in burrows during construction or maintenance activities. The San Joaquin whipsnake may become trapped in producing or injection lines during construction or may be injured or killed by predators attracted to food trash associated with construction or maintenance activities.

Indirect impacts to the San Joaquin whipsnake include temporary and permanent loss of habitat during project construction activities. Nevertheless, because there is suitable habitat in the Project Site and this is a sensitive species, OEHI would be required to implement the mitigation measures below to establish that this impact remains less-than-significant impact.

BIO-1C Effects on Plant Species Listed as Endangered, Threatened or Proposed Kern mallow, California Jewelflower, and San Joaquin Woolly-threads

Extensive botanical surveys have been conducted at EHOF over the period from 1995-2001. No listed plant species were observed within EHOF during these surveys; however, the Project could result in take of Kern Mallow, California Jewelflower, and San Joaquin Woollythreads. Kern mallow has the potential to occur within the 2 mile buffer areas surrounding EHOF. These buffer areas are characterized by low lying valley saltbush scrub and provides potential habitat for Kern Mallow.

California jewelflower is not known to occur within the Project Site. Known populations of California jewelflower do not occur on the EHOF though suitable habitat is present.

San Joaquin Woolly-threads is not known to occur in the EHOF, however it may be present within portions of the 2-mile buffer area that provides suitable habitat.

Direct Impacts

Listed plant species have the potential to be directly affected by removal of individual plants, disturbance of its seedbank, and removal of habitat during construction and maintenance activities. These disturbances can occur during ground disturbing activities including installation of producing and injection lines, well pad installation, EOR Processing Facility, and satellite distribution station construction. OEHI would be required to implement the mitigation measures below to establish that this impact remains less than significant impact.

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Indirect Impacts

Listed plant species have the potential to be indirectly affected by dust accumulation on the local vegetation during construction activities, thereby reducing the plants' vitality and reducing photosynthetic processes essential to the health and survival of these species.

BIO-1D Effects on Plant Species Listed by the California Native Plant Society as 1B (rare, threatened or endangered in California)

The 16 CNPS listed plant species identified in the Project Site from the CNDDB and CNPS Rare Plant Inventory List in Table 4.4-2 have the potential to be present in suitable areas within the Project Site, though a majority of construction activities will occur on previously disturbed areas of poor suitable habitat.

Direct Impacts

The 16 CNPS listed plant species have the potential to be directly affected by removal of individual plants, disturbance of its seed bank, and removal of its habitat during construction and maintenance activities. OEHI would be required to implement the mitigation measures below to establish that this impact remains less than significant impact.

Indirect Impacts

Listed plant species have the potential to be indirectly affected by dust accumulation on the local vegetation during construction activities, thereby reducing the plants' vitality and reducing photosynthetic processes essential to the health and survival of these species.

Mitigation Measures

Until acceptance of the Draft Elk Hills HCP and pursuant to the terms and conditions of the BO, prior to any ground breaking activities by the project, the area of disturbance (sq ft) is determined, tallied on a quarterly basis, and reported to the resource agencies on an annual basis. The biological loss of undeveloped habitat for existing and future oilfield operations within the EHOF and related facilities has been and will be fully mitigated per the BO terms and conditions, and detailed in the HCP Sections 5 and 6. The mitigation measures, as defined in the BO and HCP include the following:

Mitigation Measure BIO-1 Prior to initial ground disturbing activities (e.g., mechanized clearing or rough grading) for all project-related construction components, a qualified biologist shall conduct a preconstruction sweep of the Project Site for special-status wildlife species. During these surveys the biologist will:

- Ensure that potential habitats become inaccessible to wildlife (e.g., burrows are removed that would otherwise provide temporary refuge);

4.4 BIOLOGICAL RESOURCES

- In the event of an unanticipated discovery of a special-status ground-dwelling animal, recover and relocate the animal to adjacent suitable habitat within the Project Site at least 200 feet from the limits of grading.
- Prior to ground disturbing activities for all project related components, a qualified biologist shall conduct preconstruction surveys for special status plant species in areas where appropriate habitat exists.
- Steep-walled trenches or excavations used during construction at the Project Site shall include escape ramps at a maximum slope of 2:1 every 1000 feet and at each end of the trench(es). Trenches shall be inspected by a qualified biologist for the removal of wildlife immediately prior to final backfilling.
- Conduct species specific pre-activity surveys (PAS) in accordance with section 6.2 of the HCP. Should the results of the PAS be positive, then the biologist will recommend avoidance measures as discussed in section 6.2 of the HCP.

Mitigation Measure BIO-2 In accordance with the BO and HCP, avoidance and minimization will be achieved by minimizing future land disturbance on those portions of the EHOF considered high value on the multi species map of the HCP. In order to mitigate for unavoidable impacts to covered species, OEHI will set aside, permanently preserve, enhance, and manage habitat for sensitive species. This land will be set aside in appropriate amounts following appropriate ratios as specified in section 5.2.3 of the HCP. Furthermore, to the greatest extent possible, construction associated with the project should be located on previously disturbed lands located in High Production Areas in order to further reduce impact to listed species.

Mitigation Measure BIO-3 The BO also requires that prior to any activities commencing at the Project Site, OEHI contractors attend an employee education program approved by the USFWS/CDFG regarding the sensitive biological resources potentially occurring within the Project Site. The program must include, at a minimum, descriptions of the listed species, their habitat, and methods required to reduce impacts from this project. A fact sheet must also be prepared for distribution to all personnel associated with this project. All personnel who attend the employee orientation are required to sign an attendance roster acknowledging their participation in the orientation and their understanding of the mitigation.

Mitigation Measure BIO-4 Best management practices (BMP) have been developed over time at EHOF. These BMP's are implemented by OEHI personnel to avoid take during normal daily operations and are fully discussed in section 6 of the HCP. BMP's pertain to how vehicles are driven, where vehicles and equipment are allowed to operate, construction measures designed to reduce harm to covered species, and who to contact for incidents with covered species.

Mitigation Measure BIO-5 Per the HCP, monitoring will be conducted to document relative abundance and distribution of Covered species in the high production areas, non high production

areas, and conservation lands. To document trends, monitoring will be conducted consistently each year and follows to a large extent the protocols that have been established since OEHI obtained ownership of the EHOF in 1998. Monitoring will be used to verify that the HCP is meeting its stated conservation goals and objective.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT BIO-2 Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFG or the USFWS

Valley Saltbush scrub has been identified as a sensitive natural community by the CDFG. As described in previous sections, Valley Saltbush scrub consists of open stands of very low, to moderately high grayish chenopod dominated shrubs and sub-shrubs. Valley saltbush scrub provides habitat to a large number of listed or sensitive species identified in this document. Valley saltbush scrub communities have the potential to be impacted by both permanent and temporary disturbances of the project. No vegetation mapping has been conducted within the EHOF; however Valley Saltbush Scrub within the High Production Areas is likely to be degraded as a result of oil production and exploration activities. Potential impacts include degradation due to off road vehicle travel, removal through grading associated with well drilling and road construction, oil spills, contamination from commonly used oilfield chemicals, fragmentation, and degradation or removal due to other routine oilfield operations.

Mitigation Measures

Mitigation Measure BIO-6 Where possible, construction associated with the project shall be limited to areas previously disturbed or located in High Production Areas where Valley Saltbush Scrub is likely already degraded. Compensation lands established for the mitigation of impacts to species that use Valley Saltbush Scrub as habitat will be sufficient to mitigate for the impacts to this sensitive community.

Level of Significance after Mitigation

Impacts would be less than significant.

4.4 BIOLOGICAL RESOURCES

IMPACT BIO-3 Have a substantial adverse impact on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, and coastal wetlands), either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means

EHOF contains no federally protected wetlands as defined by section 404 of the CWA. Project activities would not interfere or impact such wetlands by removal, filling, hydrological interruption, or other means. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT BIO-4 Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors, or impede the use of wildlife nursery sites

The project is located within the EHOF, mostly in areas designated as High Production Areas characterized by heavy disturbance. It is unlikely that the project would interfere with established resident or migratory movement corridors. Most linear project components (pipelines, roads, etc.) will be placed above ground on sleepers (thus allowing movement beneath) or buried and should not interfere significantly with wildlife movement within the EHOF. Other permanent components including production and injection wells would possess a relatively small footprint and would be located in areas not likely to cause significant impacts to wildlife movement. Wildlife nursery sites (specifically San Joaquin Kit Fox) are well documented and monitored annually. It is unlikely that the project would interfere with these established sites. This is a less than significant impact.

Mitigation Measures

All mitigation measures needed for these impacts are incorporated into the design of the project and thus no additional mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.4 BIOLOGICAL RESOURCES

IMPACT BIO-5 Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

Implementation of Project would not conflict with any local policies or ordinances protecting biological resources, including, but not limited to, tree preservation. No impact will result.

Mitigation Measures

No mitigations measures are required.

Level of Significance after Mitigation

No impact.

IMPACT BIO-6 Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Communities Conservation Plan, or other approved local, regional, or state habitat conservation plan

The Project is within the jurisdictional boundaries of the Elk Hills Habitat Conservation Plan (HCP). The construction of the Project does not conflict with the provisions and activities detailed in the HCP. The Project will not be in conflict with the mitigation or minimization measures within the HCP.

The Northern edge of the Subject property is against the Lokern Area of Critical Concern (ACEC) boundary. The Lokern area has been identified by the US Fish and Wildlife Service, California Department of Fish and Game and in the Kern County HCP as a location important for the management lands to promote the conservation and recovery of endangered species. These stipulations will also include stipulations detailed in the Elk Hills HCP for the protection of listed species. The Project will not conflict with the BLM ACEC stipulations, Elk Hills HCP, or the Kern County HCP. This is a less than significant impact.

Mitigation Measures

No mitigations measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.4 BIOLOGICAL RESOURCES

4.4.5 Cumulative Impacts

The implementation of established HCPs[5] when combined with the Elk Hills Oil Field HCP should result in an increase of habitat under protection that will be or are currently managed for the benefit of listed species. In order to mitigate for associated degradation due to the land use changes and activities, these high value habitat lands will be managed in large, contiguous blocks. In conjunction with targeted agency acquisitions as well as those by private conservation organizations, these actions should result in fulfilling relevant recovery goals as stated in the Recovery Plan for the Upland Species of the San Joaquin Valley, California (USFWS, 1998).

Mitigation Measures

The mitigation measures Mitigation Measures -BIO-1 through BIO-6 detailed above is expected to reduce biological impacts to a less than significant level, and thus ensure the Project will not contribute to an overall cumulative impact to sensitive biological resources.

Level of Significance after Mitigation

The cumulative projects would not result in significant impacts to special status plant and animal species, and the Project would not contribute towards a significant cumulative impact. The Project would have less than significant cumulative impacts.

[5] The HCP's Cumulative Impacts Section 4.5 extensively describes projects that were currently under review planned by state, county, and local authorities where biological surveys and proposed set aside mitigation lands have documented the potential occurrence of the species addressed in this section. These project documents are discussed in detail in the Elk Hills HCP and include a variety of development projects including the Metropolitan Bakersfield HCP, Kern Water Bank HCP/Natural Community Conservation Plan, ARCO Western Energy/Coles Levee Ecosystem Preserve HCP, Plains Exploration and Production company HCP, Kern County Valley Floor HCP, modification of the Kern county Waste Facilities HCP, California Aqueduct San Joaquin Field Division HCP, and the Chevron's Lokern HCP.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.5 Cultural and Paleontological Resources

4.5.1 Introduction

This Cultural and Paleontological Resources section provides contextual background information on cultural and paleontological resources for the area encompassing the proposed Project, including the area's prehistoric, ethnographic, and historical settings. This section also analyzes the proposed Project's potential impacts on cultural and paleontological resources, and identifies mitigation measures to address adverse impacts.

For the purpose of addressing the CEQA of 1970, "historical resources" generally refer to prehistoric and historical archaeological sites and the built environment. Historical resources can also include areas determined to be important to Native Americans such as "sacred sites" Including burial sites which have been identified on the north flank of the Project Site. Sacred sites are most often important to Native American groups because of the role of the location in traditional ceremonies or activities.

4.5.2 Environmental Setting

Project History

The EHOF was acquired from the federal government in 1998. A combined Supplemental Environmental Impact Statement/Program Environmental Impact Report (SEIS/PEIR) was prepared for the sale of Naval Petroleum Reserve-1 (NPR-1) and published in 1997 (Department of Energy [DOE], 1997). The 1997 SEIS/PEIR considered the impacts of the maximum economic development of NPR-1 (now EHOF), including, among other EOR techniques, the use of CO2 to enhance oil production. At that time, a number of additional cultural resources investigations were occurring, and were not described in the SEIS/PEIR. Requirements for the sale of the land to a private entity included the preparation of a programmatic agreement, as well as a cultural resources management plan in order to mitigate the cultural resource effects of the sale. At the time, approximately 60 percent of the land involved in the sale had been surveyed for cultural resources. An area designated as the high production area had so heavily impacted the surface that it was assumed that any cultural resources would have been damaged to the point of lacking integrity.

On the northern boundary of the EHOF, there was a known increased density of prehistoric sites along the flanks of Elk Hills. The sites were less disturbed, and therefore considered to contain significant archaeological data. All of the recorded prehistoric sites were investigated and eight (8) were determined to be eligible for listing in the National Register of Historic Places (NRHP). Additional investigations involving limited data recovery were implemented at these sites. Since full data recovery was not implemented, additional significant information could exist at the sites. The inclusion of the eight sites in the Elk Hills Conservation Area should prevent any inadvertent significant

impacts from occurring in the future. Additional investigations would be required if the sites are to be impacted by future construction.

In 2002, the data recovery was completed on the eight National Register-eligible sites. The brochure for the general public was completed in May of 1999, and the professional journal article was published in 2000 in the proceedings of the Society for California Archaeology.

The Project Site is a well known and outstanding location of paleontological materials. During previous construction events, paleontological surveys have been conducted to identify potential prehistoric sites. In 2009, PaleoResource Consultants conducted a field survey as part of an assessment of the potential adverse impacts on scientifically significant resources. During the field survey for prospective fossil localities, many previously unrecorded sites were found on the western half of the EHOF. Fossils at these localities included vertebrate fossil bone fragments, invertebrate shells, and fossilized wood. Numerous paleosols (fossil soils) containing ichnofossils (root and burrow casts and molds) were also identified within the Tulare Formation.

Prehistory Setting

Archaeological research has been conducted for many years in the southern edge of the San Joaquin Valley. Much of the research has been focused on the Buena Vista Lake and surrounding areas including the Elk Hills. One of the first publications regarding early archaeological research was published in 1926. Gifford and Schenk of the University of California documented approximately 40 sites, as well as their excavation of nine of them. They noted the appearance of very little change over extended periods of time.

Five sites were excavated by the Civil Works Administration during the Great Depression in 1933 and 1934 on the shore of Buena Vista Lake. These were highly stratified midden sites exhibiting prehistoric, protohistoric and historic occupations. Between 1899 and 1925, data recovery at large village sites at Buena Vista Lake as well as other proximal locations were conducted, focusing on the recovery of burial sites and grave goods (Gifford and Schenk 1926; Hartzell 1992).

Importantly, later excavations in the 1960s by Fredrickson and Grossman (1977) at one of the original sites near Buena Vista Lake indicated a deeply buried component that dated to ca. 6,250 BC (Moratto 1984). Subsequent work around Buena Vista Lake led to the discovery of a number of temporal components that have been used to describe the general prehistory of the region. A chronological framework was developed from the numerous testing and excavation projects around the lake. Refinement of the chronology by several researchers has led to three broad temporal periods in the Southern San Joaquin Valley area, including the Early Holocene, the Middle Holocene and the Late Holocene.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Early Holocene: 10,000 to 5,000 BC

This is the postulated earliest known period of human existence in the San Joaquin Valley. People lived in small camps around lakes and relied on the lake environment for natural resources. Populations were small during this time period.

Middle Holocene: 5,000 to 2,000 BC

Very few preserved sites from this time period are known to exist in the region. Most were undoubtedly destroyed as a result of fluctuating lake levels. This time marks a change from primarily big game hunting to the increasing practice of gathering resources as evidenced by the increased number of milling stones. Extended burials were common, and evidence of trade items grew in type and number. During this time, there was still reliance on the lake environments.

Late Holocene: 2,000 BC to A.D. 1,850

More evidence of lake fluctuations occurred during this period. Human inhabitants of the area were highly mobile, undoubtedly taking advantage of resources on a seasonal basis. Numerous different artifacts show up in the archaeological record, indicating a more refined means of hunting and gathering. Flexed and semi-flexed burials became the norm. During the late Holocene, or protohistoric period, the artifact assemblage became even more diverse, with more elaborate projectile points, specialized mortars, beads, etc. (Frederickson 1986).

From approximately 1,000 BC to the modern era, the archaeological evidence in the areas surrounding the Buena Vista Lake and stretching to the Elk Hills indicates almost a continuous period of human occupation. The extensive marshlands around the region's lakes had interconnected sloughs that were fed by the seasonal flooding of the Kern River.

Ethnography Setting

The Yokuts were the Native American group that occupied the Southern San Joaquin Valley at the point of modern contact. A number of ethnographers have published descriptions of the Yokuts, including Kroeber (1925), Latta (1977) and Wallace (1978). There were over 40 different groups of the Yokuts, but the Southern Valley Yokuts were located in the region nearest the Project Site. The culture of the Southern Valley Yokuts included village life in which large groups were located in, or near a single, dominant village. Villages were inhabited on a permanent basis due to the ease of acquiring natural resources including roots, seeds, waterfowl, fish and shellfish.

Both villages and smaller settlements were located adjacent to, or within a short distance of permanent lakes and streams. Subsistence centered upon fishing; however, a mixed strategy of subsistence was employed. Fishing was accomplished by the use of nets. Mussels were also gathered, and hunting activities produced elk, pronghorn and rabbits.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Baskets were made with the tule grass that was very common near marshlands and lakes. The same resource was also employed in the construction of canoes utilized for fishing and travel, and in making mats for houses. Basket weaving was recognized as the primary technological skill of the Southern Valley Yokuts (Valdez 1993). Other material culture included knives, scraping tools and projectile points. Ground stone included mortars and pestles. Trade occurred for the acquisition of marine shells that were fashioned into pendants, disks, beads, etc. for use in both personal adornment and for money.

Two types of houses were constructed by the Yokuts. Smaller structures for single families were oval-shaped huts covered with tule grass mats. Communal dwellings were also constructed which were large enough to hold as many as ten families, with different areas separated for each family. Nuclear families were patrilineal and tribes were divided into moieties.

Historical Setting

Spanish Period

The first record of contact with the Southern Valley Yokuts occurred in 1772 by a band of Spanish soldiers. In 1776, Francisco Garces arrived in the region. Attempts were made to establish missions in the region, but they were unsuccessful. When the U.S. annexed California, the San Joaquin Valley was inundated with settlers and the extant cultural practices began to wane. The remaining Southern Valley Yokuts were initially sent to the Tejon and Fresno Reservations, but were later moved to the Tule Reservation in 1859.

The EHOF itself has an extensive history. Established in 1912, it eventually produced a steady supply of petroleum hydrocarbons and stood out as one of the largest crude oil and natural gas producers in the world. The management of the EHOF became the responsibility of the Department of Energy (DOE) in 1977. By the late 1990's, the majority of the EHOF was owned by the federal government, but Congress instructed the DOE to relinquish ownership of the field.

The Kern River Oilfield was discovered in 1899, which started a different type of "gold rush" in the area. Within five years after this date, most of the land in the EHOF had been claimed. In the early 1900's, the federal government became concerned about ensuring continued supplies of petroleum, and took control of the EHOF in 1909. Prior to the government claiming compete control, wildcatters began drilling throughout the field. A great deal of activity occurred, as small and large companies operated lease camps throughout the area. Standard Oil drilled a very successful well in 1919, thereby increasing the interest in the area. Lease camps continued to be set up, and a great deal of development occurred. These camps included barracks, dining halls, residences, etc.

Most of the early historic equipment is long gone, but of the known historic archaeological sites in the area, at least 175 of them have been recorded within the EHOF itself. Much of this equipment is represented and maintained at the West Kern Oilfield Museum, located in Taft, California. The initial cultural resources work conducted in the area classified these historic sites into five property types:

domestic occupation, transportation, military, industrial manufacturing and technology, and oil exploration and production.

Since the EHOF was somewhat isolated, a surprising amount of domestic life occurred there. Evidence for women and children is very clear in the archaeological record. This was true for many of the production field, pipeline pump stations, and records of these camps, the living conditions, and artifacts can be found at the West Kern Oilfield Museum in Taft.

There are still a number of historic components representing the early oil industry on the property. The old road network still exists, along with a pipeline system and foundations and many of the early structures and equipment. Modern land use in the region is the result of both agricultural and oil field development.

Paleontology

Fossils are an integral component of the rock unit below the ground surface, and consequently not observable unless exposed by erosion or human activity. Therefore, a paleontologist cannot know either the quality or quantity of fossils present before the rock unit is exposed as a result of natural erosion processes or earth-moving activities (URS, 2009).

Fossils are rarely uniformly distributed within a rock unit. Even within a fossiliferous portion of the rock unit, fossils may occur in local concentrations. According to URS (2009), "because the presence or location of fossils within a rock unit cannot be known without exposure resulting from erosion or excavation… an entire rock unit is assigned the same level of sensitivity (high, low, or undetermined) based on recorded fossil occurrences… The paleontological sensitivity of a stratigraphic unit reflects: (1) its potential paleontological productivity, and (2) the scientific significance of the fossils it has produced."

URS (2009) continues, "The potential paleontological productivity of a stratigraphic unit exposed in a project area is based on the abundance/densities of fossil specimens and/or previously recorded fossil sites in exposures of the unit in and near a project site. The underlying assumption of this assessment method is that exposures of a stratigraphic unit in a project site are most likely to yield fossil remains both in quantity and density similar to those previously recorded from that stratigraphic unit in and near the project site."

URS (2009) further states, "All identifiable land mammal fossils are considered scientifically important because of their potential use in providing relative age determinations and paleo-environmental reconstructions for the sediments in which they occur. Moreover, vertebrate remains are comparatively rare in the fossil record. Although fossil plants are usually considered of lesser importance because they are less helpful in age determination, they are actually more sensitive indications of their environment (Miller et al. 1971) and as sedentary organisms, are more valuable than mobile animals for paleo-environmental reconstructions. For marine sediments, invertebrate and marine algal fossils, including 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."

Tulare Formation

There are a number of previously recorded fossil sites in the Tulare Formation in the Elk Hills as well as neighboring areas. Several fossil localities described by Woodring et al (1932) are present in the Elk Hills, and include specimens of camel, horse, rabbit, wood rat, cotton rat, silicified wood, and freshwater invertebrates. According to URS (2009), "Based upon these fossil localities, Woodring et al (1932) stated, 'the Elk Hills offer a promising field for collecting vertebrate fossils, which would fill a gap in the succession of vertebrate faunas on the Pacific Coast.' Maher et al (1975) indicated that 'scattered fish remains,' mollusk fragments, reworked foraminifers, ostracodes, pelecypods, and small gastropods have been identified from wells in the Elk Hills."

In 2008, PaleoResource Consultants conducted a field survey of the EHOF as part of an assessment of the potential adverse impacts on scientifically significant resources. The survey identified several previously unreported fossil localities within the Tulare Formation. Fossils identified included; vertebrate fossil bones, bone fragments, invertebrate shells, and fossilized wood. Numerous paleosols (fossil soils) containing ichnofossils (root and burrow casts and molds were also identified (PaleoResource, 2008).

Quaternary Alluvium

According to URS (2009), no fossil localities have previously been reported from Quaternary alluvium in the vicinity of the EHOF. "However, significant vertebrate fossils have been reported from Holocene and Pleistocene sediments in several areas of Kern County… The occurrence of large and small mammals are well documented from these and older subsurface deposits and with further observation of earth-moving activities and prospecting for fossils, more specimens could be unearthed. Since fossil vertebrates have been previously reported from Quaternary alluvium within Kern County, the Quaternary alluvium is also judged to have a high sensitivity."

Summary

According to PaleoResource (2008), due to the numerous previously unidentified fossil localities in and around the vicinity of the Elk Hills, "there is a high probability of scientifically significant paleontological resources being unearthed during future ground disturbing activities".

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.5.3 Regulatory Setting

4.5.3.1 Local

Kern County (County) General Plan

The policies, goals, and implementation measures in the *Kern County General Plan* for cultural resources applicable to the proposed Project are provided below.

1.10.3 Archaeological, Paleontological, Cultural, and Historical Preservation (General Provisions in the Land Use, Open Space, and Conservation Element)

Policies

Policy 25. The County will promote the preservation of cultural and historic resources that provide ties with the past and constitute a heritage value to residents and visitors.

Implementation Measures

Implementation Measures K. Coordinate with the California State University, Bakersfield's (CSUB) Archaeology Inventory Center.

Implementation Measures L. The County shall address archaeological and historical resources for discretionary projects in accordance with CEQA.

Implementation Measures M. In areas of known paleontological resources, the County should address the preservation of these resources where feasible.

Implementation Measures N. The County shall develop a list of Native American organizations and individuals who desire to be notified of proposed discretionary projects. This notification will be accomplished through the established procedures for discretionary projects and CEQA documents.

Implementation Measures O. On a project-specific basis, the County Planning Department shall evaluate the necessity for the involvement of a qualified Native American monitor for grading or other construction activities on discretionary projects that are subject to a CEQA document.

4.5.3.2 State

California Environmental Quality Act

CEQA requires the assessment of a proposed Project's effects on cultural resources. Pursuant to CEQA, a "historical resource" is a resource listed in, or eligible for listing in, the California Register of Historical Resources (CRHR). In addition, resources included in a local register of historic resources or identified as significant in a local survey conducted in accordance with state guidelines are also considered historic resources under CEQA, unless a preponderance of the facts demonstrates

otherwise. According to CEQA, the fact that a resource is not listed in or determined eligible for listing in the CRHR or is not included in a local register or survey shall not preclude a lead agency, as defined by CEQA, from determining that the resource may be an historic resource as defined in California PRC Section 5024.1. CEQA applies to archaeological resources when (1) the archaeological resource satisfies the definition of a historic resource, or (2) the archaeological resource satisfies the definition of a "unique archaeological resource." A unique archaeological resource is an archaeological artifact, object, or site that has a high probability of meeting any of the following criteria:

The archaeological resource contains information needed to answer important scientific research questions and there is a demonstrable public interest in that information.

The archaeological resource has a special and particular quality such as being the oldest of its type or the best available example of its type.

The archaeological resource is directly associated with a scientifically recognized important prehistoric or historic event or person.

For the protection of paleontological resources, the CEQA also requires public agencies and private interests to identify any adverse impacts to an object or site important to the scientific annals of California.

California Register of Historical Resources (CRHR)

Created in 1992 and implemented in 1998, the CRHR is "an authoritative guide in California to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change." Certain properties, including those listed in or formally determined eligible for listing in the NRHP and California Historical Landmarks numbered 770 and higher, are automatically included in the CRHR. Other properties recognized under the California Points of Historical Interest program, identified as significant in historic resources surveys or designated by local landmarks programs, may be nominated for inclusion in the CRHR. A resource, either an individual property or a contributor to a historic district, may be listed in the CRHR if the State Historical Resources Commission determines that it meets one or more of the following criteria, which are modeled on NRHP criteria:

Criterion 1: It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.

Criterion 2: It is associated with the lives of persons important in our past.

Criterion 3: It embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Criterion 4: It has yielded, or may be likely to yield, information important in history or prehistory.

Furthermore, under PRC Section 4852(c), a cultural resource must retain integrity to be considered eligible for the CRHR. Specifically, it must retain sufficient character or appearance to be recognizable as a historical resource and convey reasons of significance. Integrity is evaluated with regard to retention of such factors as location, design, setting, materials, workmanship, feeling, and association. Cultural sites that have been affected by ground-disturbing activities, such as grazing and off-road vehicle use (both of which occur within the Project Site), often lack integrity because they have been directly damaged or removed from their original location, among other changes.

Typically, a prehistoric archaeological site in California is recommended eligible for listing in the CRHR based on its potential to yield information important in prehistory or history (Criterion 4). Important information includes chronological markers such as projectile point styles or obsidian artifacts that can be subjected to dating methods or undisturbed deposits that retain their stratigraphic integrity. Sites such as these have the ability to address research questions.

California Historical Landmarks (CHL)

California Historical Landmarks (CHLs) are buildings, structures, sites, or places that have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value and that have been determined to have state wide historical significance by meeting at least one of the criteria listed below. The resource also must be approved for designation by the County Board of Supervisors (or the city or town council in whose jurisdiction it is located); be recommended by the State Historical Resources Commission; and be officially designated by the Director of California State Parks.

To be eligible for designation as a landmark, a resource must meet at least one of the following criteria:

It is the first, last, only, or most significant of its type in the state or within a large geographic region (Northern, Central, or Southern California);

It is associated with an individual or group having a profound influence on the history of California; or

It is a prototype of, or an outstanding example of, a period, style, architectural movement or construction or is one of the more notable works or the best surviving work in a region of a pioneer architect, designer, or master builder.

California Points of Historical Interest

California points of historical interest are sites, buildings, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Points of historical interest designated

after December 1997 and recommended by the State Historical Resources Commission are also listed in the CRHR. No historic resource may be designated as both a landmark and a point. If a point is later granted status as a landmark, the point designation will be retired. In practice, the point designation program is most often used in localities that do not have a locally enacted cultural heritage or preservation ordinance.

To be eligible for designation as a point of historical interest, a resource must meet at least one of the following criteria:

It is the first, last, only, or most significant of its type within the local geographic region (city or county);

It is associated with an individual or group having a profound influence on the history of the local area; or

It is a prototype of, or an outstanding example of, a period, style, architectural movement or construction or is one of the more notable works or the best surviving work in the local region of a pioneer architect, designer, or master builder.

Native American Heritage Commission (NAHC)

Section 5097.91 of the California PRC established the NAHC, whose duties include the inventory of places of religious or social significance to Native Americans and the identification of known graves and cemeteries of Native Americans on private lands. Section 5097.98 of the PRC specifies a protocol to be followed when the NAHC receives notification of a discovery of Native American human remains from a county coroner.

California Public Records Act

Sections 6254(r) and 6254.10 of the California Public Records Act were enacted to protect archaeological sites from unauthorized excavation, looting, or vandalism. Section 6254(r) explicitly authorizes public agencies to withhold information from the public relating to "Native American graves, cemeteries, and sacred places maintained by the NAHC." Section 6254.10 specifically exempts from disclosure requests for "records that relate to archaeological site information and reports, maintained by, or in the Historical Resources Commission, the State Lands Commission, the NAHC, another state agency, or a local agency, including the records that the agency obtains through a consultation process between a Native American tribe and a state or local agency."

Health and Safety Code, Sections 7050 and 7052

Health and Safety Code, Section 7050.5, declares that, in the event of the discovery of human remains outside of a dedicated cemetery, all ground disturbances must cease and the county coroner must be notified. Section 7052 establishes a felony penalty for mutilating, disinterring, or otherwise disturbing human remains, except by relatives.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

California Penal Code, Section 622.5

The California Penal Code, Section 622.5, provides misdemeanor penalties for injuring or destroying objects of historic or archaeological interest located on public or private lands, but specifically excludes the landowner.

Public Resources Code, Section 5097.5

Public Resources Code, Section 5097.5, defines as a misdemeanor the unauthorized disturbance or removal of archaeological, historic, or paleontological resources located on public lands.

Warren-Alquist Act

The Warren-Alquist Act requires the CEC to evaluate any facility siting activity in unique areas of scientific concern. The CEC is California's primary energy policy and planning agency. The CEC has responsibility for activities that include forecasting future energy needs, promoting energy efficiency through appliance and building standards, and supporting renewable energy technologies.

4.5.3.3 Federal

Federal Agencies, Programs and Regulations

Various federal laws, regulations, and guidelines specify how cultural resources are to be managed in the context of projects that are considered "federal undertakings" (per 36 CFR 800). These federal statutes and guideline may be relevant to the proposed Project if federal permits or authorizations are required, such as an Army Corps of Engineers 401 permit for wetlands.

Among the most relevant federal laws and regulations are: the National Historic Preservation Act of 1966 (NHPA), as amended; the National Environmental Policy Act (NEPA) of 1969; the Archaeological Resources Protection Act (ARPA) of 1979; the Advisory Council on Historic Preservation's regulations, Protection of Historic Properties (36 CFR 800), establishing procedures for compliance with Section 106 of the NHPA. Pertinent federal laws and regulations are summarized below.

National Historic Preservation Act

The NHPA was enacted in 1966 as a means to protect cultural resources that are eligible to be listed on the National Register of Historic Places (NRHP). The law sets forth criterion that is used to evaluate the eligibility of cultural resources. The NRHP is composed of districts, sites, buildings, structures, objects, architecture, archaeology, engineering, and culture that are significant to American History. Virtually any physical evidence of past human activity can be considered a cultural resource. Although not all such resources are considered to be significant and eligible for listing, they often provide the only means of reconstructing the human history of a given site or region, particularly where there is no written history of that area or that period. Consequently, their significance is judged

largely in terms of their historical or archaeological interpretive values. Along with research values, cultural resources can be significant, in part, for their aesthetic, educational, cultural and religious values.

Advisory Council Regulations, Protection of Historic Properties (36 CFR 800)

These regulations establish procedures for compliance with Section 106 of the NHPA of 1966. These regulations define the Criteria of Adverse Effect, define the role of State Historic Preservation Officer (SHPO) in the Section 106 review process, set forth documentation requirements, and describe procedures to be followed if significant historic properties are discovered during implementation of an undertaking. Prehistoric and historic resources deemed significant (i.e., eligible for listing in the NRHP, per 36 CFR 60.4) must be considered in project planning and construction. The responsible federal agency must submit any proposed undertaking that may affect NRHP-eligible properties to the SHPO for review and comment prior to project approval.

Archaeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines (FR 190:44716–44742)

These guidelines offer non-regulatory technical advice about the identification, evaluation, documentation, study, and other treatment of cultural resources. Notable in these Guidelines are the "Standards for Archaeological Documentation" (p. 44734) and "Professional Qualifications Standards for Archaeology" (pp. 44740–44741).

National Environmental Policy Act (NEPA)

The NEPA of 1969 requires federal agencies to foster environmental quality and preservation. Section 101(b)(4) declares that one objective of the national environmental policy is to "preserve important historic, cultural, and natural aspects of our national heritage…" For any major federal actions significantly affecting environmental quality, federal agencies must prepare, and make available for public comment, an EIS.

4.5.4 Impacts and Mitigation Measures

4.5.4.1 Methodology

To evaluate the proposed Project's potential effects on significant cultural and paleontological resources, including prehistoric and historic archaeological sites, Stantec Consulting (Stantec) conducted an overview based upon extensive data provided by the project proponent.

4.5.4.2 Thresholds of Significance

The CEQA Guidelines (Appendix G) and the Kern County CEQA Implementation Document state that a project would have a significant impact on cultural resources if it would:

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Cause a substantial adverse change in the significance of a historical resource, as defined in CEQA Guidelines Section15064.5;

Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines Section15064.5;

Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or

Disturb any human remains, including those interred outside of formal cemeteries.

Section 21083.2(g) further defines "unique archaeological resource" for purposes of determination as to whether a project may have a significant effect on archaeological resources. As used in this section "unique archaeological resource" means 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:

Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;

Has a special and particular quality such as being the oldest of its type or the best available of its type; or

Is directly associated with a scientifically recognized important prehistoric or historic event or person.

CEQA does not define a unique paleontological resource but for purposes of this SEI, the CEQA definition for unique archaeological resources shall be used, as described above.

According to State CEQA Guidelines (CCR Title 14, 15064.5), a project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment (CCR Title 14, 15064.5(b)). The guidelines further state that a substantial adverse change in the significance of a resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historic resource would be materially impaired. Actions that would materially impair the significance of a historical resource are any actions that would demolish or adversely alter those physical characteristics of a historical resource that convey its historical significance and qualify it for inclusion in the CRHR or in a local register or survey that meet the requirements of PRC Sections 5020.1(k) and 5024.1(g).

CEQA guidelines require the identification and mitigation of paleontological resources as if they were historical resources. The definition of a historical resource is therefore quite broad and includes any site, object, area, or place that a lead agency determines to be historically significant. Paleontological resources fall within this definition and are further mentioned under the CEQA checklist.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.5.4.3 Project Impacts

IMPACT CULT-1: Cause a Substantial Adverse Change in the Significance of a Historical Resource

None of the recorded historic period sites or artifacts in the EHOF is regarded as individually eligible for listing in the National Register of Historic Places. Some early development features could be considered significant with reference to their association with individuals important in the early history of the oil industry. The EHOF may be eligible at the local, state or national level, as a rural historic landscape, for its role in the development of the California oil industry and for its relationship to the infamous "Teapot Dome" scandal of the Harding presidential administration (DOE, 1997). However, the proposed project is limited to utilizing CO2 EOR including the construction and operation of supporting facilities that will not cause a substantial adverse change in the significance of a historical resource. This is a less than significant impact.

Mitigation Measures

Mitigation measures are not required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT CULT-2: Cause a Substantial Adverse Change in the Significance of an Archaeological Resource

If all activities are conducted outside of the Elk Hills Conservation Area, no impacts to previously identified prehistoric archaeological resources are anticipated. However, prehistoric archaeological resources without surface indications could exist in the project area. Disturbance to these resources could result in a significant cultural resources impact.

Implementation of the following mitigation measures will lower any potential proposed Project impact to archaeological resources below the threshold of significance. These measures establish procedures to follow in case previously undiscovered archaeological deposits are encountered below the ground surface.

Mitigation Measures

Mitigation Measure CULT-1 Prior to initial ground-disturbing activities the Designated Cultural Resources Specialist will conduct a worker education session for construction supervisory personnel to explain the importance of and legal basis for the protection of known significant archaeological resources.

Mitigation Measure CULT-2 A Native American monitor will be present during Project excavation work in culturally sensitive areas on the EHOF.

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

Mitigation Measure CULT-3 If a new prehistoric or historic cultural resource site is discovered during construction and determined to be significant, a qualified Archaeologist will prepare and implement a mitigation plan in accordance with state regulations on private lands. This plan will emphasize the avoidance, if possible, of significant archaeological resources. If avoidance is not possible, recovery of a sample of the deposit from which the archaeologist can define scientific data to address archaeological research questions will be considered an effective mitigation measure for damage to or destruction of the deposit.

The qualified Archaeologist and archaeological monitor will follow accepted professional standards in recording any finds and will submit the standard Department of Parks and Recreation historic site form (Form DPR 523) and locational information to the Southern San Joaquin Valley Information Center of the California Historic Resources Information System at CSUB.

If the qualified Archaeologist determines that the find is not significant, construction will proceed. If the qualified Archaeologist determines that further information is needed to determine whether the find is significant, the County and SHPO will be notified for consultation. Construction will resume at the site as soon as the field data collection phase of any data recovery efforts is completed.

Mitigation Measure CULT-4 If cultural resources are recovered during proposed Project construction, a qualified Archaeologist will contact and offer the resources for curation to a curation facility, that is, a recognized, non-profit archaeological repository with a permanent curator, of any archaeological materials collected during the construction monitoring and mitigation program. The archaeologist shall submit field notes, stratigraphic drawings, and other materials developed as part of the archaeological excavation program to the curation facility along with the archaeological collection.

If buried archaeological deposits are found during construction, the archaeologist will prepare a report summarizing the monitoring and archaeological investigatory program implemented to evaluate the find or to recover data from an archaeological site as a mitigation measure. This report will describe the site soils and stratigraphy, and analyze artifacts and other materials recovered, and explain the site's significance. This report will be submitted to the curation facility with the collection.

Mitigation Measure CULT-5 The qualified Archaeologist should 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*. The Archaeological Monitor shall be qualified to detect archaeological deposits in the field. The qualified Archaeologist shall be qualified, in addition to site detection, to evaluate the significance of the deposits, consult with regulatory agencies, and plan site evaluation and mitigation activities.

Level of Significance after Mitigation

Although unlikely, significant archaeological resources may be present within various portions of the proposed Project Site outside the conservation set-aside area and could be adversely impacted during

construction activities. Implementation of the measures described above will mitigate this impact to a less than significant level.

IMPACT CULT-3 Directly or Indirectly Destroy a Unique Paleontological Resource or Site or Unique Geologic Feature

Paleontological resources are prevalent throughout the area and could be discovered during any surface disturbance activity. It is suggested that the mitigation measures that have been required for previous recent projects be implemented. Prior to the certification of the Elk Hills Power Plant, several measures were suggested, and they are relevant to any future development in the oilfield.

Under CEQA Guidelines public agencies must treat all historical and cultural resources as significant unless the preponderance of evidence demonstrates that they are not historically or culturally significant. An individual fossil specimen is considered scientifically important if it is identifiable, complete, well preserved, age diagnostic, useful in paleo-environment reconstruction a type or topotypic specimen, a member of a rare species, a species that is part of a diverse assemblage, or a skeletal element different from, or a specimen more complete than, those now available for that species.

Mitigation Measure CULT-6 Prior to the start of construction, the designated paleontological resource specialist would conduct a training session for all project managers and construction personnel that are responsible for operating heavy equipment. The training would focus upon the identification and reporting procedure for the discovery of any previously unrecorded paleontological resources.

Mitigation Measure CULT-7 If paleontological resources are recovered during proposed Project construction, a qualified individual will contact and offer the resources for curation to a paleontological curation facility.

Mitigation Measure CULT-8 All paleontological investigations during the course of the project would result in a formal report submitted to the appropriate agency.

Level of Significance after Mitigation

Although unlikely, significant paleontological resources may be present within various portions of the proposed Project Site outside the conservation set-aside area and could be adversely impacted during construction activities. Implementation of the measures described above will mitigate this impact to a less than significant level.

IMPACT CULT-4 Disturb any Human Remains, including those interred outside of formal cemeteries

Native American human remains have been encountered during past earth disturbing activities at the EHOF. As such, there is potential for their discovery during proposed Project construction. The

potential to encounter human remains during construction will be reduced by minimizing disturbances to the degree practical (e.g., use of existing wells and pads, previously disturbed pipeline corridors, and aboveground piping). If human remains were to be discovered during construction, Mitigation Measure CULT-9 would ensure that the remains are treated in accordance with the California Public Resources Code and impacts would be reduced to a less than significant level.

Mitigation Measures

Mitigation Measure CULT-2 identified above.

Mitigation Measure CULT-9 If human remains are found during construction CEQA requires that further work or disturbance of the site be halted. The discovery will be inspected and the remains be handled in a manner consistent with Public Resources Code 5097.98-99, Health and Safety Code 7050.5, and CEQA Section 15064.5.

If the remains are determined to be Native American, the NAHC will be notified within 24 hours as required by Public Resources Code 5097. The NAHC will notify designated Most Likely Descendants who will provide recommendations for the treatment of the remains within 24 hours. The NAHC will mediate any disputes regarding the treatment of remains.

Level of Significance after Mitigation

Impacts would be less than significant.

4.5.5 Cumulative Impacts

Archaeological and paleontological resources are generally not considered subject to cumulative impacts because cultural resources are localized and site-specific and are either individually impacted in a way that changes the significance of the site or are avoided. Therefore, no apparent significant cumulative impacts are anticipated because the resources are generally not considered subject to cumulative impacts, and the proposed Project would not be expected to have a significant impact on archeological or paleontological sites. In addition, if the mitigation measures mentioned above for paleontological resources are followed, the Project would not result in a cumulative impact.

Mitigation Measures

Implementation of the aforementioned mitigation measures would reduce this impact to less than significant.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.6 GEOLOGY AND SOILS

4.6 Geology and Soils

4.6.1 Introduction

This section describes the geology and soils associated with the EHOF and vicinity, and the potential impacts from seismic hazards (i.e., relating to or caused by an earthquake or earth tremor), seismic-related ground failure, soil erosion, and expansive and unstable soils that may be associated with construction and operation of the proposed Project.

4.6.2 Environmental Setting

4.6.2.1 Regional Geology

California is divided into eleven (11) Geomorphic Provinces (Sutch and Dirth, 2003). The EHOF is located in the Great Valley geomorphic province (Figure 4.6-1: California Geomorphic Provinces). The Great Valley Province is characterized by a large northwest trending valley bounded by the Sierra Nevada province to the east and south, the Klamath Mountains province to the north, the Cascade Range province to the northeast, and the Coast Range province to the west. The Great Valley Province is filled with thick sediments eroded from the surrounding mountain ranges. Sutter Buttes, Kettleman Hills, Elk Hills, and Buena Vista Hills provide the only significant topographic relief in the San Joaquin Valley portion of the Great Valley province (Sutch and Dirth, 2003). According to URS (2009), the San Joaquin Valley is filled with thick Mesozoic and Tertiary marine and non-marine sediments covered by a relatively thin veneer of Quaternary alluvial sediments (Bailey 1966).

According to Sutch and Dirth (2003), "the Great Valley province is underlain by a thick (up to 80,000 feet thick) sequence of sedimentary units (the Great Valley Sequence) which are Jurassic age or younger. The valley is an asymmetrical synclinal trough with a more gently dipping eastern limb. The bulk of the province was covered by seas prior to the early Eocene. As the seas withdrew, increasing terrestrial sediments were deposited from the erosion of the Sierra Nevada to the east. During the Eocene there was uplift on the margins of the province causing the seas to gradually recede. During this time the Stockton Arch (the division between the northern and southern parts of the province) was also rising. Subsidence of the valley during late Eocene time caused the seas to again inundate the province. As the valley continued to fill with sediments, the seas occupied smaller areas. By the end of the Pliocene the seas had finally withdrawn for the last time from the south-western portion of the province, the last area to be submerged." The last large lake to occupy the Great Valley Province was Lake Corcoran, about 600,000 years ago (URS, 2008). Lake Corcoran covered much of the western part of the southern Great Valley province. The resulting Corcoran Clay (composed of fine clays, volcanic ash, and diatomite) covers more than 5,000 square miles and forms an extensive confined aquifer (Sutch and Dirth, 2003).

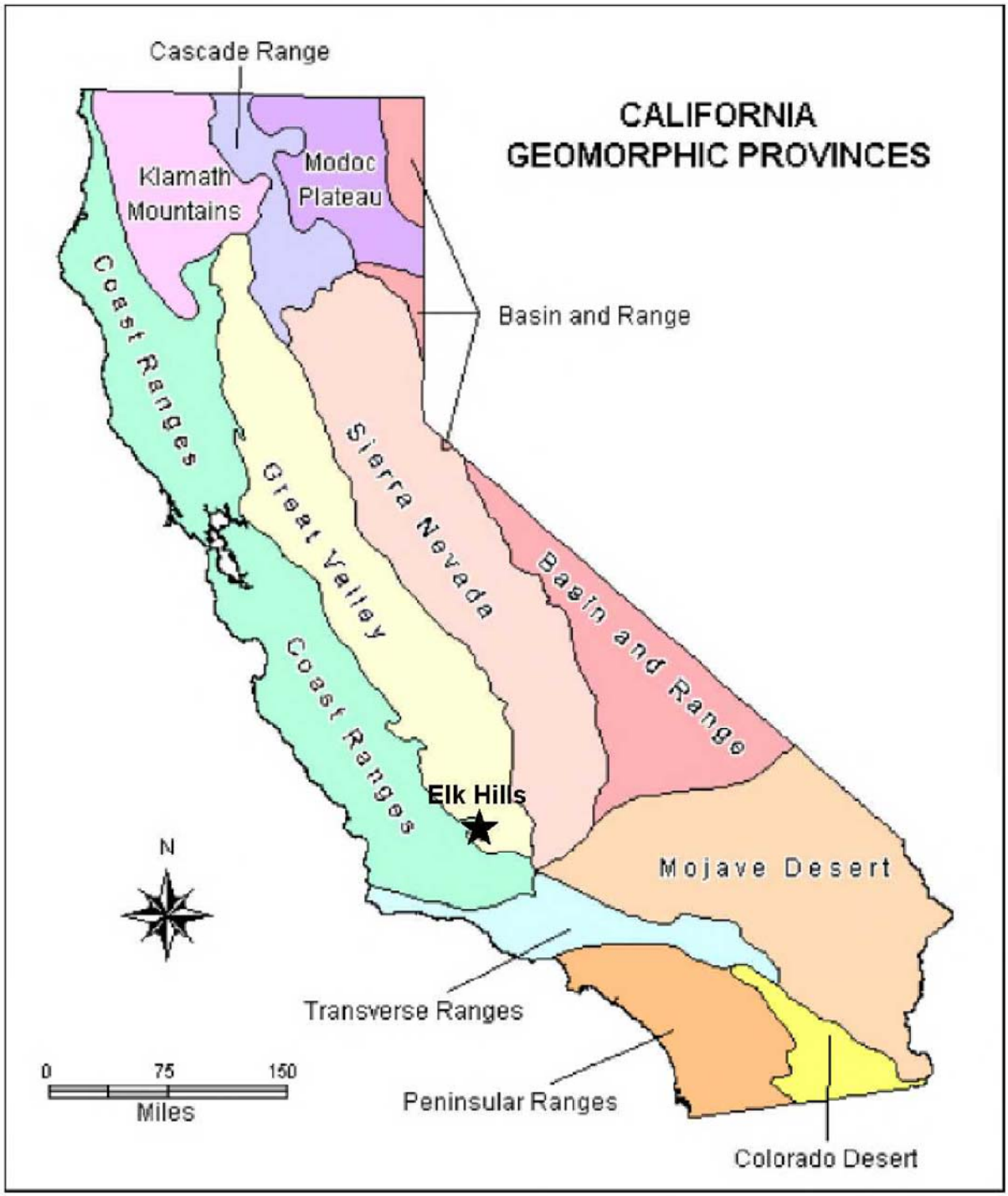

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Fig. 4.6-1

California Gemorphic Provinces

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4.6 GEOLOGY AND SOILS

4.6.2.2 Local Geology

The EHOF is located near the south-western edge of the San Joaquin Valley, approximately 25 miles southwest of the city of Bakersfield in Kern County, California. The EHOF is approximately 17 miles long (generally east to west) and over 7 miles wide (generally north to south) (ManageTech, 2010). The highest elevation in the Elk Hills is 1,551 feet above mean sea level, which is between 1,000 to 1,200 feet above the floor of the San Joaquin Valley. The Tertiary and Quaternary-aged deposits underlying the Elk Hills and nearby areas are up to 24,000 feet thick (U.S. Department of Energy [DOE], 1997).

According to White (1987), the Elk Hills are a foothill spur that extends from the Temblor Range south-eastward. The Elk Hills are the topographic expression of the Elk Hills Anticline. The Elk Hills Anticline is a large compound anticline with about 400 feet of closure folded from Tulare Formation (the upper geologic unit of the EHOF) (MangageTech, 2010) and is part of the *en échelon* folding of the Tertiary and Quaternary sedimentary strata along the western side of the San Joaquin Valley, associated with strain caused by movement along the San Andreas Fault (URS, 2009; White 1987).

The Tulare Formation lies at the surface of Elk Hills and consists of alternating beds of gravel, sand, silt, and clay, deposited under non-marine conditions (DOE, 1997). The specific soils that are present on the Project Site will be discussed in the "Soils Types and Characteristics" section below.

4.6.2.3 Geologic Resources

According to DOE (1997), "Elk Hills is one of the largest domestic producing oil fields in the lower 48 states. It is also one of the nations' ten largest natural gas fields. The natural gas liquids extracted from the reserve include propane, butane, isobutane and natural gasoline." According to the California Department of Conservation, Oil and Gas Statistics, 2006 Annual Report, the EHOF is a large oil field in northwest Kern County, in the Elk Hills of the San Joaquin Valley. It was discovered in 1911, and having a cumulative production close to 1.3 billion barrels of oil at the end of 2006, it is the fifth-largest oil field in California, and the seventh-most productive field in the United States. Its estimated remaining reserves, as of the end of 2006, were around 107 million barrels, and it had 2,387 active oil producing wells. It is by an order of magnitude the largest natural gas-producing oil field in California, having produced over 2 trillion cubic feet of gas since its discovery, and retaining over 700 billion cubic feet in reserve. Overall the EHOF encompasses 47,409 acres (or about 75 square miles). To date, thirteen separate oil pools have been identified in the EHOF, in rock units ranging in age from Oligocene to Pleistocene (DOGGR 2007). Oil was first found in the Tulare Formation (the shallowest formation), at 1,120 feet below ground surface; the deepest oil found is in the Oligocene portion of the Temblor containing the Agua Pool at a depth of 9,500 feet, found in 1977 (DOGGR, 1998) (Figure 4.6-2: Elk Hills Oil Field Stratigraphy based on 934 29R Well).

4.6 GEOLOGY AND SOILS

According to ManageTech (2010), "the EHOF produces hydrocarbons (oil and gas) from several vertically-stacked Tertiary-aged (65 to 2 million years ago) coarse-grained clastic reservoirs inter layered with multiple layers of saling fine-grained shale. These layers have been folded and faulted, resulting in anticlinal structures containing hydrocarbons of probable Oligocene and Miocene (approximately 33 to 5 million years ago) source. The hydrocarbons were generated in the deep flanks of the Elk Hills structure and/or migrated into the structure from surrounding subbasins, beginning in the Pliocene (approximately 5 to 2.5 million years ago [Zumberger et al, 2005]). The combination of the multiple porous and permeable sandstone reservoirs inter layered with multiple impermeable shale seals and large anticlinal structure make the EHOF one of the most suitable locations for the extraction of hydrocarbons and the trapping of CO2 in North America".

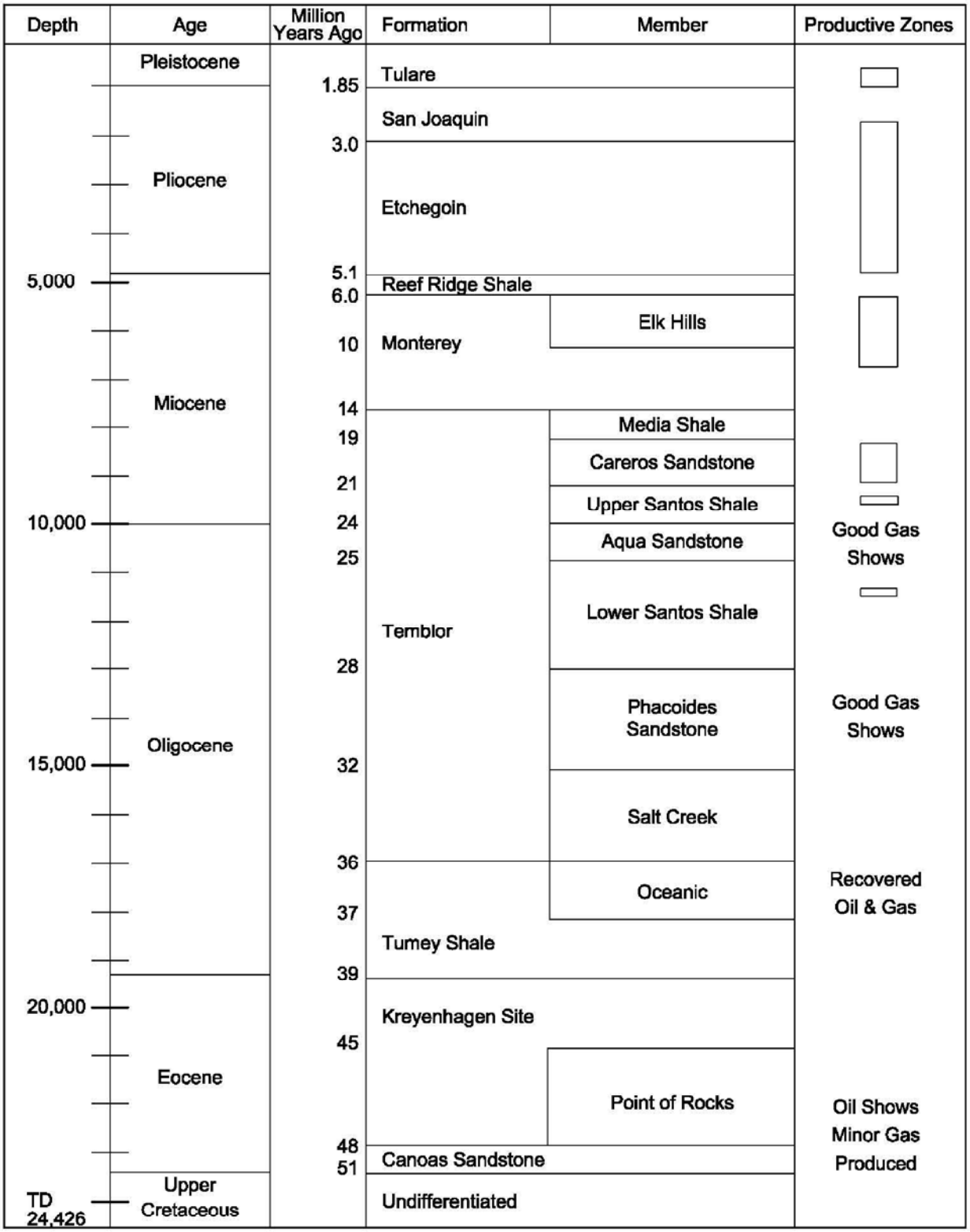
According to ManageTech (2010), "to date, there have been more than 6,000 wells drilled to various depths within the EHOF. The deepest well in the field is the 934 29R, drilled to a total depth of 24,426 feet, bottoming in Mesozoic, Upper Cretaceous age (93 to 65 million years ago) sediments. The oldest rocks observed in the field are Upper Cretaceous in age but they are not productive. The Miocene-aged Carneros sandstone member of the Temblor Formation is the lowermost hydrocarbon producing interval in the field, although oil and gas shows have been recorded in deeper Oligocene- and Eocene-aged (55 to 23 million years ago) sediments. Above the Temblor is the Miocene-aged Monterey Formation."

ManageTech (2010) continues, "the Monterey (approximately 4,500 to 10,000 feet deep) is known locally as the EHOF member and this formation includes the Stevens oil sands that produce from stratigraphic-structural traps on three deep anticlines. Major Stevens Reservoirs include Main Body B ("MBB"), 26R, W31S, 24Z, 2B, A1A6 and T&N pools. The Stevens sands are composed of stacked fining upward turbidite deposits composed of lenticular sheet sands, channels and levee deposits within a submarine fan complex (Reid, 1990). Reservoir properties of the Stevens sands are excellent and have led to decades of hydrocarbon production, with porosities averaging between 20 and 25 percent, permeabilities averaging 150 millidarcy (mD) and net reservoir thicknesses that can exceed 1,000 feet. The uppermost Miocene formation is the Reef Ridge Shale, which is hard and siliceous (Nicholson, 1990) and acts as a stratigraphic trap keeping hydrocarbons below. A number of deep thrust and wrench faults, as well as a series of curvilinear normal faults, intersect the Stevens Reservoirs within the EHOF. These faults are believed to have influenced hydrocarbon migration from deeper source rocks (McJannet, 1996), but faults within the lower productive limits on the anticlinal structures die-out above in the overlying Reef Ridge Shale and Etchegoin Shale.

4.6 GEOLOGY AND SOILS

These faults may provide some limited communication between some of the productive sands, though most units are not in communication with one another, having different oil-water contacts. Further, individual anticline sands are compartmentalized, as exhibited by different pressures and temperatures (C&C Resources, 2000)."

No mineral resources other than oil and gas have been commercially developed within Elk Hills. However, the coarser deposits of alluvium and the Tulare Formation could be used as a local source of sand and gravel (DOE, 1985).



(Source: Nicholson, 1990)

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Fig. 4.6-2

Elk Hills Oil Field Stratigraphy Based on 934 29R Well

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4.6 GEOLOGY AND SOILS

4.6.2.4 Stratigraphy

The Tulare Formation of Pleistocene age (approximately 2.5 million to 10,000 years ago) is the uppermost formation in the EHOF (from surface to 1,500 feet below ground surface) and is comprised of fluvial and alluvial sediments (Nicholson, 1990). Below the Tulare Formation is the San Joaquin Formation of Pliocene age (DOGGR, 1998). According to ManageTech (2010), the San Joaquin Formation, includes the productive basal Scalez sand member and overlying shales. The San Joaquin formation overlies Pliocene Etchegoin Formation, which includes several productive silty and sandy members; including Calitroleum, Gusher, Wilhelm, Bittium, and Sub-Mulinia, and intervening shales. The Etchegoin Formation, in turn, overlies the Reef Ridge Formation of Miocene age. The "Pliocene rocks represent a depositional transition from deep water to shallow, including near-shore deposition." (ManageTech, 2010 [Figure 4.6-3 Generalized Cross Section of the Southern San Joaquin Valley, C – D]).

Two stratigraphic units have been observed at the surface within the EHOF: Quaternary alluvium and the Tulare Formation (URS, 2009). According to URS (2009), quaternary, "alluvium unconformably overlies sediments of the Tulare Formation (Dibblee, 2005). Thus, although Quaternary alluvium is mapped as being present at the surface… the older Tulare Formation may still be encountered in the shallow subsurface."

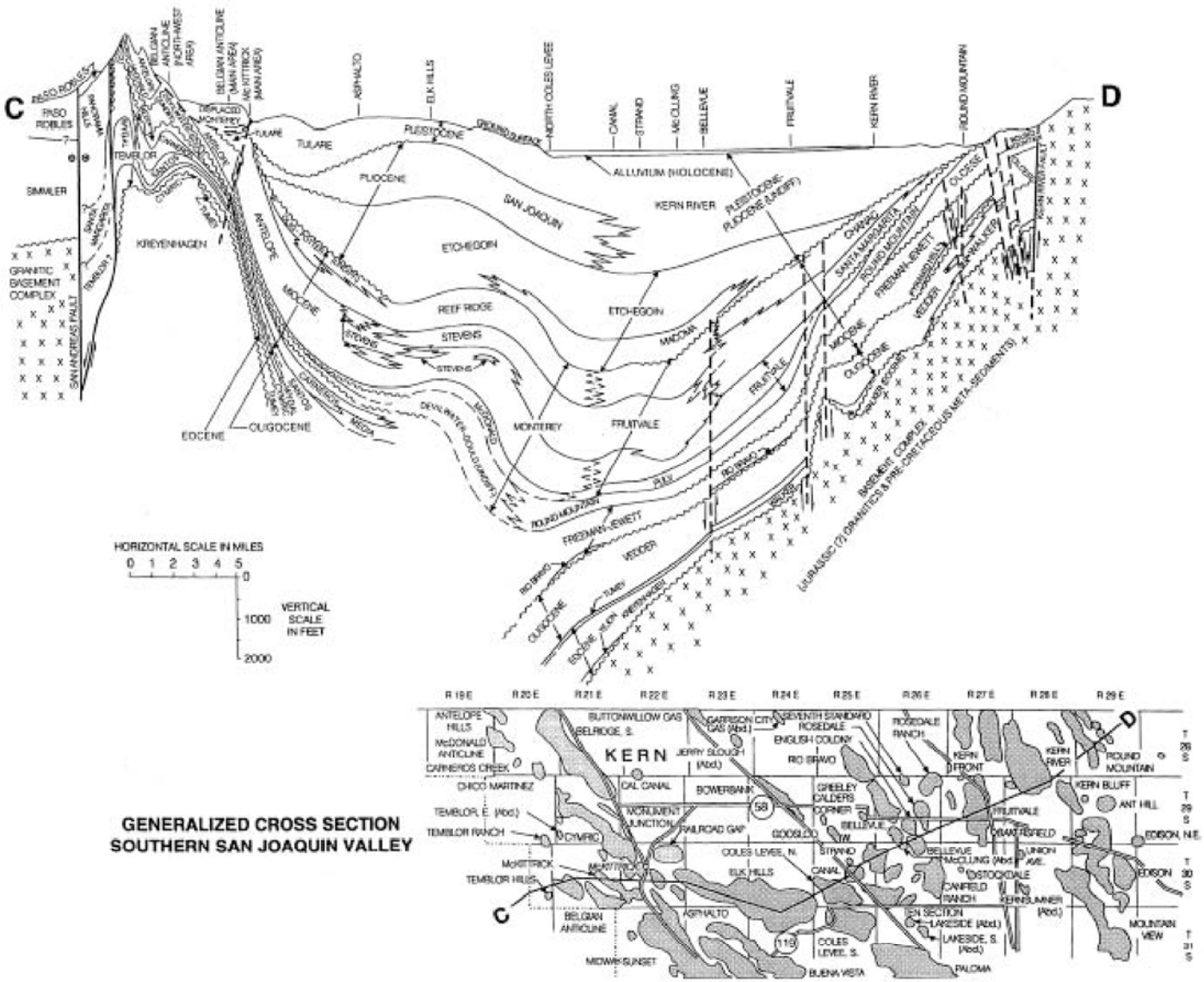
Tulare Formation

According to URS (2009), "Dibblee (1973) described the Tulare Formation as "locally deformed dissected valley deposits composed of gravel, sand, and silt." Lithologically, the Tulare Formation consists of argillaceous sand and silt deposits with lenses of coarse sand and gravel. White (1987) described sediments of the Tulare Formation as found in the Elk Hills as "low-angle, cross-bedded, fine to medium pebbly sands interbedded with structureless to faintly laminated, gypsiferous, olive-green, brown, and gray muds and clays. Conglomerate units do occur, but are rare overall. Pebbles and clasts of siliceous shale are common and are most likely derived from the Monterey Formation exposed in the Temblor Range to the west." Tulare Formation sediments in the Elk Hills have a thickness up to approximately 610 meters (~2,000 feet), while Tulare sediments found elsewhere may be as much as 1,525 meters (~5,000 feet) thick (Maher et at, 1975; White 1987). Most of the formation is composed of reworked sedimentary materials whose origin is from erosion of the Coast Ranges. The Tulare Formation overlies the San Joaquin Formation, likely conformably, in the Elk Hills area, though in other places throughout the San Joaquin Valley it unconformably overlies sediments of various formations and ages (Dibblee, 1973; Lettis 1982)."

4.6 GEOLOGY AND SOILS

Quaternary Alluvium

According to URS (2009), "Quaternary alluvium is composed primarily of fluvial sands and gravels reworked from older formations and transported from the topographically-high adjacent areas. Within and in the immediate vicinity of the Project Site, the alluvium in primarily composed or either reworked Tulare Formation material and recent soils, or sediments of the Kern River distal fan. There is also some lacustrine material in the local alluvium, including sediments of Buena Vista Lake and other periodic lakes."



GENERALIZED CROSS SECTION SOUTHERN SAN JOAQUIN VALLEY

(Source: DOGGR, 1998)

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Fig. 4.6-3

Generalized Cross Section of the Southern San Jaquin Valley, C-D

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4.6 GEOLOGY AND SOILS

4.6.2.5 Structural Geology

According to ManageTech (2010), "at the surface, the EHOF presents as a large WNW-ESE trending anticlinal structure, approximately 17 miles long and over 7 miles wide. With increasing depth, the structure subdivides into three distinct anticlines, separated at depth by high angle reverse faults. The anticlines are believed to have formed in a transpressional regime associated with formation of the San Andreas Fault beginning in the Middle Miocene, which began approximately 16 million years ago (Callaway and Rennie, 1991). The anticlines labeled 29R, 31S and Northwest Stevens formed bathymetric highpoints on the deep inland marine surface (seafloor), affecting geometry and lithology of the contemporaneously deposited turbidite sands and muds generated as subaqueous debris flows."

The 29R structure, oriented in a southeasterly direction, is tightly folded, asymmetrical and faulted. The 31S structure, oriented in an eastward direction, is cut by numerous normal faults, four of which reach the surface in the northeast portion of the structure (DOE, 1997). The other faults in the shallow out-bearing beds do not have topographic expression (Maher et at. 1975). According to DOE (1997), "Woodring et al. (1932) describe smaller 'earthquake cracks' along and parallel to the extreme north flank. Their trend is approximately perpendicular to the surface faults. Most noticeable among these cracks or small faults is the Tupman Fault, a fracture cutting post-Tulare fan deposits with strike-slip and vertical displacement in the northeast flank of the EHOF."

According to ManageTech (2010), "the shallow Pliocene and Pleistocene section (of the EHOF) is cut by several shallow listric faults, some of which are sealing; however, these faults do not traverse through the Reef Ridge Shale and do not extend into the deeper Stevens Reservoirs (C&C Reservoirs, 2000).

Surface anticlines such Elk Hills, Kettleman Hills, and Wheeler Ridge are major surface features rising from the valley floor. This deformation and uplift continues today, and is measured at places such as Buena Vista Hills (URS, 2008).

4.6.2.6 Hydrogeology

Groundwater is at least 50 feet below ground surface in the lower units of the Tulare Formation, which are saturated with both water and oil (DOE, 1997).

4.6.2.7 Seismicity

The State of California considers a fault segment historically active if it has generated earthquakes accompanied by surface rupture during historic time, i.e., approximately the last 200 years. A fault that shows evidence of movement within Holocene time (approximately the last 11,000 years) is defined as active. A fault segment is considered potentially active if there is evidence of displacement during Quaternary time or approximately the last 2 million years.

4.6 GEOLOGY AND SOILS

The U.S. Geological Survey's (USGS) earthquake database lists six recorded earthquakes of magnitude 5.0 or greater recorded since 1900 within about 50 kilometers of the EHOF (USGS National Earthquake Information Center, 2010). The largest recorded earthquake in the region occurred in 1952 with an estimated Richter scale magnitude of 7.7 occurred along the San Andreas Fault near Frazier Park. There have been no earthquakes within the 50 kilometer radius of the EHOF with a magnitude greater than 5.0 since 1954 (California Geological Survey, 2010).

The Elk Hills is considered to be located in a seismically active region, but no historically active faults have been identified by the State Geologist of the California Division of Mines and Geology (CDMG) for the Elk Hills area (DOE, 1997). Some minor faults have been observed in the EHOF, but the most important active fault near the Elk Hills is the San Andreas Fault (located 12 miles west, beyond the Temblor Range). The San Andreas Fault is an important fault in the formation of the southern Coast Ranges and adjacent structures on the west side of the San Joaquin Valley (Maher et at., 1975). The other major fault near the EHOF, besides the San Andreas Fault, is the White Wolf Fault (25 miles southeast from the EHOF).

San Andreas Fault

The EHOF is located approximately 12 miles east of the San Andreas Fault. The San Andreas Fault is part of a complex system of faults, isolated segments of the East Pacific Rise, and scraps of tectonic plates lying east of the East Pacific Rise that collectively separate the North American plate from the Pacific plate (Wallace 1990). Relative movement between the Pacific and the North American tectonic plates dominates the regional seismo-tectonic setting (active transform fault). The boundary between the Pacific and North American tectonic plates extends from the Rivera triple junction, south of Baja California, northwards to the Mendocino triple junction. Atwater (1970) and, more recently, Irwin (1990) describe the evolution of the Pacific-North American plate boundary. For much of the length of the plate boundary, and certainly for the Project Site region, the San Andreas Fault functions as a transform fault (tectonic plate boundary) with strike-slip displacement (Wilson 1965).

White Wolf Fault

The White Wolf Fault traverses the southeast end of the San Joaquin Valley from Wheeler Ridge to northeast of Caliente, a distance of approximately 34 miles. It is a high angle reverse fault with a left lateral component.

Kern County experienced a major earthquake on the White Wolf Fault in 1952 (magnitude ~7.3). This earthquake was the largest earthquake in "Southern California" since the Owens Valley earthquake of 1872. The earthquake occurred north of the intersection of the Garlock and San Andreas Faults. The area shaken by this earthquake was large; the main shock was felt over most of California and in parts of western Arizona and western Nevada. The main earthquake and associated aftershocks (at least 20 were of magnitude 5.0 or greater) were responsible for damaging hundreds of buildings in the Kern County area.

4.6 GEOLOGY AND SOILS

The 1952 Kern County earthquake came as a surprise to geologists and seismologists as the White Wolf Fault had not previously been considered a major threat. The White Wolf Fault is traceable for only about 34 miles, much less than the fault length typical thought necessary to produce such a major earthquake (compared to the nearly 250 mile San Andreas Fault, which broke in the magnitude 8 during the Fort Tejon earthquake of 1857).

Other Faults of Potential Interest

Four smaller faults of potential significance to the site are the Wheeler Ridge, Pleito, Premier New Hope, and the Kern Front Faults. The Wheeler Ridge and Pleito Faults are located southeast of the EHOF and trend east-west. The Premier New Hope and the Kern Front Faults are located northeast of the EHOF (north of Bakersfield) and trend north-south (Figure 4.6-4 Faults in the vicinity of EHOF).

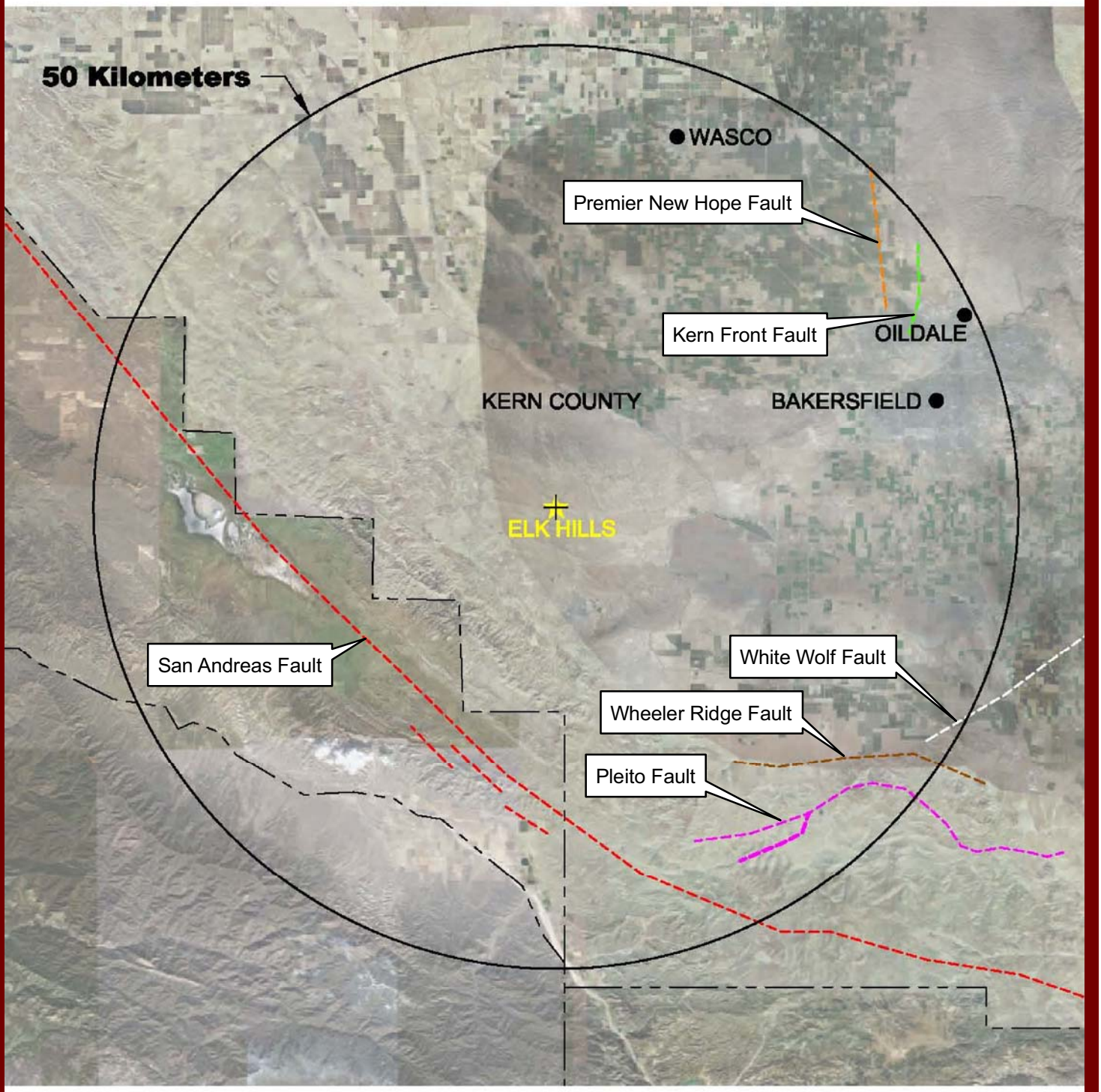

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Fig. 4.6-4

Faults in the Vicinity of EHOF

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Seismic Hazards

There are several potential hazards associated with an area of seismic activity, including fault rupture, ground shaking, landslides, liquefaction, and tsunamis, as described briefly below. Because of the seismicity in the vicinity of the EHOF, it should be expected that an earthquake could cause damage to improperly designed structures.

Fault Rupture

Ground surface displacement, or rupture, caused by an earthquake is a major consideration in the design of construction across active faults. An earthquake can cause significant surface displacement along its surface trace. For example, the 1992 Landers earthquake, located in the Mojave Desert, had offsets of up to 19 feet. It should be noted that, most earthquakes do not result in fault rupture.

The state has mapped known active faults that may cause surface fault rupture in inhabited areas as part of the Alquist-Priolo Earthquake Fault Zoning Act (Figure 4.6-5: Alquist Priolo Special Study Zone and Regional Fault Map). The Project Site is not located in the Alquist-Priolo Special Study zone.

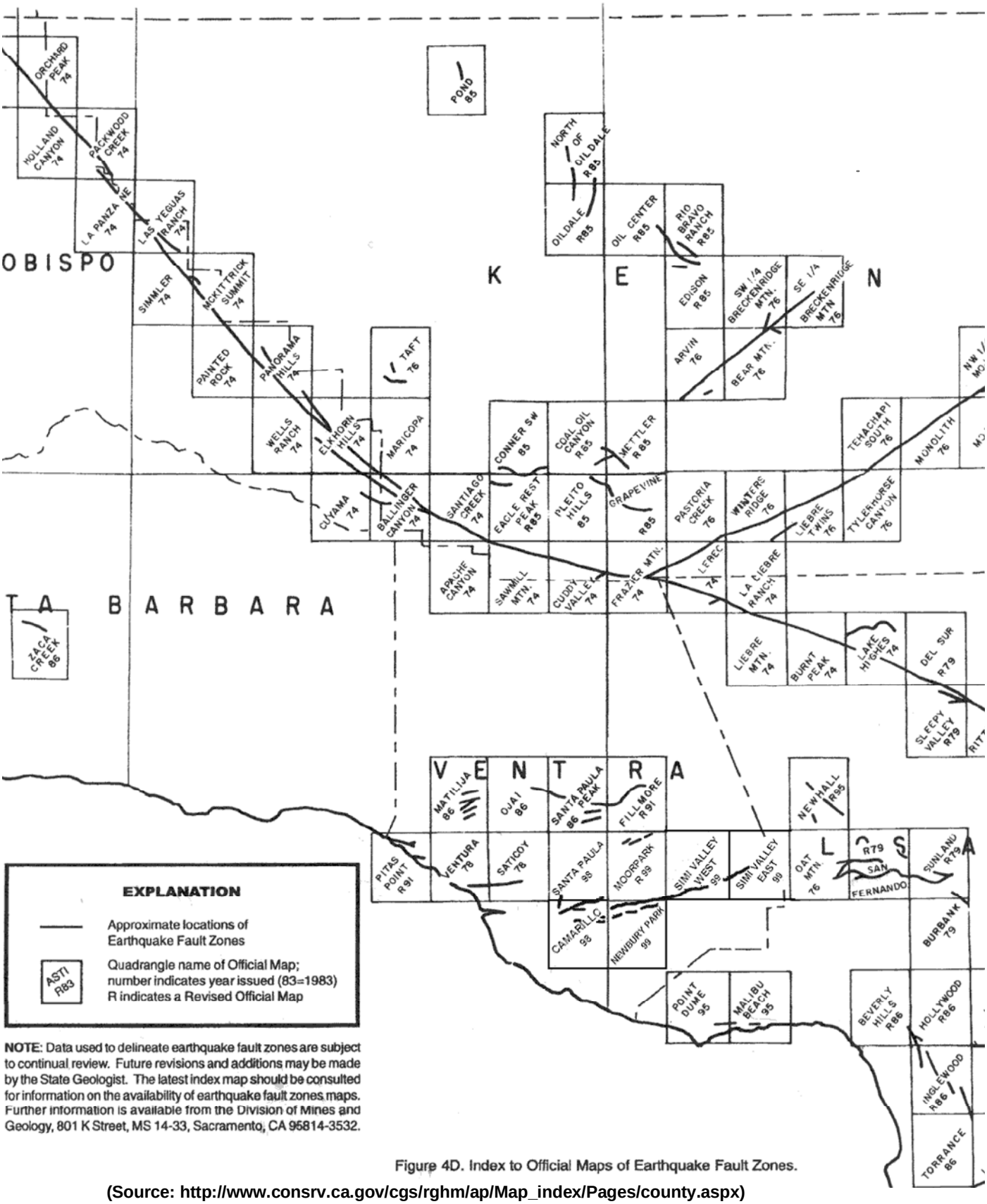

Figure 4D. Index to Official Maps of Earthquake Fault Zones.

(Source: http://www.consrv.ca.gov/cgs/rghm/ap/Map_index/Pages/county.aspx)

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Fig. 4.6-5

Alquest Priolo Special Study Zone and Regional Fault Map

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Maximum Credible Earthquake (MCE)

The CDMG defines the MCE as the maximum earthquake that appears capable of occurring under the presently known geologic framework. In determining the MCE, little regard is given to probability of occurrence except that the likelihood of occurring is great enough to be of concern.

Identifying faults capable of generating earthquakes that may affect the Project Site is the initial step in developing MCE estimates. To accomplish this, faults that lie within 100 kilometers of the Project Site and considered to have been active in Late Quaternary time (the last 500,000 years) were evaluated based on reviews of publications pertaining to geology and tectonics (Jennings, 1975; Hart, 1988; Clark, 1973; Astiz and Allen, 1984; Buwalda, 1954; Ross, 1986; and Wesnousky, 1986). The 100-kilometer radius was selected based on guidelines developed by the CDMG (1975).

As discussed in the seismic history subsection above numerous significant faults and fault zones are located within a 100-kilometer radius of the Project Site. The San Andreas Fault is the nearest known late Quaternary fault, which is located approximately 12 miles west of the Project Site. The White Wolf Fault is the next nearest significant fault; located approximately 25 miles south east of the EHOF.

A preliminary analysis of other late Quaternary faults within 100-kilometers of the Project Site indicates that earthquakes occurring along them will not affect the Project Site to the extent on the previously identified faults. This is because of the smaller size of earthquakes anticipated on other faults in comparison with the faults previously discussed, the distance of other faults from the Project Site in comparison with the distance from previously identified faults, and observations that earthquake ground motions generally attenuate with distance from the causative fault. Therefore, further discussion of potential earthquake sources will be limited to the San Andreas and White Wolf Faults.

Published studies show that the San Andreas Fault is capable of generating earthquakes similar in magnitude (7.9) to the Fort Tejon Earthquake and the White Wolf Fault is considered capable of generating earthquakes up to a magnitude 7.7. The level of ground motions resulting from earthquakes may be estimated from widely accepted, published relationships that relate various ground motion parameters to earthquake magnitude and distance from the causative fault or earthquake epicenter. Estimated bedrock accelerations at the Project Site and their corresponding MCE's are presented in the Table 4.6-1.

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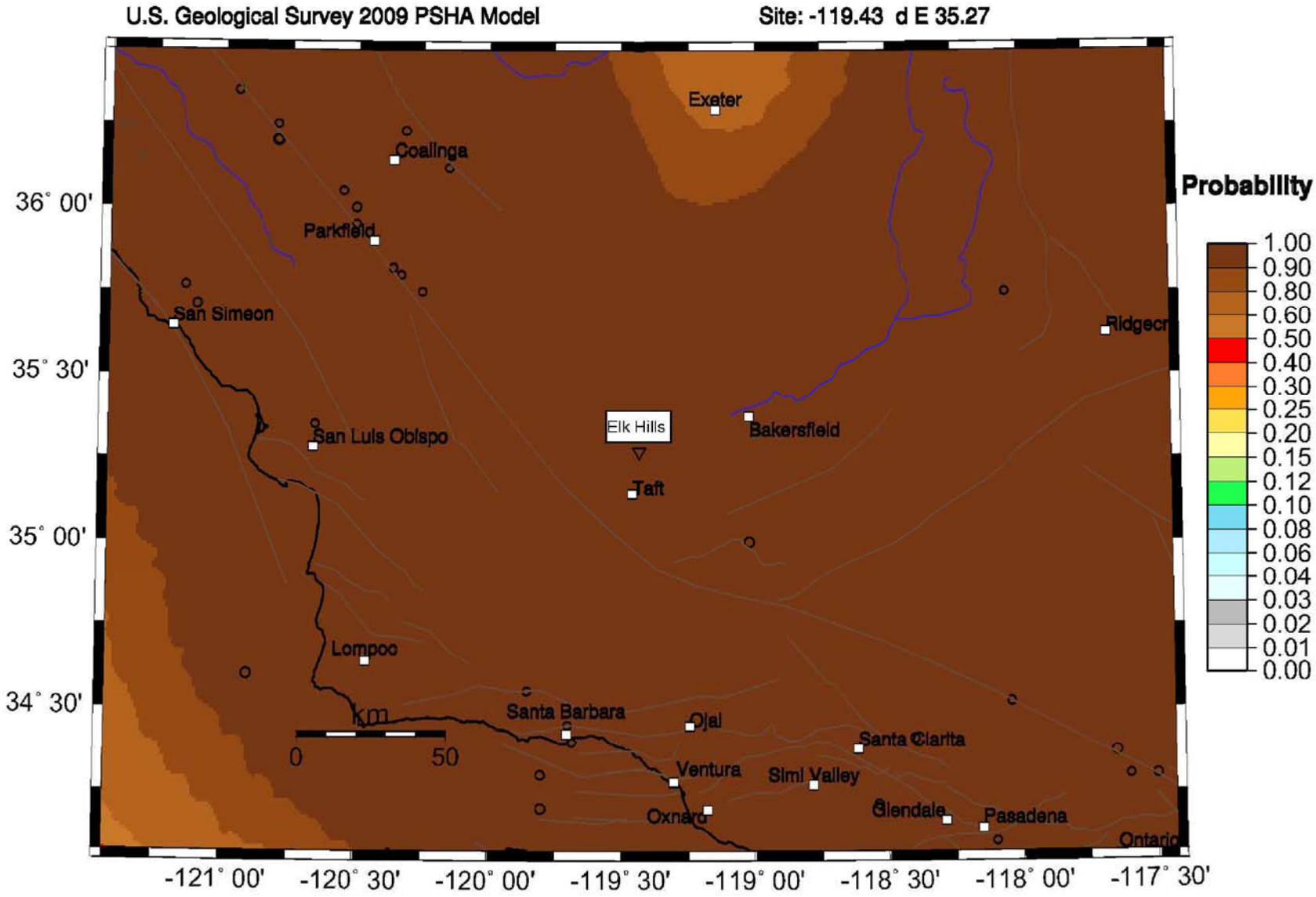
TABLE 4.6-1: SUMMARY OF SIGNIFICANT SEISMIC SOURCES				
Fault Name	**Estimated Distance from Elk Hills Oil Field (miles)**	**Maximum Historical Earthquake (Magnitude [M_W]/Date)**	**Maximum Credible Earthquake (M_W)**	**Mean Ground Peak Acceleration (g)**
San Andreas	12	7.9 / 1857	7.9*	0.24
White Wolf	25	7.3 / 1952	7.7	0.32

Maximum Historical Earthquake Sources:
United States Geological Survey (http://earthquake.usgs.gov/earthquakes/states/historical_state.php)
Southern California Earthquake Data Center (http://www.data.scec.org/chrono_index/quakedex.html)
M_W is the moment magnitude scale used to measure the size of an earthquake in terms of the energy released (http://earthquake.usgs.gov/learn/faq/?faqID=23).
* Reported magnitude is a moment magnitude from Wesnousky (1986)

The anticipated accelerations are 0.24g for the San Andreas Fault and 0.32g for the White Wolf Fault. The MCE on the San Andreas Fault and White Wolf Faults would be 7.9 and 7.7, respectively (Figure 4.6-6: Probability of Earthquake with Magnitude > 5.0 within 150 Years & 50 Kilometers of the Elk Hills).

Earthquake probabilities from USGS OFR 08-1128 PSHA.



Elk Hills: triangle. Fault traces are tan; rivers blue. Epicenters M>=6.0 circles.

(Source: USGS Earthquake Probability Mapping https://geohazards.usgs.gov/eqprob/2009/index.php)

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Fig. 4.6-6

Probability of Earthquake With Magnitude > 5.0 Within 150 Years & 50 Kilometers of the Elk Hills

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Ground Shaking

Ground shaking is the earthquake effect that results in the most damage. Strong shaking from an earthquake can result in landslides and turbidity flows, ground lurching, structural damage, and liquefaction. Strong ground shaking can also set into motion other hazards such as fire, disruption of essential facilities and systems (water, sewer, gas, electricity, transportation, communications, irrigation, and drainage systems), releases of hazardous materials, or floods as a result of dam or water tank failure.

According to the 2007 California Building Code (CBC), the Project Site is located in seismic zone 4 - the region of highest expected ground shaking in the State. In compliance with County engineering requirements for new development, OEHI will be required to address impacts of hazards associated with strong ground shaking by utilizing the 2007 CBC which references the International Building Code Standards of 2006 and the American Society of Civil Engineers (ASCE) Standard 7.05 "Minimum Design Loads for Buildings and other Structures."

Slope Stability

The Project Site has several areas of moderate to relatively steep slopes. By disturbing the land and removing vegetation, construction activities can destabilize soils and slopes and increase the potential for landslides. In addition, roads can concentrate water in the adjacent land, thereby decreasing the stability of soils in these areas.

A landslide is the slipping down or flowing of a mass of land (rock, soil, and debris) from a mountain or hill. Landslide potential is highest in steeply sloped areas with alluvial soils but can also happen on gentle slopes. As would be expected, the potential for landslides is greatest in areas underlain by or adjacent to previous landslides. Landslides could result in danger to Project personnel and Project facilities.

The Project Site is not located within a State of California Seismic Hazard Zone for landslides, which would require an evaluation of the potential for seismically induced landslides. The dense, relatively hard soils in the portion of the Project Site where operating equipment and pipelines will be placed generally supports a very low potential for land sliding or other forms of natural slope instability.

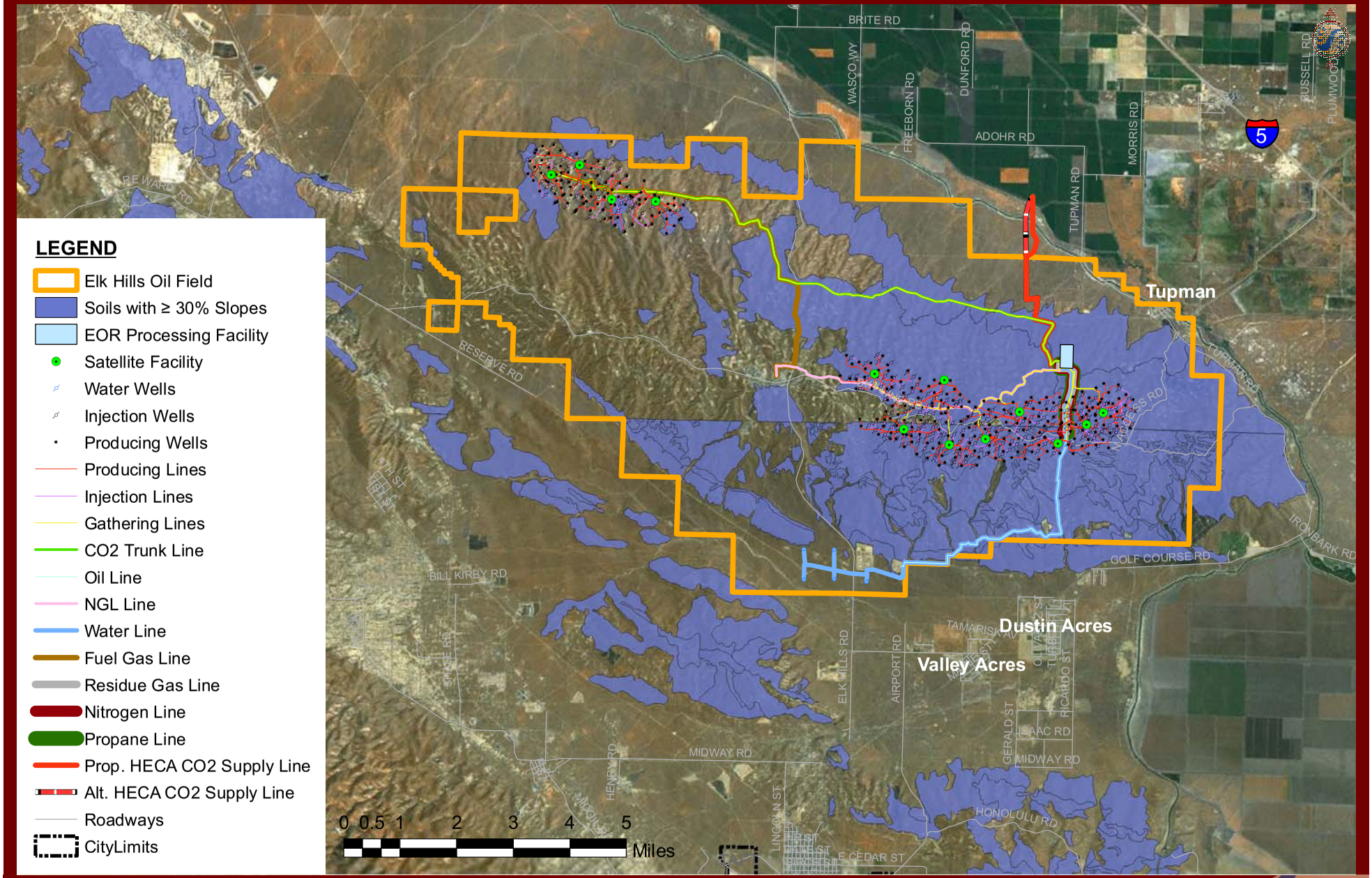

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Fig. 4.6-7

Project Site Steep Slopes

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Groundwater and Liquefaction

Liquefaction is the transformation of surface materials from a solid to near-liquid state when moderate to severe ground shaking causes pore-water pressure to increase, particularly in materials with high porosity, such as sand and silty sand. Liquefaction takes place during some earthquakes when clay free soil deposits behave as viscous fluids. Poorly consolidated, water-saturated fine sands and silts located within 50 feet of the surface are typically considered the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction (CMDG, 1997). Liquefaction is not a significant concern within the Project Site as granitic bedrock, boulders, cobbles, gravels and coarse sands make up the majority of the underlying deposits at groundwater depths. Liquefaction is also not considered problematic where the depth to groundwater is greater than 50 feet. The groundwater depth in the vicinity of the Project Site exceeds 50 feet. The geology, soil types, and the average groundwater level present in the Project Site indicate that the potential for liquefaction is very low. Further phases of geotechnical analysis and evaluation as discussed below under "Impacts and Mitigation Measures" would further reduce damage from liquefaction hazards.

Two potential ground failure types associated with liquefaction are lateral spreading and differential settlement. Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a nearly level surface toward a river channel or other open face. Lateral spreading is not a significant concern within the Project Site.

Another common hazard is differential settlement, as soil compacts and consolidates to varying degrees after ground shaking ceases. Differential settlement occurs when layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills.

Tsunami / Seiche

A tsunami can be caused by an offshore earthquake, volcanic activity, or landslide. Tsunamis can inundate low-lying areas and cause extensive erosion and the deposition of sediment. Seiches are wave oscillations that can form on enclosed bodies of water, such as a lake, that may be caused by an earthquake. The nearest enclosed body of water is Lake Webb within the Buena Vista Aquatic Recreational Area approximately 5 miles southeast of the Project Site. In addition, the Project Site is not located in a low-lying area and is also 90 miles from the edge of the Pacific Ocean. Therefore, the risks of a tsunami or seiche are minimal.

4.6.2.8 Soils Types and Characteristics

There are eleven soil complexes in the Project Site. A soil complex is a map unit made up of two or more kinds of soil in such an intricate pattern or in so small an area that it is not practical to map them separately. Soil survey information for the Project Site is divided between the northwest and southwest parts of the Soil Surveys of Kern County California. Soil Surveys prepared (for both parts in 1982 and 2009 respectively) by the U.S. Department of Agriculture's Soil Conservation Service

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(now the Natural Resources Conservation Service [NRCS]), indicate the presence of the following eleven surface soils on-site: Granoso, Cajon, Elkhills, Torriorthents, Excelsior, Kettleman, Kimberlina, Lokern, Guijarral, Riverwash, and Sodic Haplocambids. Seven of these eleven soils are established by the NRCS as an official soil series and include the following: the Cajon, Elkhills, Excelsior, Guijarral, Kettleman, Kimberlina, and Lokern Series. Cajon soils are extensive, found on recent alluvial fans, fan skirts, fan aprons, inset fans and river terraces throughout south-eastern California (the lower elevations commonly occur in the San Joaquin Valley), southern Nevada, and Arizona. Elkhills soils are of small extent, found mainly on uplifted fan terraces along the south-western edge of the San Joaquin Valley. Excelsior soils are of moderate extent, limited only to alluvial fans and bars or channels on flood plains of the San Joaquin Valley. Guijarral soils are not extensive, limited only to fan remnants on the western edge of the San Joaquin Valley. Kettleman soils are of large extent, found on hills and uplands of the Kettleman Hills, Kreyenhagen Hills, Anticline Ridge, Big Blue Hills, and Pyramid Hills in California. Kimberlina soils are of large extent, found mainly on flood plains and recent alluvial fans in the southern part of the San Joaquin Valley. The Lokern soils are moderately extensive, found mainly on basins in the southern part of the San Joaquin Valley. Figure 4.6-8, Project Soils, illustrates a general map from the Soil Survey of Kern County, California, Southwest Part, of the soil-types located at the Project Site (a general map from the Soil Survey of Kern County, California, Northwestern Part, was not available). A comprehensive discussion of the seven established on-site soils is provided below:

Cajon Loamy Sand, 0 to 2% Slopes; Cajon Sandy Loam 2 to 5% Slopes; Cajon Sandy Loam, Overblown, 0 to 2%. The Cajon series consists of very deep, somewhat excessively drained soils, which demonstrate very slow runoff, rapid permeability, and low shrink-swell potential. Cajon soils form in sandy alluvium from dominantly granitic rocks. Cajon soils are on alluvial fans, fan aprons, fan skirts, inset fans and river terraces. The Cajon Series have slopes of 0 to 15 percent. The hazard of water erosion is slight and the hazard of soil blowing is high. Surface soils are comprised of light gray, light yellowish brown, or pale brown loamy sand. Beneath the surface soils are light gray sand and light grayish brown sandy loam. This soil does not meet hydric criteria.

Elkhills Sandy Loam, 5 to 15%, 15 to 30%, 9 to 50%, and 30 to 60% Slopes; Elkhills Gravelly Sandy Loam, 9 to 15% and 15 to 50% Slopes; Elkhills-Bitterwater-Kettlmen Association, 9 to 15%; Elkhills-Torriorthents, Stratified, Complex, 9 to 15% Slopes; Elkhills-Torriorthents, Stratified, Eroded, Complex, 15 to 50%; and Elkhills-Haplocambids, Thick, Complex, 15 to 30%. The Elkhills series consists of deep, well drained soils, which demonstrate medium or rapid runoff, moderately rapid permeability, and low shrink-swell potential. Elkhills soils form in mixed stratified alluvium from sedimentary and granitic rocks on uplands. The Elkhills Series have slopes of 9 to 50 percent. This soil is susceptible to soil blowing and water erosion. Surface soils are comprised of very pale, pale brown and light yellowish brown sandy loam. Beneath the surface soils are light gray stratified gravelly coarse sand, sand, gravelly sandy loam, loamy sand, loam, and clay loam. Included in these units are small areas of

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Torriorthents sand, Kimberlina gravelly sandy loam, Panoche clay loam, Bitterwater sandy loam, and Kettleman loam. This soil does not meet hydric criteria.

Excelsior Fine Sandy loam, Saline Sodic, 0 to 1% Slopes; Excelsior Sandy Loam, 0 to 2% Slopes; and Excelsior Variant Silt Loam, 0 to 2% Slopes. The Excelsior series consists of deep, well drained soils, which demonstrate negligible to medium runoff, moderate to slow permeability, and low shrink-swell potential. Excelsior soils form in mixed alluvium dominantly from igneous and calcareous sedimentary rocks on old alluvial fans and terraces. The Excelsior series have slopes of 0 to 2 percent. The hazard of water erosion is slight. Surface soils are comprised of light gray and light brownish gray and light gray gravelly sandy loam and gravelly loamy sand. Beneath the surface soils are light brownish gray loamy sand, and light gray sandy loam and silt loam. This soil does not meet hydric criteria.

Guijarral Sandy Loam, 0 to 2% and 2 to 9% Slopes; and Guijarral Gravelly Sandy Loam 2 to 5% Slopes. The Guijarral series consists of deep, well drained soils, which demonstrate very low or low runoff, moderately rapid permeability, and low shrink-swell potential. Guijarral soils form in alluvium derived dominantly from calcareous sedimentary rock on fan remnants. The Guijarral series have slopes of 2 to 15 percent. The hazard of water erosion is slight. Surface soils are comprised of grayish brown sandy loam and light brownish gray silt loam. Beneath the surface soils are light brownish gray loamy sand, and light gray sandy loam and silt loam. This soil does not meet hydric criteria.

Kettleman Loam, 9 to 15% and 15 to 50% Slopes; and Kettleman Gravelly Loam, 15 to 50% Slopes. The Kettleman series consists of moderately deep, well drained soils, which demonstrate medium to high runoff, moderate permeability, and low shrink-swell potential. Kettleman soils form in material weathered from sandstone and shale on hills and uplands. The Kettleman series have slopes of 5 to 50 percent. The hazard of water erosion is moderate to high. Surface soils are comprised of pale brown loam and light brownish gray gravelly loam. Beneath the surface soils are light yellowish brown loam and pale brown gravelly loam. This soil does not meet hydric criteria.

Kimberlina Sandy Loam, 2 to 5% and 5 to 9% Slopes; Kimberlina Sandy Gravelly Loam, 2 to 5% and 5 to 9% Slopes; Kimberlina Fine Sandy Loam, 0 to 2% and 2 to 5% Slopes; Kimberlina Fine Sandy Loam, Saline-Sodic, 0 to 2%; Kimberlina Gravelly Sandy Loam, 0 to 2% and 5 to 9% Slopes; Kimberlina-Granoso Complex, 0 to 5% Slopes, Occasionally Flooded; and Kimberlina-Urban Land Complex, 0 to 5% Slopes. The Kimberlina series consists of deep, well drained soils, which demonstrate negligible to medium runoff, moderately rapid to moderate permeability (saline-sodic phases and soils with sandy clay loam substratums have moderately slow permeability), and low shrink-swell potential. Kimberlina soils form in mixed alluvium derived dominantly from igneous and/or sedimentary rock sources. The Kimberlina Series have slopes of 0 to 9 percent. The hazard of water erosion is negligible to slight. Surface soils are comprised of pale brown and brown fine sandy loam, sandy loam, sandy clay loam, and light gray gravelly sandy loam. Beneath the surface soils are pale brown fine sandy loam,

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loamy sand, silt loam, coarse sandy loam, gravelly sandy loam, and light gray gravelly sandy loam. Included in these units are small areas of Wasco sandy loam, Milham sandy loam, Cajon loamy sand, Panoche clay loam, Kettleman loam, and Excelsior sandy loam. This soil does not meet hydric criteria.

Lokern Clay, Drained, 0 to 2% Slope. The Lokern series consists of deep, somewhat poorly drained soils, which demonstrate slow to very slow runoff, slow permeability, and high shrink-swell potential. Lokern soils form in mixed but predominantly granitic alluvium. The Lokern Series have slopes of 0 to 2 percent. The hazard of water erosion is slight. Surface soils are comprised of dark gray clay and silty clay. Beneath the surface soils are gray and dark gray clay, and light brownish gray fine sandy loam. This soil does not meet hydric criteria.

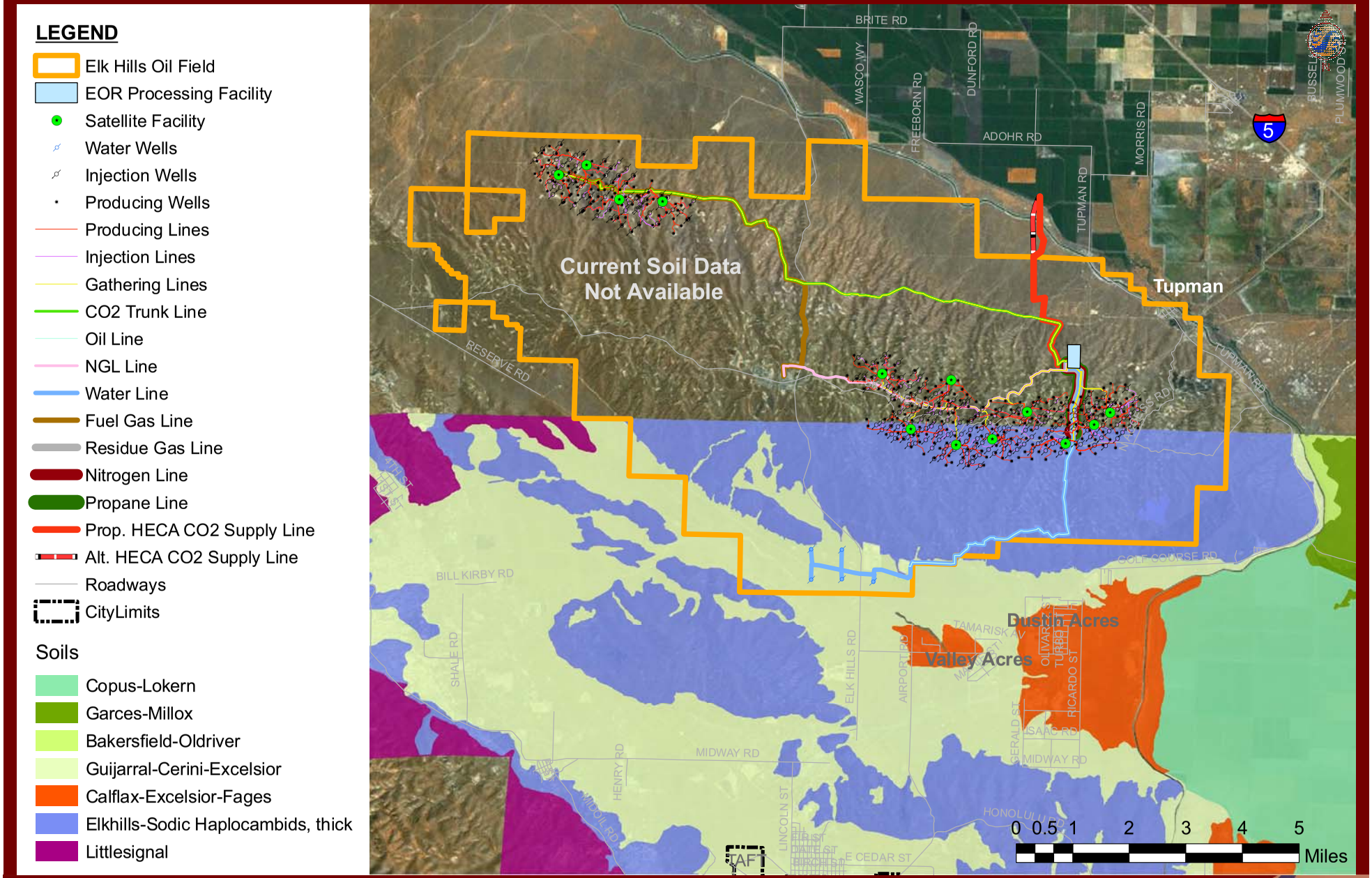

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Fig. 4.6-8

Project Site Soils

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The following table, Table 4.6-2 Project Site Soils Properties, summarizes the characteristics of the soil components identified within the Project Site:

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Granoso Loamy Sand, 2-5% Slopes	southwest part / 121	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Very Low	3-4 (irrigated) 7 (nonirrigated)	e
Granoso Loamy Sand, Loamy Substratum, 0-2% Slopes	southwest part / 122	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Very Low	3-4 (irrigated) 7 (nonirrigated)	e
Granoso Sandy Loam, 0-2% Slopes, Overwash	southwest part / 123	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Slow or Very Slow	3-4 (irrigated) 7 (nonirrigated)	s
Granoso Gravelly Loamy Sand, 0-2% Slopes	southwest part / 124	Somewhat Excessively Drained	Moderately Slow (hydrologic soil group B)	Low	Slow or Very Slow	4 (irrigated) 7 (nonirrigated)	e s
Cajon Loamy Sand, 0-2% Slopes	northwest part / 125	Somewhat Excessively Drained	Rapid (hydrologic soil group B)	Low	Negligible to low runoff	3 (irrigated) 7 (nonirrigated)	s
Cajon Loamy Sand, 2-5% Slopes	northwest part / 126	Somewhat Excessively Drained	Rapid	Low	Negligible to low runoff	2 (irrigated) 7 (nonirrigated)	e
Cajon Sandy Loam, Overblown, 0-2% Slopes	northwest part / 127	Somewhat Excessively Drained	Rapid	Low	Negligible to low runoff	2 (irrigated) 7 (nonirrigated)	w
Elkhills Sandy Loam, 9-50% Slopes, Eroded	northwest part / 146	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e
Elkhills Gravelly Sandy Loam, 9-15% Slopes	northwest part / 147	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e
Elkhills Gravelly Sandy Loam, 15-50% Slopes	northwest part / 148	Well-Drained	Moderately Rapid	Low	Medium to Rapid	7 (nonirrigated)	e
Elkhills-Bitterwater-Kettleman Association, 9-50% Slopes	northwest part / 149	Well-Drained	Moderately Rapid	Low	Medium to Rapid	7 (nonirrigated)	e
Elkhills-Torriorthents, Stratified, Complex, 9-15% Slopes	northwest part / 150	Well-Drained	Moderately Rapid	Low	Medium	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Excelsior Fine Sandy Loam, Saline-Sodic, 0-1% Slopes	southwest part / 151	Well Drained	Slow (hydrologic soil group B)	Low	Negligible to Medium	2 (irrigated) 7 (nonirrigated)	s e
Excelsior Sandy Loam, 0-2% Slopes	southwest part / 152	Well Drained	Slow (hydrologic soil group B)	Low	Negligible to Medium	2 (irrigated) 7 (nonirrigated)	s e
Excelsior Variant Silt Loam, 0-2% Slopes	northwest part / 153	Moderately Well Drained	Moderately Rapid	Low	Slow	2-4 (irrigated) 7 (nonirrigated)	s
Kettleman Loam, 9–15% Slopes	northwest part/ 168	Well Drained	Moderate	Low to Moderate	Medium	7 (nonirrigated)	e
Kettleman Loam, 15-50% Slopes	northwest part / 169	Well Drained	Moderate	Low to Moderate	Medium	7 (nonirrigated)	e
Kettleman Gravelly Loam, 15-50% Slopes	north west / 170	Well Drained	Moderate	Low to Moderate	Rapid	7 (nonirrigated)	e
Kimberlina Sandy Loam, 2-5% Slopes	northwest part / 175	Well Drained	Moderate	Low	Slow	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Sandy Loam, 5-9% Slopes	north west / 176	Well Drained	Moderate	Low	Medium	1-3 (irrigated) 7 (nonirrigated)	e
Kimberlina Gravelly Sandy Loam, 2-5% Slopes	northwest part / 177	Well Drained	Moderate	Low	Slow	7 (nonirrigated)	e
Kimberlina Sandy Gravelly Loam, 5-9% Slopes	northwest part / 178	Well Drained	Moderate	Low	Medium	7 (nonirrigated)	e
Lokern Clay, Drained, 0-2% Slope	northwest part / 187	Poorly Drained	Slow	High	Slow	2-5 (irrigated) 7 (nonirrigated)	s
Guijarral Sandy Loam, 0-2% Slopes	southwest part / 190	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	2-4 (irrigated) 7 (nonirrigated)	e
Guijarral Sandy Loam, 2-9% Slopes	southwest part / 191	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	3-4 (irrigated) 7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Guijarral Gravelly Sandy Loam, 2-5% Slopes	southwest part / 193	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	3-4 (irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, 0-2% Slopes	southwest part / 210	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Very Low	1(irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, 2-5% Slopes	southwest part / 211	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Fine Sandy Loam, Saline-Sodic, 0-2% Slopes	southwest part / 212	Well Drained	Moderate and Moderately Rapid (hydrologic soil group C)	Low	Low	2-6 (irrigated) 7 (nonirrigated)	s
Kimberlina Gravelly Sandy Loam, 0-2% Slopes	southwest part / 214	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Very Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina Gravelly Sandy Loam, 5-9% Slopes	southwest part / 215	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	2-4 (irrigated) 7 (nonirrigated)	e
Kimberlina-Granoso Complex, 0-5% Slopes, Occasionally Flooded	southwest part / 216	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Kimberlina-Urban Land Complex, 0-5% Slopes	southwest part / 217	Well Drained	Moderate and Moderately Rapid (hydrologic soil group B)	Low	Low	1-2 (irrigated) 7 (nonirrigated)	e
Torriorthents, Stratified, Eroded-Elkhills Complex, 9-50% Slopes	northwest part / 232	Well Drained	Moderate to Slow	Low	Rapid	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Riverwash	southwest part / 290	None Noted	None Noted	Low	Low	8 (nonirrigated)	Not Assigned
Sodic Haplocambids, Thick, 9-30% Slopes	southwest part / 441	Well Drained	None Noted (hydrologic soil group C	Low to Moderate	Very High	7 (nonirrigated)	e
Elkhills Sandy Loam, 5-15% Slopes	southwest part / 442	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Low	7 (nonirrigated)	e
Elkhills Sandy Loam, 15-30% Slopes	southwest part / 444	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Sodic Haplocambids, thick-Elkhills Complex, 30-50% Slopes	southwest part / 445	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Elkhills Sandy Loam, 30-60% Slopes	southwest part / 724	Well Drained	Moderately Rapid (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Sodic Haplocambids, thick, 9-15% Slopes	southwest part / 725	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, thick, 15-30% Slopes	southwest part / 726	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, thick, 30-50% Slopes	southwest part / 727	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Torriorthents, Very Thin, 30-50% Slopes	southwest part / 728	Well Drained	None Noted (hydrologic soil group C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Torriorthents, Thin-Torriorthents, Very Thin, Eroded, Complex, 30-60% Slopes	southwest part / 729	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass
Haplocambids, Thick-Elkhills Complex, 9-15% Slopes	southwest part / 730	Well Drained	None Noted (hydrologic soil group B)	Low	Medium	7 (nonirrigated)	e
Haplocambids, thick-Elkhills Complex, 15-30% Slopes	southwest part / 731	Well Drained	None Noted (hydrologic soil group B)	Low	Medium to High	7 (nonirrigated)	e
Elkhills-Haplocambids, Thick, Complex, 30-50% Slopes	southwest part / 732	Well Drained	None Noted (hydrologic soil group B)	Low	Medium to High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Torriorthents, Thin, Complex, 15-30% Slopes	southwest part / 733	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick Torriorthents, Very Thin, Eroded-Elkhills Complex, 15-50% Slopes	southwest part / 734	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	e
Sodic Haplocambids, Thick-Elkhills-Torriorthents, Thin, Complex, 30-60% Slopes	southwest part / 735	Well Drained	None Noted (hydrologic soil group B and C)	Low to Moderate	Very High	7 (nonirrigated)	E

4.6 GEOLOGY AND SOILS

TABLE 4.6-2 PROJECT SITE SOILS PROPERTIES

Soil Type	Soil Survey / Map Unit	Drainage Class	Permeability	Shrink-Swell Potential	Runoff	Land Capability Class	Land Capability Subclass

Land Capability Classes and Subclasses:

Capability class is the broadest category in the land capability classification system. Class codes 1, 2, 3, 4, 5, 6, 7, and 8 are used to represent both irrigated and nonirrigated land capability classes.

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

Class 5 soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.

Class 6 soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.

Class 7 soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.

Class 8 soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

Capability subclass is the second category in the land capability classification system. Class codes e, w, s, and c are used for land capability subclasses.

Subclass e is made up of soils for which the susceptibility to erosion is the dominant problem or hazard affecting their use. Erosion susceptibility and past erosion damage are the major soil factors that affect soils in this subclass.

Subclass w is made up of soils for which excess water is the dominant hazard or limitation affecting their use. Poor soil drainage, wetness, a high water table, and overflow are the factors that affect soils in this subclass.

Subclass s is made up of soils that have soil limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content.

Subclass c is made up of soils for which the climate (the temperature or lack of moisture) is the major hazard or limitation affecting their use.

The subclass represents the dominant limitation that determines the capability class. Within a capability class, where the kinds of limitations are essentially equal, the subclasses have the following priority: e, w, s, and c. Subclasses are not assigned to soils or miscellaneous areas in capability classes 1 and 8.

Sources:

United States Department of Agriculture, Natural Resources Conservation Service (NRCS). 2009. Soil Survey of Kern County, California, southwest part (southwest). Accessible online at http://soils.usda.gov/survey/printed_surveys/

United States Department of Agriculture, Natural Resources Conservation Service (NRCS). 1982. Soil Survey of Kern County, California, northwest part (northwest). Accessible online at http://soils.usda.gov/survey/printed_surveys/

http://www.nrcs.usda.gov/technical/NRI/maps/meta/m6175.html

https://soilseries.sc.egov.usda.gov/osdname.asp

4.6 GEOLOGY AND SOILS

Overall, (with the exception of Lokern Clay which occurs primarily north of Tupman Road and the California Aqueduct) the soils in the Project Site are coarser grained and well drained. These types of soils do not exhibit shrink-swell patterns (i.e., are not considered expansive soils).

4.6.2.9 Soil Erosion

Erosion is the process by which rocks, soil, and other land materials are abraded or worn away from the earth's surface. The erosive potential of soil is determined by a number of soil characteristics, including soil texture and content, surface roughness, vegetation cover, and slope grade and length. Ground-disturbing activities can increase erosion potential by altering natural soil characteristics, removing vegetation, and generally destabilizing an area.

Erosion from water mainly occurs in loose soils on moderate to steep slopes, particularly during high-intensity storm events. To estimate erosion potential of soils unprotected by vegetation during precipitation events, the Natural Resource Conservation Service has considered soil characteristics such as available water capacity, permeability, and associated water table and bedrock depth and categorized soils into four hydrological soil groups (HSGs), Groups A through D. Soils are classified according to the intake of water when they are thoroughly wet and receive precipitation from long-duration storms and they have had a chance to swell (U.S. Department of Agriculture 1977). Group A soils have a high infiltration rate when thoroughly wet, consist mainly of deep and well-drained to excessively drained sands or gravelly sands, and, therefore, have a low runoff potential (less erosive). Group D soils have a very slow infiltration rate and consist chiefly of clays that have high shrink-swell potentials, soils with a permanent high water table, and soils having a clay pan or clay layer at or near the surface and, therefore, have a high runoff potential (more erosive). The soil types found in the Project Site (see table 4.6-2 for the Permeability) include group B and C Soils which has slow to moderately rapid permeability respectively (U.S. Department of Agriculture, Natural Resources Conservation Service 2007).

Erosion may also occur as a result of wind. Wind erosion may be anticipated when dry, fine-grained, non-cohesive soils are exposed to high velocity wind. To estimate the erosion potential of soils by wind, the Natural Resource Conservation Service has considered soil characteristics such as soil texture, organic matter content, rock content, and mineralogy, and has categorized soils into wind erodibility groups (WEGs), Groups 1 to 8. Group 1 soils are dominated by sands (coarse, fine, and very fine) and are extremely erodible, while Group 8 soils are typically stony or gravelly soils and are not as susceptible to wind erosion. The soils types in the Project Site (see Figure 4.6-9: Project Soils Wind Erodibility Group) range from WEG 3 to 5, which are moderately susceptible to wind erosion (U.S. Department of Agriculture, Natural Resources Conservation Service 2007).

Wind Erodibility Groups (WEG) and Index (Exhibit 618-16)

WEG [1,3,4,5,7]	Properties of Soil Surface Layer	Dry Soil Aggregates More Than 0.84 mm (wt.%)	Wind Erodibility Index (I) (tons/ac/yr)
1	Very fine sand, fine sand, sand or coarse sand[2]	1	310
		2	250
		3	220
		5	180
		7	160
2	Loamy very fine sand, loamy fine sand, loamy sand, and loamy coarse sand; very fine sandy loam and silt loam with 5 or less percent clay and 25 or less percent very fine sand; and sapric soil materials (as defined in *Soil Taxonomy*); except Folists.	10	134
3	Very fine sandy loam (but does not meet WEG criterion 2), fine sandy loam, sandy loam, and coarse sandy loam; noncalcareous silt loam that has greater than or equal to 20 to less than 50 percent very fine sand and greater than or equal to 5 to less than 12 percent clay.	25	86
4	Clay, silty clay, noncalcareous clay loam that has more than 35 percent clay and noncalcareous silty clay loam that has more than 35 percent clay; all of these do not have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy (high iron oxide content).	25	86
4L	Calcareous[6] loam, calcareous silt loam, calcareous silt, calcareous sandy clay, calcareous sandy clay loam, calcareous clay loam, and calcareous silty clay loam.	25	86
5	Noncalcareous loam that has less than 20 percent clay; noncalcareous silt loam with greater than or equal to 5 to less than 20 percent clay (but does not meet WEG criterion 3); noncalcareous sandy clay loam; noncalcareous sandy clay; and hemic soil materials (as defined in *Soil Taxonomy*).	40	56
6	Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay; noncalcareous clay loam and noncalcareous silty clay loam that have less than or equal to 35 percent clay; silt loam that has parasesquic, ferritic, or kaolinitic mineralogy (high iron oxide content).	45	48
7	Noncalcareous silt; noncalcareous silty clay, noncalcareous silty clay loam, and noncalcareous clay that have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy (high content of iron oxide) and are Oxisols or Ultisols; and fibric soil materials (as defined in *Soil Taxonomy*).	50	38
8	Soils not susceptible to wind erosion due to rock and pararock fragments at the surface and/or wetness; and Folists.	--	0

The following footnotes are applied in the order listed:

[1] For all WEGs except 1 and 2 (sands and loamy sand textures), if percent rock and pararock fragments (>2mm) by volume is 15-35, reduce "I" value by one group with more favorable rating. If percent rock and pararock fragments by volume is 35-60, reduce "I" value by two favorable groups except for sands and loamy sand textures which are reduced by one group with more favorable rating. If percent rock and pararock fragments is greater than 60, use "I" value of 0 for all textures except sands and loamy sand textures which are reduced by three groups with more favorable ratings. An example of more favorable "I" rating is next lower number: "I" factor of 160 to "I" factor of 134 or "I" factor of 86 to "I" factor of 56. The index values should correspond exactly to their wind erodibility group (e.g., "I" factor of 56 = WEG 5).

[2] The "I" values for WEG 1 vary from 160 for coarse sands to 310 for very fine sands. Use an "I" of 220 as an average figure.

[3] All material that meets criterion 3 in the required characteristics for andic soil properties as defined in the *Keys to Soil Taxonomy*, 11th edition. Such material is placed in WEG 2 regardless of the texture class of the fine-earth fraction.

[4] All material that meets criterion 2, but not criterion 3, in the required characteristics for andic soil properties as defined in the *Keys to Soil Taxonomy*, 11th edition. Such material is placed in WEG 6, regardless of the texture class of the fine-earth fraction. The only exception to this is for Cryic Spodosols which have a medial substitute class and a MAAT < 4 degrees C.; these soils are placed in WEG 2.

[5] For surface layers or horizons that do not meet the required characteristics for andic soil properties but do meet Vitrandic, Vitritorrandic, Vitrixerandic, and Ustivitrandic subgroup criteria (thickness criterion excluded) move one wind erodibility group (WEG) with a less favorable rating.

[6] Calcareous is a strongly or violently effervescent reaction (class) of the fine-earth fraction to cold dilute (1N) HCL; a paper "Computing the Wind Erodible Fraction of Soils" by D. W. Fryear et.al (1994) in the Journal of Soil and Water Conservation 49 (2) 183-188 raises a yet unresolved question regarding the effect of carbonates on wind erosion.

[7] For mineral soils with thin "O" horizons, the WEG is based on the first mineral horizon.

(Source: http://soils.usda.gov/technical/handbook/contents/part618ex.html#ex16)

Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

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Fig. 4.6-9

Project Soils Wind Erodibility Group

OEHI CO2 EOR Project - Supplemental Environmental Information

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4.6.2.10 Expansive Soils

Expansive soils are those whose volume expands and contracts in a "shrink-swell" pattern. Shrink-swell potential is generally related to the presence of highly plastic clayey soils found near the ground surface. Fine-grain clay sediments expand and contract as the result of changing moisture levels. As the density of soils changes, overlying materials can shift, causing structural damage to foundations and other above ground facilities.

Because the Project Site is predominantly composed of sandy loam with very little to no fine-grained soil, there is a low probability of impact due to shrink-swell soil behavior (see Table 4.6-2).

4.6.2.11 Settlement

Settlement, or the sinking, depression, or descending of soils, can result from the placement of a heavy load, such as building, foundation, or fill material, on the underlying sediments. Settlement can disrupt the stability of aboveground structures and destabilize slopes.

Seismically induced settlement potential for this site is considered to be low to moderate. The site materials that might have the most likely potential for seismically induced settlement potential are the alluvial materials located within the major site drainages.

4.6.2.12 Soil Radon Hazards

Kern County is located in an EPA Radon Zone 2, having a moderate potential for elevated indoor radon levels. Radon is a radioactive gas resulting from the natural decay of uranium that is found in nearly all soils. It typically moves up through the ground via soil gases or water. Once airborne, radon has the potential to accumulate inside homes, posing a significant health risk to occupants.

Sections 307 and 309 of the Indoor Radon Abatement Act of 1988 (IRAA) directed the U.S. Environmental Protection Agency (EPA) to list and identify areas of the U.S. with the potential for elevated indoor radon levels. The EPA's Map of Radon Zones assigns each county in the U.S. to one of three zones based on radon potential. For a more detailed analysis of the risks associated with Radon, see Hazards and Hazardous Materials Section 4.7.

4.6.3 Regulatory Setting

4.6.3.1 Local

Kern County General Plan

The policies, goals, and implementation measures in the Kern County General Plan for geology and soils applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and are not specific to development such as the Project. These measures are not listed below, but, as stated in

4.6 GEOLOGY AND SOILS

Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

1.3 Physical and Environmental Constraints

Policies

Policy 1. Kern County will ensure that new developments will not be sited on land that is physically or environmentally constrained (Map Code 2.1 [Seismic Hazard], Map Code 2.2 [Landslide], Map Code 2.3 [Shallow Groundwater], Map Code 2.5 [Flood Hazard], Map Codes from 2.6 – 2.9, Map Code 2.10 [Nearby Waste Facility], and Map Code 2.11 [Burn Dump Hazard]) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.

Policy 6. Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby, minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.

Policy 7. Ensure effective slope stability, wastewater drainage, and sewage treatments in areas with steep slopes are adequate for development.

1.9 Resource (Land Use, Open Space, and Conservation Element)

Policies

Policy 20. Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreational, and other beneficial uses while acknowledging existing land use patterns.

4.3 Seismically Induced Surface Rupture, Ground Shaking, and Ground Failure (Safety Element)

Policies

Policy 1. The County shall require development for human occupancy to be placed in a location away from an active earthquake fault in order to minimize safety concerns.

4.5 Landslides, Subsidence, Seiche, and Liquefaction (Safety Element)

Policies

Policy 1. Determine the liquefaction potential at sites in areas of shallow groundwater (Map Code 2.3) prior to discretionary development and determine specific mitigation to be incorporated into the foundation design, as necessary, to prevent or reduce damage from liquefaction in an earthquake.

Policy 2. Route major lifeline installations around potential areas of liquefaction or otherwise protect them against significant damage from liquefaction in an earthquake.

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Policy 3. Reduce potential for exposure of residential, commercial, and industrial development to hazards of landslide, land subsidence, liquefaction, and erosion.

Kern County Building Code

All construction in Kern County is required to conform to the Kern County Building Code (Chapter 17.08, Building Code, of the Kern County Code of Regulations). The Kern County Building Code adopts the 2007 California Building Standards Code that imposes substantially the same requirements as are contained in the International Building Code of 2006, with particular minor modifications and amendments for conditions specific to Kern County. The requirements for seismic protection are the same as those of the California Building Standards.

Kern County Grading Ordinance

The purpose of the Kern County Grading Ordinance is to safeguard life, limb, property and the public welfare by regulating grading on private property. Although the proposed Project will involve grading, the Kern County Grading Ordinance exempts the requirement to obtain a grading permit for accepted oil field activities related to oil field drilling, such as oil field roads, drilling pads, and sumps used for drilling mud and grading required for the setting of production equipment. Access roads with cut and fill slopes less than two feet in height are also exempt.

Permits Required and Schedule

Permits potentially required for matters dealing with geologic resources and hazards for the proposed Project and the schedule to obtain each of these permits are provided in Table 4.6-3: Permits required and permit schedule. Information required to obtain each permit is also included.

TABLE 4.6-3: PERMITS REQUIRED AND PERMIT SCHEDULE

Permit/Required Information	Schedule
• Building Permit including Seismic Design Criteria: • 30 day review and approval process • Requires structural, civil, electrical and mechanical plans • Geotechnical/Geologic report • Identify geologic hazards and potentially conduct a seismic risk analysis • Architectural plans	• Submit application 30 days prior to start of construction.
• Grading/Drainage/Erosion Control Permit: • Engineered Grading Plan • Topographic Plan • Drainage controls • Surface Hydrology Report • Geotechnical/Geological Hazard Evaluation • Identify material source or disposal location and haul route • Erosion and Dust Control Plan • Traffic Control Plan	• Submit application 30 days prior to start of construction activities.

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4.6.3.2 State

California Building Code (CBC)

The CBC contains requirements related to excavation, grading, and construction. According to the CBC, a grading permit is required if more than 50 cubic yards of soil is moved. The CBC specifies the acceptable design criteria for construction of facilities with respect to seismic design and load-bearing capacity.

Applicable codes and industry standards related to various geologic and soil features are identified in the ASCE Standard 7.05 Minimum Design Loads for Buildings and other Structures. The Project Site is not located within a State of California Seismic Hazard Zone for landslides.

Alquist-Priolo Earthquake Fault Zoning Act of 1972

In response to the 1971 San Fernando Earthquake, which damaged numerous homes, commercial buildings, and other structures, California passed the Alquist-Priolo Earthquake Fault Zoning Act. The goal of the act is to avoid or reduce damage to structures like that caused by the San Fernando Earthquake by preventing the construction of buildings on active faults.

In accordance with the law, the California Geological Survey maps active faults and the surrounding earthquake fault zones for all affected areas. Any project that involves the construction of buildings or structures for human occupancy, such as residential housing, is subject to review under this law. Structures for human occupancy must be constructed at least 50 feet from any active fault. As described above, the Project is not located in an Alquist-Priolo Special Study zone and it will not involve the construction of buildings or structures for human occupancy within 1.5 miles of an active fault.

Seismic Hazards Mapping Act of 1990

The California Seismic Hazards Mapping Act is designed to protect the public from the effects of strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. The Act requires site-specific geotechnical investigations to identify the hazard and formulation of mitigation measures before the permitting of most developments designed for human occupancy.

Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, (California Geological Survey 1997) constitutes the guidelines for evaluating seismic hazards other than surface fault rupture, and for recommending mitigation measures as required by Public Resources Code Section 2695(a).

4.6 GEOLOGY AND SOILS

4.6.4 Impacts and Mitigation Measures

4.6.4.1 Methodology

Potential impacts on the environment, human life, property and geologic resources were evaluated on the basis of the existing conditions of the Project Site and the Project's potential to result in soil erosion and to be subject to geologic harzards.

4.6.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on agricultural resources if it would:

Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving;

Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;

Strong seismic ground shaking; or

Seismic-related ground failure, including liquefaction.

Landslides;

Result in substantial soil erosion or loss of topsoil;

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 off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

Be located on expansive soils, as defined in section 1802.3.2 of the International Building Code (IBC) (2006) creating substantial risk to life or property; or

Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems, where sewers are not available for the disposal of wastewater.

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4.6.4.3 Project Impacts

IMPACT GEO-1 Expose People or Structures to Substantial Adverse Effects Involving the Rupture of a Known Earthquake Fault

The Project Site is located in an area classified as a low seismic activity zone under the Alquist-Priolo Act. The proposed Project is not in the Alquist-Priolo Earthquake Special Study zone. The Project Site is located in a designated Seismic Hazard Zone. However, the Project Site's proximity to active faults in the region that could generate significant earthquakes could subject the Project Site to a potential ground shaking hazard.

Additionally, the Project Site is located within Seismic Zone 4, as set forth in the adopted IBC/CBC. All structures associated with the proposed Project would be required to meet the seismic design standards for Seismic Zone 4. As part of compliance with the locally adopted sections of the IBC/CBC, proposed Project development would be designed to withstand expected seismic forces that could sustain both horizontal and vertical oscillations and net displacement of earth material along faults. The IBC/CBC may require certain engineering methods and flexible utility connections to accommodate warping and distributive deformation associated with faulting, or other methods as deemed appropriate. Compliance with IBC/CBC standards would ensure that impacts associated with ground shaking would be less than significant.

There is a potential for strong seismic ground shaking to affect the Project Site in the event of a large magnitude earthquake occurring on fault segments associated with the San Andreas or White Wolf Fault zones. Seismic hazards and potential adverse foundation conditions will be minimized by conformance with the recommended seismic design criteria of the IBC/CBC Seismic Zone 4 requirements. Furthermore, the Project Site will not be located within the projected trace of any active or potentially active faults. As such, potential impacts as a result of ground shaking are expected to be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.6 GEOLOGY AND SOILS

IMPACT GEO-2 Expose People or Structures to Substantial Adverse Effects Involving Strong Seismic Ground Shaking

Strong seismic ground shaking could occur at the site resulting in damage to structures and, potentially, to individuals in or near proposed Project infrastructure during an earthquake. As described above, the Project Site is located in a seismically active area, including two active faults adjacent to the Project Site. OEHI shall design all associated infrastructure to meet applicable design requirements which will minimize potential impacts as a result of strong ground shaking. All proposed Project facilities shall be designed to be in accordance with applicable CBC seismic design standards, Kern County Building Code, Chapter 17, and as recommended by a California registered professional engineer in the site-specific geotechnical review. As such, potential impacts as a result of ground shaking are expected to be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-3 Expose People or Structures to Substantial Adverse Effects Involving Seismic-Related Ground Failure, Including Liquefaction

The alluvial deposits within the majority of the site are relatively dense and coarse-grained, and groundwater in the Project Site is relatively deep (over 50 feet deep); therefore, the potential for liquefaction is limited. Therefore, this impact is less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-4 Expose People or Structures to Substantial Adverse Effects Involving Landslides

There is a risk of landslides on steep slopes due to seismic events, particularly after slopes have been disturbed by construction activities. While it is unlikely that a large landslide would occur, there is potential for local landslides, debris flows, or rock fall that could affect individuals on the Project Site. This is considered a potentially significant impact and mitigation would be required.

4.6 GEOLOGY AND SOILS

Mitigation Measures

Mitigation Measure GEO-1 The applicant shall design cut/fill slopes for an adequate factor of safety, considering material type and compaction, identified during the site-specific geotechnical study. The slope of cut surfaces shall be no steeper than 2:1 (horizontal to vertical units), unless the applicant furnishes a soils engineering or an engineering geology report, or both, stating that the site has been investigated and giving an opinion that a cut at a steeper slope will be stable and will not create a hazard to public or private property.

Mitigation Measure GEO-2 The applicant shall cut slopes with a slope ratio compatible with the known geologic conditions and/or shall stabilize the slope by using stabilizing methods such as a buttressed fill.

Mitigation Measure GEO-3 Project facilities where slopes exceed 4:1 shall require specific consultation and approval by the Kern County Engineering and Survey Services Department.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-5 Result in Substantial Soil Erosion or Loss of Topsoil

Preparation of the ground surface at the Project Site will involve grading, leveling, and filling. Potential soil erosion impacts will be reduced by conducting such operations in accordance with the Kern County Grading Ordinance. To further minimize potential soil erosion, slopes will be provided with temporary drainage and erosion control measures during construction until permanent measures are installed.

Soils in the Project Site are categorized as HSG B and C, have a moderate infiltration rate when thoroughly wet, consist mainly of deep and well-drained to excessively drained sands or gravelly sands and, therefore, have a relatively slow to moderate runoff potential. Soils in the Project Site also are categorized as WEG 3 to 5, which are moderately susceptible to wind erosion. Wind may erode soils from graded surfaces and soils stockpiled for use during restoration.

The proposed Project area topsoil is poor to fair, which is reflected by the use of the Project Site and surrounding area as rangeland, natural habitat, and other non-irrigated agricultural uses. Nevertheless, the topsoil layer contains native seed and organic materials that will facilitate restoration of areas of temporary disturbance and should be salvaged to the extent feasible.

This impact is considered potentially significant, and mitigation would be required.

Mitigation Measures

Mitigation Measure GEO-4 OEHI shall limit grading to the minimum area necessary for construction.

4.6 GEOLOGY AND SOILS

Mitigation Measure GEO-5 As required by Kern County, OEHI shall prepare an Erosion Control Plan to mitigate potential loss of soil and erosion. The plan will be submitted for review and approval by the Kern County Engineering and Survey Services Department. The plan will include the following:

Best management practices (BMPs) will be implemented to minimize soil erosion.

Provisions to maintain flow in washes, should it occur, throughout construction.

Sediment collection facilities as may be required by the Kern County Engineering and Survey Services Department.

Mitigation Measure GEO-6 OEHI shall water disturbed areas during construction to reduce dust and minimize loss of soils from wind (see Section 4.3, "Air Quality," for additional discussion).

Mitigation Measure GEO-7 In all areas disturbed by the Project, OEHI shall salvage topsoil and reuse during restoration.

Mitigation Measure GEO-8 OEHI shall use existing roads to the greatest extent feasible to minimize increased erosion.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-6 Located on Soil that is Unstable

The initial geological evaluation did not identify significant geological hazards, with the exception of impacts from fault rupture or ground shaking. As discussed above, the proposed Project is located on soils that are not likely to become unstable. However, construction activities on steep slopes (greater than 30 percent) have the potential to cause soil to become unstable. This is a potentially significant impact. Implementation of mitigation measure GEO-1 through GEO-3 will reduce the impact to less than significant.

Mitigation Measures

Implement Mitigation Measures GEO-1 through GEO-3.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GEO-7 Located on Expansive Soils

As described in the "Soils" sub section, the soil complexes found in the Project Site have only a low to moderate shrink-swell potential and do not include expansive soils. As such, this impact is considered less than significant.

4.6 GEOLOGY AND SOILS

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.6.5 Cumulative Impacts

The proposed Project will be constructed to the requirements of the CBC Seismic Zone 4. Site-specific geotechnical investigations will be performed prior to final design and construction. Since construction and operation of the proposed Project will not cause significant impacts to geological resources, it will not cause cumulative impacts to geological resources.

Geologic hazards such as seismicity, landslides, and erosion and other geologic and soil hazards at the proposed Project Site would be mitigated by implementing standard design measures, which would reduce impacts to less than significant levels.

Mitigation Measures

Implement Mitigation Measures GEO-1 through GEO-8.

Level of Significance after Construction

The proposed Project would have less than significant cumulative impacts.

4.7 HAZARDS AND HAZARDOUS MATERIALS

4.7 Hazards and Hazardous Materials

4.7.1 Introduction

The CO2 EOR Project (Project) includes activities that will involve procedures, chemicals, and materials which pose some risk of fires, spills, gaseous releases, or other health and environmental hazards within the EHOF. These risks are primarily generated during production, transportation, storage, treatment, handling or disposal of potentially toxic hazardous materials associated with construction, operation, and maintenance of the Project.

This section describes the potential hazards, other than geologic hazards, associated with the Project. The potential safety issues associated with airports and flight paths, naturally occurring radioactive materials (NORM), CO2 releases, hydrogen sulfide (H2S), radon gas, proximity to navigable waterways, and hazardous materials, are analyzed in this section.

4.7.2 Environmental Setting

Wildfires

Kern County categorizes the areas of the County into three fire hazard levels: moderate, high, and very high. Based on the map of Hazardous Fire Areas in the Kern County General Plan Safety Element, the fire hazard rating for the proposed Project area ranges from high to very high (Kern County 2004a). The Kern County Fire Department (KCFD) would be the first responder to a wildfire within the Project Site, including helicopter support when needed. As described in Section 4.13, "Public Services," within the KCFD network, the Taft Station would likely be the first responder. The proposed Project does not fall within the mutual aid areas of the U.S. Forest Services (USFS) or their jurisdiction within Los Angeles or Ventura Counties; however, these agencies would likely provide air support from the USFS.

The proposed Project will not be placing residential dwellings adjacent to wildlands and will not increase the size of the wildland-urban interface (WUI), defined as the area where structures and other human development meet or intermingle with undeveloped wildland or natural open space. The Project Site is a currently operating oil field and the amount WUI is minimal.

Hazardous Materials and Waste

Hazardous material can be defined as any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a hazard to human health or the environment. Hazardous materials can be categorized as flammable and combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. They can be highly reactive and cause irritation to skin and eyes. The term "hazardous substances" encompasses chemicals regulated by both the U.S. Department of Transportation (DOT) hazardous materials regulations and the U.S. Environmental Protection Agency (EPA) hazardous waste regulations. Inert gases including

4.7 HAZARDS AND HAZARDOUS MATERIALS

refrigerated liquids, such as CO2, are also regulated by the DOT. Hazardous wastes require special handling and disposal because of their potential to damage public health and the environment.

Past and current uses of the Project Site are primarily oil production. Agricultural and grazing occurs to the north and down-slope of the Project Site and have minimal impacts on the Project Site. On occasion, herbicides are laid down adjacent to structures on EHOF to reduce the amount of weeds. It is anticipated that herbicides will be applied to control weeds near the CO2 EOR Processing Facility located in Section 27S.

Airports in Proximity

The proposed Project is not located in any area regulated by the Kern County Airport Land Use Compatibility Plan. The Elk Hills – Buttonwillow Airport is located approximately four miles north of the Project Site. To evaluate private airport obstructions for this Project, regulatory thresholds of significance were chosen from the *CFR*, *Title 14*, *Chapter 1*, *Part 77*, *Subpart C*, which sets standards for determining obstructions. These standards apply to existing and proposed manmade objects, objects of natural growth, and terrain.

Naturally Occurring Radioactive Materials (NORM)

NORMs are comprised of radioactive elements found in the environment, such as uranium, thorium and potassium and any of their decay products, such as radium and radon (see below). They are present in very low concentrations in the Earth's crust and are brought to the surface through activities such as oil and gas exploration.

The hazards associated with NORM are inhalation and ingestion routes of entry as well as external exposure where there has been a significant accumulation of scales. Respirators may be necessary in dry processes, where NORM scales and dust become air borne and have a significant chance to enter the body.

The radioactive isotopes found in NORM are radium-226, radium-228 and radon-222, and also daughter products from these radionuclides. If present inside the body, these elements can migrate to the bone tissue and concentrate. The exposure can cause bone cancers and other bone abnormalities. Concentrations of radium, radon, and other daughter products can build over time if there are several years of excessive exposure.

Radium radionuclide's emit alpha and beta particles as well as gamma rays. The radiation emitted from a radium-226 atom is 96 percent alpha particles and 4 percent gamma rays. The alpha particle is the most dangerous particle associated with NORM. Alpha particles are helium nuclei. Alpha particles can travel short distances in air, approximately 2 to 3 centimeters, but cannot penetrate through a dead layer of skin on the human body. If radium atoms are not expelled from the body, they concentrate in areas where chloride ions are prevalent, such as bone tissue. The half-

4.7 HAZARDS AND HAZARDOUS MATERIALS

life for radium 226 is approximately 1,601 years, and will remain in the body for the lifetime of the human.

Beta particles are high energy electrons or positrons. They are in the middle of the scale in terms of ionizing potential and penetration power, being stopped by a few millimeters of aluminum foil. The radiation is a small portion of the total emitted during radium-226 decay. Radium-228 emits 100 percent beta particles, which are also a concern for human health through inhalation and ingestion. Beta particles are electrons or positrons and can travel farther than alpha particles in air. The half-life of radium-228 is approximately 5.75 years.

The gamma rays emitted from radium-226, accounting for 4 percent of the radiation, are harmful to humans with sufficient exposure. Gammas rays are highly penetrating and some can pass through metals, so Geiger-Müller (Geiger) counters with a scintillation probe are used to measure gamma ray exposures when monitoring for NORM.

NORM is not federally regulated in the United States. The U.S. Nuclear Regulatory Commission (NRC) has jurisdiction over a relatively narrow spectrum of radioactive material, and the Federal EPA has jurisdiction over NORM and has not developed NORM regulations to date. Therefore, the responsibility falls upon the State of California and OEHI has implemented a NORM monitoring program to provide guidelines for protecting members of the public, company and contractor employees from possible effects of NORM.

OEHI currently has a NORM Guideline in place at EHOF. Radiation survey instruments are used to monitor oil and produced water tanks, tank battery process equipment, equipment at water hauling facilities, pig traps, pits and ponds, tubular goods, ground surfaces in immediate vicinity of present or past scale/sludge removal, and scrape yard materials, warehouses and pipeyards. The action level for sale or disposal of equipment and/or management of miscellaneous materials is 50 micro-rems **per hour (µr/hr) including background.**

Radon Gas Hazards

Radon (Rn) is a naturally occurring inert, colorless, odorless, tasteless, radioactive noble gas derived from the decay of radium. Radium occurs in geologic units including granite, shale, phosphate, or pitchblende that contain minor amounts of uranium and was commercially used in luminescent products. Radium decays into reactive, radioactive daughter particles that attach themselves to other particles such as dust and are a lung cancer risk. Radon can move through permeable rocks and soils and can eventually seep into buildings. The movement of radon into buildings is controlled largely by the soil permeability under a foundation and preventing access to the interior of buildings through openings in the foundation.

According to the USEPA, Kern County is located in Radon Zone 2. Zone 2 counties have a predicted average indoor radon screening between 2 and 4 picocuries per liter (pCi/L). This indicates that

4.7 HAZARDS AND HAZARDOUS MATERIALS

there is a moderate potential for elevated indoor radon levels (USEPA 2007) if these structures are to be built for the proposed Project.

Carbon Dioxide (CO2)

Some CO2 used as part of the proposed Project will be handled close to or above its critical pressure (73.82 bar) where many of its properties are similar to that of a liquid. In this state it is often referred to as a dense phase fluid. If CO2 is above both its critical temperature (31.04°C) and critical pressure it is referred to as supercritical. Most of the additional hazards associated with the handling of dense phase or supercritical CO2 arise when pressure suddenly falls or is lost completely.

In the event of a major pressure loss, e.g. a pipe rupture or containment failure, the depressurization will result in an increase in the volume occupied by the CO2 of several hundred fold as the escaping fluid undergoes a rapid expansion (and phase change) as a portion essentially "boils" and becomes a gas while the remainder forms solid particles. This rapid, violent expansion causes the temperature of escaping CO2 to fall very rapidly, frequently below -80°C; and particles of solid CO2 formed (dry ice) can be expelled at high velocities. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

Carbon dioxide is classified as an asphyxiant that inhibits cellular respiration and uptake of oxygen, causing biochemical suffocation. Table 4.7-1 lists the permissible exposure limit (PEL) concentrations of CO2 as established by the US Occupational Safety and Health Administration (OSHA). These concentrations are stated in terms of Time Weighted Average (TWA) and Short-Term Exposure Limit (STEL). A TWA is the average exposure over a specified period of time, usually eight hours; while the STEL represents the average concentration to which workers can be exposed continuously for a 15 minute period of time without suffering from irritation, chronic or irreversible tissue damage, or narcosis of sufficient degree to increase the likelihood of accidental injury, impaired judgment, or materially reduction in work efficiency.

TABLE 4.7-1: CO2 EXPOSURE LIMITS

Exposure Limit for Carbon Dioxide	Concentration	Exposure Period
OSHA TWA	5,000 ppm	Maximum concentration to which a healthy individual can be exposed over an eight-hour work period and expressed in parts per million.
OSHA STEL	30,000 ppm	The maximum level to which a healthy individual can be exposed to a chemical for 15 minutes and escape without suffering irreversible health effects or impairing symptoms and expressed in parts per million.

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Hydrogen Sulfide (H2S)

Hydrogen sulfide (H2S, CAS # 7783-06-4) is an extremely hazardous, toxic compound. It is a colorless, flammable gas that can be identified in relatively low concentrations by a characteristic rotten egg odor. The gas occurs naturally in oil and gas production fields, and results from the bacterial breakdown of organic matter in the absence of oxygen.

H2S has a very low odor threshold, with its smell being easily perceptible at concentrations well below one (1) part per million (ppm) in air. The odor increases as the gas becomes more concentrated, with the strong rotten egg smell recognizable up to 30 ppm. Above this level, the gas is reported to have a sickeningly sweet odor up to around 100 ppm. However, at concentrations above 100 ppm, a person's ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a loss of the sense of smell. This means that the gas can be present at dangerously high concentrations, with no perceivable odor. Prolonged exposure to lower concentrations can also result in similar effects of olfactory fatigue.

H2S is classified as a chemical asphyxiant, similar to CO2; however, H2S is also toxic and flammable. Typical exposure symptoms include:

- Low (0 – 10 ppm) irritation of the eyes, nose and throat;
- Moderate (10 – 50 ppm) headache, dizziness, nausea and vomiting, coughing and breathing difficulty; and
- High (50-200 ppm) severe respiratory tract irritation, eye irritation including acute conjunctivitis, shock, convulsions, coma, and death in severe cases.

Prolonged exposures at lower levels can lead to bronchitis, pneumonia, migraine headaches, pulmonary edema, and loss of motor coordination. While the distinctive odor of H2S is easily detected, its olfactory fatigue effects mean that one cannot rely on the nose as a warning device. The only reliable way to evaluate exposure levels is to measure the amount in the air using continuous monitoring systems such as personal H2S monitoring alarms set at 10 ppm or less.

With a vapor density of 1.19, H2S is approximately 20 percent heavier than air, so this invisible gas will collect in depressions and in confined spaces. Cal-OSHA requires the use of direct reading gas detection instrumentation before entering any areas where H2S is suspected.

H2S may be found at EHOF near production tanks and separators, produces water tanks/filters, compressor stations, casing vent systems, valve boxes/drains, well cellars, mud shakers, electrical vaults, and low lying areas near production and gas operations facilities. Typically, H2S meters are installed at their larger oil related facilities and at least one person per work crew, including contractors, subcontractors, and visitors, are required to have a calibrated portable H2S monitor. Monitors sound an audible alarm when 10 ppm of H2S is detected.

4.7 HAZARDS AND HAZARDOUS MATERIALS

OEHI has specific recommendation to follow if the H2S alarm is sounded at the EHOF. All contractors and subcontractors are required to take a mandatory safety OEHI orientation that outlines working safely in conditions where H2S may accumulate. If an alarm is sounded, workers are to stop what they are doing and immediately check the direction the wind is blowing, followed by evacuation crosswind then upwind of the suspected release. Re-entry to the work site is only allowed after it is verified that the H2S levels are below 10 ppm, a new Job Safety Analysis (JSA) Permit is completed, and continuous monitoring is conducted.

The OSHA PEL-TWA and PEL-Ceiling for H2S is listed below in Table 4.7-2. Because H2S is a highly toxic substance, a ceiling value is reported instead which corresponds to a concentration that may not be exceeded for any period of time.

TABLE 4.7-2: H2S EXPOSURE LIMITS

Exposure Limit for Hydrogen Sulfide	Concentration	Exposure Period
OSHA TWA	10 ppm	Maximum concentration to which a healthy individual can be exposed over an eight-hour work period and expressed in parts per million.
OSHA Ceiling Limit	20 ppm	A ceiling limit is one that may not be exceeded for any period of time, and is applied to irritants and other materials that have immediate effects.

4.7.3 Regulatory Setting

The use of hazardous materials and disposal of hazardous waste are subject to numerous laws and regulations at all levels of government. Table 4.7-3 provides a brief overview of federal and state laws and regulations.

4.7 HAZARDS AND HAZARDOUS MATERIALS

TABLE 4.7-3: APPLICABLE HAZARDOUS MATERIALS LAWS AND REGULATIONS

Law/Regulation	Context
The Hazard Communication Standard (HCS)	The Occupational Safety and Health Act of 1970 established the OSHA within the US Department of Labor. The original Act included language to the effect that employees should be apprised of all hazards to which they are exposed to on the job. In the early 1980's, OSHA implemented this instruction by enacting the Hazard Communication Standard (HCS) as 29 CFR 1910.1200. The HCS became effective in 1986. A fundamental premise of the HCS is that employees who may be exposed to hazardous chemicals in the workplace have a right to know about the hazards and how to protect themselves. For this reason, the HCS is sometimes referred to as the Worker Right-to-Know Legislation. The HCS sets forth guidelines and requirements in six areas: Chemical labeling, Material Safety Data Sheets (MSDS), Hazard Determination, Written Implementation Program, Employee Training, and Trade Secrets.
Hazardous Materials Management	State and federal laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and dispose of, and in the event that such materials are accidentally released, to prevent or to mitigate injury to health or the environment. These laws require hazardous materials users to prepare written plans, such as HCS, Hazardous Materials Business Plans, and Chemical Hygiene Plans. Laws and regulations require hazardous materials users to store these materials appropriately and to train employees to manage them safely. A number of agencies participate in enforcing hazardous materials management requirements. For the Project Site, the KCEHSD is the agency most involved.
Hazardous Waste Handling	The California Environmental Protection Agency's (Cal EPA) Department of Toxic Substances Control (DTSC) regulates the generation, transportation, treatment, storage, and disposal of hazardous material waste. These laws impose "cradle to grave" regulatory systems that require generators of hazardous materials waste to handle it in a manner that protects human health and the environment to the extent possible. The DTSC permits and oversees hazardous materials waste treatment, long-term storage, and disposal facilities.
Hazardous Materials Transportation	The DOT regulates hazardous materials transportation between states. Within California, the state agencies with primary responsibility for enforcing federal and state regulations and for responding to transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans). Together, federal and state agencies determine driver-training requirements, load labeling procedures, and container specifications. Although special requirements apply to transporting hazardous materials, requirements for transporting hazardous waste are more stringent, and hazardous waste haulers must be licensed to transport hazardous waste on public roads.
Pipeline Safety (Hazardous Liquids or Highly Volatile Liquids)	The Federal Hazardous Liquid Pipeline Safety Act of 1979 established the basic safety standards for the transportation of hazardous liquids and pipeline facilities. Authority for enforcement of this law rests with the DOT's Office of Pipeline Safety. Specific federal regulations concerning the safety of hazardous liquid pipelines are found in parts 190, 195, 199 and 40 of the Code of Federal Regulations. Title 49 CFR, Part 195 (Transportation of Hazardous Liquids by Pipeline) was amended on October 1, 2001 to include Pipeline Integrity Management and defines high consequence areas, requires preparation of an Integrity Management Plan, and the performance of integrity assessments. The most current version of 49 CFR 195, revised on July 3, 2008, regulates rural low-stress and gathering

4.7 HAZARDS AND HAZARDOUS MATERIALS

TABLE 4.7-3: APPLICABLE HAZARDOUS MATERIALS LAWS AND REGULATIONS	
Law/Regulation	**Context**
	pipelines within a prescribed buffer of an Unusually Sensitive Area. The Elder California Pipeline Safety Act of 1981, authorized the California State Fire Marshal to exercise exclusive safety and enforcement authority over intrastate hazardous liquid pipelines. Chapter 5.5 of the California Government Code, Sections 51010-51019.1.
Injection Well Regulations	Section 1425 was added to the Safe Drinking Water Act in 1980. This section deals with underground injection wells related to the recovery and production of oil and natural gas (Class II injection wells). This addition to the Safe Drinking Water Act allows states with programs that effectively protect drinking water sources through the regulation of Class II injection wells to continue their programs in full compatibility with the Safe Drinking Water Act.
Soil and Groundwater Contamination	The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and associated Superfund Amendments provide the EPA with the authority to identify hazardous sites, to require site remediation, and to recover the costs of site remediation from polluters. California has enacted similar laws intended to supplement the federal program. The DTSC is primarily responsible for implementing California's Superfund Law.
Emergency Response	California has developed an emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies. Responding to hazardous materials incidents is one part of this plan. The plan is administered by the California Emergency Management Agency, which coordinates the responses of other agencies, including Cal EPA, CHP, the California Department of Fish and Game (CDFG), the State Regional Water Quality Control Board (RWQCB), and the local fire department. The fire department provides first response capabilities, if needed, for hazardous materials emergencies within the Project area.

4.7.3.1 Kern County

The policies, goals, and implementation measures in the Kern County General Plan for hazards and hazardous materials applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the Project. Therefore, they are not listed below, but, as stated in Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

4.7 HAZARDS AND HAZARDOUS MATERIALS

Kern County General Plan

Safety Element

Wildland and Urban Fire

Goals

Goal 1. Minimize injuries and loss of life and reduce property damage.

Policies

Hazard Identification

Access and Evacuation Routes. All developments must be planned with circulation routes that will ensure safe access for fire and other emergency equipment. The circulation routes must include secondary means of ingress and egress, consistent with topography, to meet emergency needs. The general circulation routes presently provided throughout Kern County by federal, state, and County-maintained road systems are adequate for access and evacuation. State and county laws regulate standards for new public circulation routes. Private circulation routes that are not maintained by the state or county are subject to the standards set forth in Kern County Ordinance No. G-1832.

Clearance of Vegetative Cover for Fire Control. In accordance with the 1963 State Public Resources Code clearance law, a minimum vegetative growth around structures, especially in brush- and tree-covered watershed areas, must be kept to a minimum. The enactment of a local ordinance is necessary where more restrictive fire safety clearance measures are desirable to meet local conditions.

Fuel Breaks and Firebreaks. Fuel breaks and/or firebreaks separating communities or clusters of structures from the native vegetation may be required. Such fuel breaks may be "greenbelts," as all vegetation need not be removed but rather thinned or landscaped to reduce the volume of fuel. All fuel and firebreaks are required to meet the minimum design standards of the Kern County Fire Chief. The Fire Department's Chief may require a fire plan during the critical fire season; the plan is to reflect the proposed plan of operation on the development for fire prevention and suppression. The parcel size and setback distances of buildings placed thereon should be such that adequate clearance of flammable vegetation cover may be performed within the limits of the owner's parcel of land. Should the owner of a property fail to create the required firebreak clearance following proper notice, the County may require the clearing to be done and make the expense of such clearing a lien against the property upon which the work was accomplished.

Water Supply for Fire Control. An adequate and reliable water supply must be provided specifically for fighting fires. Minimum requirements of water flow are determined by the Kern County Fire Chief. The fire department promotes the installation of fire hydrants in areas served by water companies. In areas served by a water purveyor, single-family residences constructed on existing parcels of record

may be provided with a suitable water supply for firefighting based on County requirements.

Hazardous Fire Area. The Kern County Hazardous Fire Area was established by an addendum to the Uniform Fire Code, Section l.49H, under Section 4016 of the Kern County Ordinance. The boundaries of the Hazardous Fire Area are determined and publicly announced before the start of each annual fire season, normally the period from April 15 to December 01, except when the fire chief extends this period. The Hazardous Fire Area consists mainly of wildlands, which are mountain and hill land in an uncultivated, more or less natural state, covered with timber, wood, brush, and grassland. The Hazardous Fire Area also includes some urban influence and agricultural uses where it occurs adjacent to wildland areas. The wildlands include valuable watersheds that must be preserved for receiving and passing water into surface streams and underground storage. Protection of the watersheds will prevent erosion and flood damages or the protection of wildlands, it is necessary to consider all factors that will aid in fulfilling the policy stated in CEQA Public Resources Code Section 21000 et seq., to "create and maintain conditions under which man and nature can exist in productive harmony to fulfill the social and economic requirements of present and future generations."

Policies

Policy 1. Require discretionary projects to assess impacts on emergency services and facilities.

Policy 2. The County will encourage the promotion of public education about fire safety at home and in the work place.

Policy 3. The County will encourage the promotion of fire prevention methods to reduce service protection costs and costs to taxpayers.

Policy 4. Ensure that new development of properties have sufficient access for emergency vehicles and for the evacuation of residents.

Policy 5. Require that all roads in wildland fire areas are well marked and that homes have addresses prominently displayed.

Policy 6. All discretionary projects shall comply with the adopted Fire Code and the requirements of the Fire Department.

Implementation Measures

Implementation Measure A. Require that all development comply with the requirements of the Kern County Fire Department or other appropriate agency regarding access, fire flows, and fire protection facilities.

4.7 HAZARDS AND HAZARDOUS MATERIALS

Safety Element

Hazardous Materials

Policies

Policy 1. The proposed siting or expansion of hazardous waste facilities will be in conformance with the adopted Kern County and Incorporated Cities Hazardous Waste Management Plan.

Policy 2. Innovative technologies to manage hazardous waste streams generated in Kern County will be encouraged.

Implementation Measures

Implementation Measure A. Facilities used to manufacture, store, and use of hazardous materials shall comply with the Uniform Fire Code, with requirements for siting or design to prevent on-site hazards from affecting surrounding communities in the event of inundation.

Implementation Measure B. The proposed siting or expansion of hazardous waste facilities will be in conformance with the adopted Kern County and Incorporated Cities Hazardous Waste Management Plan.

Circulation Element

Airport Land Use Compatibility Plan (ALUCP)

Goals

Goal 1. Plan for land uses that are compatible with public airport and military bases and mitigate encroachment issues.

Policies

Policy 1. Review land designations and zoning near public and private airports, Edwards Air Force Base (EAFB) and Naval Air Weapons China Lake (China Lake) for compatibility.

Policy 2. To the extent legally allowable prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measures

Implementation Measure A. Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Implementation Measure B. Coordinate and cooperate with airport operators, the County Department of Airports, Caltrans, Division of Aeronautics, affected cities, EAFB, China Lake, and the

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U.S. Department of Defense (DOD) on ALUCP, review of land use applications, public education and encroachment issues.

Kern County ALCUP-Section 1.0 General Applicability

Section 1.7.1(c). Prior to the approval of a proposal involving any type of land use development, as stated in Section 1.6.1, or other review as required by a Specific Plan, specific findings shall be made that such development is compatible with the training and operational missions of the military aviation installations. Incompatible land uses that result in significant impacts on the military mission of DOD installations or to the Joint Service Restricted R-2508 Complex that cannot be mitigated, shall not be considered consistent with this plan.

Circulation Element

Transportation of Hazardous Materials

Goals

Goal 1. Reduce risk to public health from transportation of hazardous materials.

Policies

Policy 1. The commercial transportation of hazardous material, identification, and designation of appropriate shipping routes will be in conformance with the adopted Kern County and Incorporated Cites Hazardous Waste Management Plan.

Policy 2. Kern County and affected cities should reduce use of County-maintained roads and city-maintained streets for transportation of hazardous materials.

Implementation Measures

Implementation Measure A. Roads and highways utilized for commercial shipping of hazardous waste destined for disposal will be designated as such pursuant to Vehicle Code Sections 31303 et seq. Permit applications shall identify commercial shipping routes they propose to utilize for particular waste streams.

Kern County Zoning Ordinance

Interpretation and General Standards

Section 19.08.160 Height of Structures. This section restricts the height of structures or buildings to the maximum permitted heights shown in Figure 19.08.160 unless the military authority responsible for operations in that flight area first provides the planning director with written concurrence that the height of the proposed structure or building would create no significant military

mission impacts. Nearly the entire Project Site is located within an area on Figure 19.08.160 shown as red and structures are limited to 200 feet above ground elevation.

Kern County Wildland Fire Management Plan

The Kern County Wildland Fire Management Plan documents the assessment of wildland fire situations throughout the State Responsibility Areas (SRA) within the County. The Kern County Fire Department Wildland Fire Management Plan provides for systematically assessing the existing levels of wildland protection services and identifying high-risk and high-value areas that are potential locations for costly and damaging wildfires. The goal of the plan is to reduce costs and losses from wildfire by protecting assets at risk through focused pre-fire management prescriptions and increasing initial attack success. Based on this assessment, preventive measures are implemented, including the creation of wildfire protection zones.

Kern County Hazardous Waste Management Plan

In response to the growing public concern regarding hazardous waste management, State Assembly Bill 2948 (Tanner 1986) enacted legislation authorizing local governments to develop comprehensive hazardous waste management plans. The intent of each plan is to ensure that adequate treatment and disposal capacity is available to manage the hazardous wastes generated within the local government's jurisdiction.

The Kern County and Incorporated Cities Hazardous Waste Management Plan (Hazardous Waste Plan) was first adopted by Kern County and each incorporated city before September 1988 and was subsequently approved by the State Department of Health Services. The Hazardous Waste Plan was updated and incorporated by reference into the Kern County General Plan in 2004 as permitted by Health and Safety Code Section 25135.7(b), and thus must be consistent with all other aspects of the Kern County General Plan. The Hazardous Waste Plan provides policy direction and action programs to address current and future hazardous waste management issues that require local responsibility and involvement in Kern County. In addition, the Hazardous Waste Plan discusses hazardous waste issues and analyzes current and future waste generation in the incorporated cities, county, and state and federal lands. The purpose of the Hazardous Waste Plan is to coordinate local implementation of a regional action to effect comprehensive hazardous waste management throughout Kern County. The action program focuses on development of programs to equitably site needed hazardous waste management facilities; to promote on-site source reduction, treatment, and recycling; and to provide for the collection and treatment of small quantity hazardous waste. An important component of the Hazardous Waste Plan is the monitoring of hazardous waste management facilities to ensure compliance with federal and state hazardous waste regulations. The siting criteria and any subsequent environmental documentation required pursuant to the CEQA would also ensure the mitigation of adverse impacts associated with the siting of any new hazardous waste facility.

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Kern County Airport Land Use Compatibility Plan

The Kern County ALUCP has been prepared to establish procedures and criteria by which Kern County and the affected incorporated cities can address compatibility issues when planning and discussing airports and the land uses around them. The plan addresses all properties on which land uses could be affected by present or future aircraft operations at 16 airports. The operation nearest to the Project Site is the Elk Hills – Buttonwillow Airport (approximately 4 miles north of Project Site). The Project Site is not within the sphere of influence of the Elk Hills – Buttonwillow Airport.

Kern County Multi-Hazard Mitigation Plan

The purpose of hazard mitigation plans is to reduce or eliminate long-term risk to people and property from natural hazards. All Multi-Hazard Mitigation Plans must be prepared to meet the Disaster Mitigation Act of 2000 (DMA 2000) requirements in order to maintain eligibility for the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Programs (HMGP). The Kern County Hazard Mitigation Planning Committee (HMPC) comprised of key County, City, Special District and Stakeholder representatives is responsible for the preparation of the Kern County Multi-Hazard Mitigation Plan. The planning process examined the recorded history of losses resulting from natural hazards, and analyzed the future risks posed to the county by these hazards. Kern County is vulnerable to several natural hazards that are identified, profiled, and analyzed in the plan. Earthquakes, wildfires, floods and drought are some of the hazards that can have a significant impact on the County.

The plan puts forth several mitigation goals and objectives that are based on the results of the risk assessment. The plan includes specific recommendations for actions that can mitigate future disaster losses. The plan also includes a review of the County's current capabilities to reduce hazard impacts. The multi-jurisdictional plan includes the County, and the incorporated municipalities Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco. This plan also covers 45 special districts that include school, recreation and park, water, community service, and other districts.

4.7.3.2 State

Soil Contamination

Soils having concentrations of contaminants higher than certain acceptable levels must be handled and disposed as hazardous waste when excavated. The CCR, Title 22, §66261.20-24 contains technical descriptions of characteristics that would cause a soil to be classified as a hazardous waste.

Hazardous Materials Management

The California Hazardous Materials Release Response Plans and Inventory Law of 1985 (Business Plan Act) requires that any business that handles hazardous materials prepare a business plan, which must include the following:

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Details, including floor plans, of the facility and business conducted at the site;

An inventory of hazardous materials that are handled or stored on site;

An emergency response plan; and

A safety and emergency response training program for new employees with annual refresher courses.

In January 1996, the Cal EPA adopted regulations implementing a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program). The program has six elements: hazardous waste generators and hazardous waste on-site treatment; underground storage tanks; aboveground storage tanks; hazardous materials release response plans and inventories; risk management and prevention programs; and Uniform Fire Code hazardous materials management plans and inventories. The plan is implemented at the local level. The local agency that is responsible for the implementation of the Unified Program is called the Certified Unified Program Agency (CUPA), and the KCEHSD is designated as the CUPA.

Hazardous Waste Handling

Under Resource Conservation and Recovery Act (RCRA) of 1976 - 42 U.S.C. s/s 6901 et seq., individual states may implement their own hazardous waste programs in lieu of RCRA as long as the state program is at least as stringent as federal RCRA requirements. The EPA must approve state programs intended to implement federal regulations. In California, Cal EPA and the DTSC, a department within Cal EPA, regulate the generation, transportation, treatment, storage, and disposal of hazardous waste. The EPA approved California's RCRA program, called the Hazardous Waste Control Law (HWCL), in 1992. The DTSC has primary hazardous material regulatory responsibility, but can delegate enforcement responsibilities to local jurisdictions that enter into agreements with the DTSC for the generation, transport, and disposal of hazardous materials under the authority of the HWCL.

The hazardous waste regulations establish criteria for identifying, packaging, and labeling hazardous wastes; prescribe the management of hazardous wastes; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in ordinary landfills. The generator for a minimum of three years must retain hazardous waste manifests. Hazardous waste manifests provide a description of the waste, its intended destination, and regulatory information about the waste. A copy of each manifest must be filed with the state. The generator must match copies of hazardous waste manifests with receipts from treatment, storage, and disposal facilities.

Contaminated soils and other hazardous materials removed from a site during construction or remediation may need to be handled as hazardous waste. In Kern County, remediation of contaminated sites is performed under the oversight and with the cooperation of the RWQCB.

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Hazardous Materials Transportation

The State of California has also adopted DOT regulations for the intrastate movement of hazardous materials. State regulations are contained in 26 CCR. In addition, the State of California regulates the transportation of hazardous waste originating in the state and passing through the state (26 CCR). Both regulatory programs apply in California.

The two state agencies with primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the CHP and Caltrans.

The CHP enforces hazardous material and hazardous waste labeling and packing regulations to prevent leakage and spills of material in transit and to provide detailed information to cleanup crews in the event of an accident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of the CHP, which conducts regular inspections of licensed transporters to assure regulatory compliance. Caltrans has emergency chemical spill identification teams at as many as 72 locations throughout the state that can respond quickly in the event of a spill.

Common carriers are licensed by the CHP, pursuant to California Vehicle Code Section 32000. This section requires the licensing of every motor (common) carrier who transports, for a fee, in excess of 500 pounds of hazardous materials at one time, and every carrier, if not for hire, who carries more than 1,000 pounds of hazardous material of the type requiring placards.

Every hazardous waste package type used by a hazardous materials shipper must undergo tests that imitate some of the possible rigors of travel. While not every package must be put through every test, most packages must be able to be kept under running water for a time without leaking; dropped, fully loaded, onto a concrete floor; compressed from both sides for a period of time; subjected to low and high pressure; and frozen and heated alternately.

Hazardous Materials Emergency Response

Pursuant to the Emergency Services Act, California has developed an Emergency Response Plan to coordinate emergency services provided by federal, state, and local governmental agencies and private persons. Response to hazardous materials incidents is one part of this plan. The plan is administered by the California Emergency Management Agency. The Office of Emergency Services (OES) coordinates the responses of other agencies, including the EPA, CHP, CDFG, SJVAPCD, and local agencies.

Pursuant to the Business Plan Law, local agencies are required to develop "area plans" for response to releases of hazardous materials and wastes. These emergency response plans depend to a large extent on the Business Plans submitted by persons who handle hazardous materials. An area plan must include pre-emergency planning and procedures for emergency response, notification, and coordination of affected governmental agencies and responsible parties, training, and follow up. As

described above under Hazardous Materials Management, the KCEHSD, which is also the CUPA, is responsible for implementing the Unified Program, which includes provisions for the implementation of hazardous materials release response plans.

In addition, California Accidental Release Prevention Program (CalARP) regulations became effective January 1, 1997, replacing the California Risk Management and Prevention Program. CalARP was created to prevent the accidental release of regulated substances. It covers businesses that store or handle certain volumes of regulated substances at their facilities. A list of regulated substances is found in Section 2770.5 of the CalARP regulations. If a business has more than the listed threshold quantity of a substance, an accidental release prevention program must be implemented and a risk management plan may be required. The KCEHSD, local CUPA, is responsible for implementing the provisions of CalARP.

Pipeline Safety

The Elder California Pipeline Safety Act of 1981 authorized the California State Fire Marshal to exercise exclusive safety and enforcement authority over intrastate hazardous liquid pipelines (Chapter 5.5 of the California Government Code, Sections 51010-51019.1). This responsibility is exercised by the California State Fire Marshal, Office of Pipeline Safety. The California State pipeline safety regulations generally mirror the federal regulations discussed further below.

Wildfires

Under Title 14 of the CCR, the California Department of Forestry and Fire Protection (CAL FIRE) has the primary responsibility for implementing wildfire planning and protection for the State Responsibility Areas (SRA). The CAL FIRE develops fire safe regulations and issues fire safe clearances for land within a fire district of the SRA. More than 31 million acres of California's privately owned wildlands are under the jurisdiction of the CAL FIRE.

In addition to wildland fires, the CAL FIRE's planning efforts involve responding to other types of emergencies that may occur on a daily basis, including residential or commercial structure fires, automobile accidents, heart attacks, drowning victims, lost hikers, hazardous material spills on highways, train wrecks, floods, and earthquakes. Through contracts with local government, the CAL FIRE provides emergency services in 36 of California's 58 counties.

4.7.3.3 Federal

Hazardous Materials and Waste

Hazardous materials and waste are regulated at the federal level by the EPA through numerous laws. The following list identifies the primary laws and their purposes:

Resource Conservation and Recovery Act (RCRA) enacted in 1976, 1076 – 40 CFR Parts 240-299. Establishes a system for controlling hazardous waste from its point of origin to its final disposal.

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Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Establishes prohibitions and requirements concerning closed and abandoned hazardous waste sites; provides for liability of persons responsible for release of hazardous waste at these sites; and establishes a trust fund to provide for cleanup when no responsible party can be identified.

National Oil and Hazardous Substances Pollution Contingency Plan. Outlines requirements for responding to both oil spills and releases of hazardous substances and provides for comprehensive system for reporting, spill containment, and cleanup.

Clean Water Act. Establishes the basic structure for regulating discharges of pollutants into the waters of the United States; establishes pollution control programs such as setting wastewater standards for industry; sets water quality standards for all contaminants in surface waters; and makes it unlawful for any person to discharge any pollutant from a point source into navigable waters without a permit.

Spill Prevention, Control, and Countermeasures (SPCC) Plan – 40 CFR Part 112. Requires facilities that store, handle, or produce significant quantities of hazardous material to prepare a plan to ensure that containment and countermeasures are in place to prevent release of hazardous materials to the environment.

Superfund Amendments and Reauthorization Act (SARA). Establishes a nationwide emergency planning and response program and reporting requirements for facilities that store, handle, or produce significant quantities of hazardous materials. Identifies requirements for planning, reporting, and notification concerning hazardous materials.

Occupational Safety and Health Standards (Title 29 CFR Parts 1910 and 1926). Provides regulations for safety in the workplace and provides regulations for construction safety.

Clean Air Act (CAA). Regulations (40 CFR 68) under the CAA are designed to prevent accidental releases of hazardous materials. These regulations require facilities that store a Toxic Quantity (TQ) or greater of listed hazardous materials to develop a Risk Management Plan, including hazard assessments and response programs to prevent accidental releases of certain chemicals. Section 112(r)(5) of the CAA discusses the chemicals regulated. These chemicals are listed in 40 CFR 68.130 of the regulations.

Pipeline Safety

The Federal Hazardous Liquid Pipeline Safety Act of 1979 established the basic safety standards for the transportation of hazardous liquids and pipeline facilities. The DOT Pipeline and Hazardous Material Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other

approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities.

Specific federal regulations concerning the safety of hazardous liquid pipelines are found in parts 190, 195, 199 and 40 CFR. These parts have been amended numerous times since their inception in 1979. Most recently, the regulations have been amended to focus on potential impacts to high consequence areas and exerting jurisdiction to rural low-stress and gathering pipelines located in close proximity to an Unusually Sensitive Area. Although CO2 is not considered a hazardous liquid, vapors from liquefied gas are initially heavier than air and spread along the ground. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite and potentially subject to DOT regulation when conveyed by pipeline. It is anticipated that the CO2 lines running to the satellite stations from the CO2 EOR Processing Facility will be subject to compliance with 49 CFR 195.

4.7.4 Impacts and Mitigation Measures

4.7.4.1 Methodology

Potential impacts on the environment and public health from hazards and hazardous materials were evaluated on the basis of the existing conditions of the Project Site and adjacent properties, and historical uses, to determine the likelihood of encountering hazardous materials.

4.7.4.2 Thresholds of Significance

The CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact from a hazard or hazardous materials if it would:

Create a significant hazard for the public or the environment through the routine transport, use, or disposal of hazardous materials;

Create a significant hazard for 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 or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;

Result in a safety hazard for people residing or working in the Project area for a project located within the Kern County ALUCP;

Result in a safety hazard for people residing or working in the Project area for a project within the vicinity of a private airstrip;

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Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; and

Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands;

- The CO2 EOR Processing Facility is located approximately 4 miles southwest of Elk Hills Elementary School in Tupman. This significance criterion is analyzed below for potential Project impacts.

4.7.4.3 Project Impacts

IMPACT HAZ-1 Routine Transport, Use, or Disposal of Hazardous Materials.

Construction

The proposed Project will transport, use, dispose, and store hazardous materials during construction of the Project. These materials would primarily be limited to fuels and construction materials, including: gasoline, diesel fuel, motor oil (for construction equipment), compressed gas cylinders containing oxygen, acetylene, and argon (for welding), paint and cleaning solvents, concrete form release, miscellaneous lubricants, adhesives, and sealants (ManageTech Solutions 2010).

The majority of hazardous waste generated during construction of the proposed Project will consist of liquid waste such as waste oil from equipment maintenance, flushing and cleaning fluids, waste solvents, and waste paints or other coatings. Contractors will employ practices consistent with the proper handling of all hazardous wastes in accordance with applicable laws, ordinances, regulations and standards. Workers will be required to meet all licensing requirements, and contractors will be required to train employees where required, be aware of accumulation limits and duration, and maintain records and meet reporting requirements. All hazardous wastes will be removed from the Project Site by a licensed hazardous waste management facility (ManageTech Solutions 2010).

Contractors will maintain a set of MSDSs for each chemical that is used on the Project, as well as notify workers where the chemicals are stored and the hazard associated with the chemicals. Compliance with applicable laws, ordinances, regulations and standards will adequately mitigate the hazards associated with the transport, use, and disposal of hazardous materials. This is a less than significant impact.

Operations

Hazardous materials that may be routinely used in conjunction with the operation of the proposed Project include: compressed CO2, nitrogen, natural gas liquids, produced hydrocarbon gas, dimethyl ethers of polyethylene glycol, chemical reagents (acids/bases/standards), miscellaneous gases (acetylene, oxygen, other welding gases, calibration gases), natural gas, diesel fuel, paint, thinners,

solvents, and adhesives (ManageTech Solutions 2010). Dimethyl ether (DME) is an organic compound that is a colorless gas used as precursor to other organic compounds and as an aerosol propellant. If storage of large quantities of chemicals is planned for operation of the proposed Project, OEHI will be required to prepare a Hazardous Materials Business Plan and submit it to the KCEHSD.

Storage, handling, and use of hazardous materials will be in accordance with applicable laws, ordinances, regulations and standards. Storage will occur in designated areas. Bulk tanks will be placed atop secondary containment to contain leaks or spills. Personnel who could potentially handle hazardous materials will be trained to perform their duties and to respond to emergency situations that may occur in the event of an accidental spill or release (ManageTech Solutions 2010). Compliance with applicable laws, ordinances, regulations and standards will adequately mitigate the hazards associated with the transport, use, and disposal of hazardous materials. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-2 Create a Significant Hazard for the Public or the Environment through Reasonably Foreseeable Upset and Accident Conditions Involving the Release of Hazardous Materials into the Environment

Construction

The proposed Project will transport, use, dispose, and store hazardous materials during construction of the Project. These materials would primarily be limited to fuels and construction materials, including: gasoline, diesel fuel, motor oil (for construction equipment), compressed gas cylinders containing oxygen, acetylene, and argon (for welding), paint and cleaning solvents, concrete form release, miscellaneous lubricants, adhesives, and sealants (ManageTech Solutions 2010).

The most likely accidents involving hazardous materials during construction could occur from small-scale spills during refueling of equipment, cleaning, or the use of other materials in the storage areas. Any spills that occur during construction would be reported to applicable regulatory agencies (KCEHSD) and appropriately responded to and mitigated in accordance with OEHI's oil field spill response plan. In addition, all hazardous materials and wastes will be handled and disposed in accordance with applicable laws, ordinances, regulations, and standards. Construction of the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. In addition, it is the responsibility of each contractor to have a health

and safety plan (HASP) in place in case of an accident with proper chain-of-command to be followed during the notification process. This is a less than significant impact.

Operations

Hazardous Materials Used in Existing Oil Field Operations

Hazardous materials that may be routinely used in conjunction with the operation of the proposed Project include: CO2, nitrogen, natural gas liquids, produced hydrocarbon gas, dimethyl ethers of polyethylene glycol, chemical reagents (acids/bases/standards), miscellaneous gases (acetylene, oxygen, other welding gases, calibration gases), natural gas, diesel fuel, paint, thinners, solvents, and adhesives (ManageTech Solutions 2010).

A majority of these materials are commonly used at the Project Site during existing oil recovery operations. The safe handling of these materials is addressed through existing OEHI hazardous materials handling practices that comply with all applicable regulatory requirements. These safe handling practices in addition to the relative remoteness of the Project Site to sensitive receptors are expected to minimize potential impacts. The use of hazardous materials that are already commonly used as part of existing oil field operations are not evaluated further in this SEI.

Use of CO2 and H2S

The use of large volumes of pressurized CO2 for enhanced oil recovery presents a new potential hazard to the Project Site. Because CO2 is heavier than air, it has potential to be an asphyxiant; a release of CO2 during an upset condition or accident has the potential to create a hazard to the public. The CO2 provided to the proposed Project from HECA is expected to contain hydrogen sulfide with a peak concentration of 100 ppm and an average concentration of 30 ppm. As hydrogen sulfide is toxic, a release could create a hazard to the public. The hazards associated with conveyance and use of CO2 in support of the proposed Project has been evaluated in two studies summarized below. It should be noted that the reports conclude that the only two Project components that have the potential to substantially impact the public are operation of the main CO2 truck line from the HECA project to the CO2 EOR Processing Facility in Section 27S and operation of the CO2 EOR Processing Facility due to the proximity of Tupman to this facility. Due to flares operating at the CO2 EOR Processing Facility and storage of excess CO2 within the Northwest Stevens Reservoir, upset conditions are anticipated to be significantly reduced and have no impact on the public.

A Preliminary Hazards Review Report (Mustang, 2010) consistent with the requirements of OSHA's 29 CFR 1910.119 was prepared to identify and evaluate potential hazards of the proposed Project. A preliminary Hazards Identification (HAZID) session was conducted by the Pre-FEED Design Team over a two-day period in January 2010. In many cases, the identified hazard issue was one that is best "Deferred to FEED" (e.g., detailed engineering design). It should be noted that a majority of the potential hazards identified do not pose a substantial hazard to the public through the release of hazardous materials. The Preliminary Hazards Review Report does identify a release of CO2 and

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H2S from the CO2 EOR Processing Facility and trunk line from HECA as a potential hazard that warrants further study.

CO2 Risk Analysis

A Carbon Dioxide Pipeline Risk Analysis was prepared by HECA for the proposed CO2 trunk line from HECA to the CO2 EOR Processing Facility located in Section 27S. The risks associated with CO2 release within the Project Site would be reduced after passage through the CO2 EOR Processing Facility. This risk analysis is summarized below. The risk analysis sets forth the Risk Evaluation conducted for an accidental worst-case release scenario from the Project's CO2 trunk line. Specifically, an Offsite Consequence Analysis was performed, using the methodology prescribed under the California Accidental Release Prevention program and the federal CAA Risk Management Program, to address the maximum potential consequence from a worst-case release from the CO2 trunk line. The models provide an examination of the dispersion of CO2 in the form of a vapor cloud. The modeling assumptions for a worst-case release scenario are that the total contents from the largest inventory are accidentally released into the atmosphere.

The modeling assumed worst-case atmospheric conditions during such a release, where applicable. These conditions provide conservative results because these extreme and unlikely climatic conditions maximize the vaporization to create the vapor cloud and minimize its dispersion. For purposes of this analysis, the worst-case climate condition consists of an ambient temperature of 115 degrees Fahrenheit (°F) (the highest average temperature in the Project area), a 50 percent average humidity, a wind speed of 1.5 meters per second, and a level F atmospheric stability.

The extent of potential impact from the hypothetical accidental release was computed by using the Area Locations of Hazardous Atmospheres (ALOHA) 5.4.1 air dispersion modeling program. ALOHA is a Gaussian plume model that incorporates continuous source and meteorological parameters. The ALOHA model was selected to model the release, as it is suitable for modeling the release of a heavy gas (i.e., gas that is heavier than air) such as CO2. All the basic phenomena associated with a heavy gas release, such as horizontal spreading, the mass exchange between the plume and the plume temperature are considered through the ALOHA program. Operating through Gaussian plume dispersion, the ALOHA model also takes into consideration the specific atmospheric conditions that may affect a potential release.

In order to provide conservative results as to the extent of impact of a CO2 release from the proposed Project, the modeling for the worst-case release scenario examined an instantaneous release from a complete lateral shear and de-pressurization of pipeline sections isolated by emergency block valves. For the worst-case release scenario, the rupturing of the CO2 trunk line was assumed to produce a 0.8-square-foot aperture (meaning a complete severing of the 12-inch-diameter pipeline) at which CO2 would escape. The worst-case scenario assumes that the total CO2 volume of each section will release through the rupture within 1 minute (the minimum duration used by the ALOHA model for

immediate releases). The atmospheric conditions modeled represent the least favorable conditions for the normal dissipation of a concentrated CO2 release.

In addition to the gas volume released from each isolated pipeline segment, the analysis also accounted for the additional CO2 that would be released during the reaction time for activation of the automated emergency block valves. It would take approximately 20 seconds for the CO2 trunk line emergency block valves to activate based on pressure loss conditions identified for the pipeline. Based on the foregoing, the worst-case scenario with the highest potential to impact the public would be the release of 461,540 pounds of CO2 from a 15,893 foot pipeline segment (longest segment between block valves). The CO2 dispersion model results show that the immediately dangerous to life and health (IDLH) for CO2 (40,000 ppm) can be expected to extend 2,508 feet from the release point. Considering that the community of Tupman is located approximately 1.5 miles from the proposed CO2 trunk line, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

Although the dispersion modeling shows that a release of CO2 would not create a substantial public hazard, the probability for a worst-case scenario to occur is low. In fact, based on historical data obtained from the DOT's Office of Pipeline Safety covering the period 1986 to 2008 through the National Response Center, the failure rate for this period of time was determined to equal about 0.000169 failures per mile of CO2 pipeline per year. No record of catastrophic explosion or rupture has been recorded since the 1970s. The probability of occurrence of an actual failure event was calculated using the incident data from 1986 through 2008. As such, the historical failure rate for the 4-mile CO2 pipeline is estimated to be about 0.0007 failures per year, which will not present a significant likelihood of occurrence.

It should be noted that the CO2 EOR Processing Facility in Section 27S is also located approximately 1.5 miles southwest from the community of Tupman. As the CO2 EOR Processing Facility does not have substantial CO2 storage capacity, the risks and consequences of a release of CO2 from the facility is not expected to create a higher level of risk or consequences compared to a release from the CO2 trunk line. Considering the above, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of CO2 into the environment. This is a less than significant impact.

In addition, due to the distance to the community of Tupman, the proposed Project is not expected to create a significant hazard for the public or the environment through reasonably foreseeable upset and accident conditions involving the release of H2S into the environment. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

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Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-3 Project Located on a Site Which is Included on a List of Hazardous Materials Sites Compiled Pursuant to Government Code Section 65962.5 and, as a Result, Create a Significant Hazard to the Public or the Environment

The Hazardous Waste and Substances Sites (Cortese) List is a planning document used by the State, local agencies and developers to comply with the CEQA requirements in providing information about the location of hazardous materials release sites. Government Code section 65962.5 requires the Cal EPA to develop at least annually an updated Cortese List. Listed sites are designated by the State RWQCB and listed under their leaking underground storage tanks (LUST), the Integrated Waste Board (IWB), and the DTSC.

Stantec reviewed the Cortese List to determine if any proposed Project components are located on a Cortese List site. Based on this review, the closest Cortese List site to the Project Site is located in Taft (Gardner Field), approximately 5 miles south of Project Site. The proposed Project is not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and will not result in or create a significant hazard to the public or the environment. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-4 Result in a Safety Hazard for People Residing or Working in the Project Area for a Project Located within the Kern County ALUCP

Elk Hills – Buttonwillow Airport is located approximately 4 miles north of the Project Site. The Project Site is not within the sphere of influence of the Elk Hills – Buttonwillow Airport. In addition, the proposed Project does not include a residential development component that has the potential to expose residents to airport safety hazards. An evaluation of the proposed Project's potential to result in obstructions to airport safety, height compatibility, and safety compatibility are discussed below.

<u>Obstruction</u>

The proposed Project is of sufficient distance from the Elk Hills - Buttonwillow Airport's runway that it will not obstruct airplanes taking off or landing (as defined by 14 CFR Part 77 Section 44718). The Project Site is located to the southwest of the runway approach. The south side of the runway is

approximately 4 miles from the closest portion of the Project Site. This distance makes it unlikely the proposed Project will cause an obstruction.

Findings of Height Compatibility

The proposed Project does not lie under the Elk Hills - Buttonwillow Airport runway transitional zone.

The proposed Project will not pose a hazard to air navigation due to its distance from the Airport runway. The proposed Project will create a less than significant level of hazards pertaining to aircraft operations.

Findings of Safety Compatibility

Based on the following findings, the proposed CO2 EOR Project should be considered a compatible land use within the Elk Hills – Buttonwillow Airport environs and is consistent to the Caltrans Aeronautics Update of the Airport Land Use Planning Handbook regarding safety issues:

The Project Site is located outside of the Runway Protection Zones (Clear Zones) for the Elk Hills – Buttonwillow Airport.

The proposed Project will not cause an obstruction of the runway.

The proposed Project will employ a lighting design that will minimize glare and mitigate any potential navigation hazards from lights during dusk hours prior to visual flight rules requiring aviation operations to cease.

Portions of the proposed Project will be located under the flight path for the Elk Hills – Buttonwillow Airport. However, workers associated with the Project development will not be subjected to noise, vibrations, fumes, dust, fuel particles, and safety hazards associated with take off and landings of general aviation aircraft as the location of the Airport is approximately 4 miles from the closest portion of the Project Site.

Considering the above in addition to the fact that the Project Site is located outside of the Kern County ALUCP, the proposed Project will have a less than significant airport-related safety hazard impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.7 HAZARDS AND HAZARDOUS MATERIALS

IMPACT HAZ-5 Private Airstrip Operations within vicinity of proposed Project resulting in safety hazards for people residing or working in the proposed Project Site

There are no private airstrips located in proximity to the proposed Project Site that could present a safety hazard to workers. In addition, the proposed Project does not include a residential development component that has the potential to expose residents to private airstrip safety hazards. No impact would result.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-6 Impair Implementation of or Physically Interfere with an Adopted Emergency Response Plan or Emergency Evacuation Plan

Emergency response planning includes the ability to effectively evacuate the Project Site and the vicinity in the event of an emergency. Among the agencies that would likely coordinate such responses are the California Emergency Management Agency, Kern County Sheriff's Department, and the Kern County Fire Department. Although no specific emergency evacuation routes have been designated by the County, it is expected that Highway 119 would be the main evacuation route in the event of an emergency in the Project Site.

The Project Site would have multiple access points from Highway 119, Skyline Road, Elk Hills Road, and North Access Road. This would facilitate access to the site by emergency vehicles and evacuations from the Site. The multiple access points on the roads mentioned above, would reduce the likelihood of traffic congestion and accidents during an evacuation. The proposed Project configuration would not cause any obstruction on Highway 119, Skyline Road, Elk Hills Road, or North Access Road. Impacts on emergency response or emergency evacuation would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HAZ-7 Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Wildland Fires

4.7 HAZARDS AND HAZARDOUS MATERIALS

As the proposed Project does not include residential development, it does not meet the definition of wildlands urban interface (WUI). The proposed Project is limited to utilizing CO2 EOR in an active oil field operation. The proposed Project does not include any component that will measurably increase the potential exposure of people or structures to significant risk of loss, injury, or death involving wildland fires. This is a less than significant impact.

Mitigation Measures

No mitigation measures required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.7.5 Cumulative Impacts

During construction and operation of the proposed Project various types of hazardous materials will be transported, used, and stored at the Site. Any spills of materials at the Project Site would be controlled locally. Spills of hazardous materials or discovery of hazardous materials that require cleanup would be contained, managed, and remediated. Therefore, spills at the Project Site would not be expected to have significant impacts on resources beyond the boundary of the Site. All transportation of hazardous materials would be handled in conformance with requirements of the DOT. Therefore, the proposed Project would not contribute to cumulative impacts on the environment through the release of hazardous materials beyond the Project Site.

For the reasons discussed above, the proposed Project would have less than significant cumulative impacts.

Mitigation Measures

No mitigation measures are required.

Level of Significant after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.8 HYDROLOGY AND WATER QUALITY

4.8 Hydrology and Water Quality

4.8.1 Introduction

This section of the SEI addresses the environmental impact(s) of the proposed Project with regard to the issues of drainage, flooding, water quality, and groundwater. As explained in the following paragraphs, these issues are the subject of various regulatory programs that are designed to avoid adverse impacts that include the following: 1) human injury/loss of life; 2) property damage/loss; 3) harm to fisheries as well as terrestrial wildlife; 4) degradation of plant communities; and 5) economic losses.

4.8.2 Environmental Setting

Climate

The climate in the Central Valley in this region can be characterized as semi-arid with long, hot, dry summers and relatively mild winters. The average annual temperature based on the 69 years of record is 65.4 °F. The average annual precipitation in the area is 5.75 inches.

Hydrology

Surface Hydrology

The proposed Project Site is characterized as mountainous terrain with slopes averaging 30 percent or greater within the EHOF. The topography slopes from southwest to northeast towards the California Aqueduct. The elevation of the project area ranges from 1,500 to 300 feet above mean sea level (at the Aqueduct).

The FEMA Insurance Rate Maps (FIRMs) for the proposed Project Site are included in Community Panel Numbers 060075 C2200E, C2225E, C2625E, and C2650E for Kern County Unincorporated Areas. The proposed Project does not fall in a FEMA designated flood zone.

The project area is located within an unnamed basin where several ephemeral washes flow across alluvial sediments and terminate at various points north of the EHOF. Per the Occidental of Elk Hills Construction General Permit Compliance Plan (Compliance Plan), this area has no common water conveyance connections that can be defined between various channels. Two constructed structures that cross over/under the California aqueduct are located north of Section 23 and at the northern extent of the basin near Highway 58 west of the Lokern Road junction. These washes terminate in fields east of the Aqueduct and do not flow into jurisdictional waters. Furthermore, the Compliance Plan finds that the ephemeral washes are non-jurisdictional according to the analysis method provided by the U.S. EPA and the U.S. Army Corps of Engineers. No wetlands were identified as a result of a Wetland Delineation conducted in 1996.

4.8 HYDROLOGY AND WATER QUALITY

Groundwater Hydrology

The source of non-potable water for the proposed Project is the Tulare aquifer. The project site is located in the Tulare Lake Hydrologic Region, within the Kern County Subbasin of the San Joaquin Valley Groundwater Basin. The depth to groundwater ranges from 380 feet to as much as 780 feet below the surface. The groundwater has both artificial and natural sources. The artificial sources are from injection of produced water. The natural source of groundwater recharge is likely from the Temblor Range to the west. The Tulare aquifer is an exempt aquifer and currently accepts produced water from oil production activities at Elk Hills.

The groundwater in the Tulare aquifer is highly mineralized and generally poor quality. Total dissolved solids concentrations can be as high as 5,000 parts per million (ppm).

4.8.3 Regulatory Setting

4.8.3.1 Kern County

Chapter 17.28 Grading Code

Requirements of the Kern County Grading Code will be implemented with respect to hydrology and water quality as outlined in Section 17.28.140, Erosion Control.

1.9 Resource

Policies

Policy 10. To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:

a. Promote groundwater recharge activities in various zone districts.

b. Support for the development of Urban Water Management Plans and promote Department of Water Resources grant funding for all water providers.

c. Support the development of groundwater management plans.

d. Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.

Policy 11. Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through utilization of grading and flood protection ordinances.

4.8 HYDROLOGY AND WATER QUALITY

Policy 20. Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreational, and other beneficial uses while acknowledging existing land use patterns.

4.8.3.2 State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Water Code Sections 13000 et seq.), passed in 1969, requires protection of water quality by appropriate designing, sizing, and construction of erosion and sediment controls. The Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and divided California into nine regions, each overseen by a regional water quality control board. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies and has delegated primary implementation authority to the nine Regional Water Quality Control Boards (RWQCB). The Porter-Cologne Act assigns responsibility for implementing Clean Water Act (CWA) Sections 401 through 402 and 303(d) to the SWRCB and the nine RWQCBs, including the Central Valley RWQCB, which has jurisdiction over the Project Site.

California Streambed Alteration Program

The California Lake and Streambed Alteration Program, Section 1602 of the California Fish and Game Code, regulates activities that would "substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed of a natural watercourse" that supports wildlife resources. The California Department of Fish and Game (CDFG) has authority to review and regulate all proposed alterations of streambeds.

OEHI holds a 12 year site-wide streambed alteration maintenance permit as required by 14 CCR Sections 1601 and 1603 of the Fish and Game Code. The current permit for OEHI expires in the year 2020. If it is determined that the activity may substantially adversely affect fish and wildlife resources within state jurisdictional waters, a Lake or Streambed Alteration Agreement will be prepared.

4.8.3.3 Federal

Clean Water Act

The CWA is intended to restore and maintain the chemical, physical, and biological integrity of the nations waters (33 Code of Federal Regulations [CFR] 1251). The regulations implementing the CWA protect waters of the U.S., streams and wetlands (33 CFR 328.3). The CWA ensures that water quality within aquatic ecosystems is maintained at a level of integrity that enables biological resources to exist and function properly. The following paragraphs provide details on specific sections of the CWA.

4.8 HYDROLOGY AND WATER QUALITY

Section 401, Water Quality Certification

Compliance with Section 401 of the CWA is required for applicants who require a Section 404 permit from the United States Army Corps of Engineers (USACE) because of potential discharges and impacts on waters of the U.S. or wetlands. If issued, a Section 401 certification from the SWRCB/RWQCB indicates that discharges and impacts will also comply with state water quality standards. The SWRCB has a policy of no net loss of wetlands in effect and typically requires mitigation for all impacts on wetlands before it will issue a water quality certification or waiver thereof.

Section 402, National Pollutant Discharge Elimination System as Related to Oil/Gas Construction Activities

Section 402 of the CWA regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, administered by the EPA with implementation authority delegated to the SWRCB in California, Order 2009-0009-DWQ. The issue of whether oil/gas construction activities require NPDES permit coverage has recently been the subject of litigation in the Ninth Circuit of the US Court of Appeals. In a May 18, 2010 memo published by the State Water Board titled "Impact of Natural Resources Defense Council (NRDC) v. U.S. EPA on the Regulation of Storm Water Discharges of Sediment from Oil and Gas Construction Activities", the State Board advises that oil and gas construction activities that discharge storm water contaminated only with sediment are now subject to California and federal NPDES permitting requirements, if the discharge of sediment contributes to a violation of a water quality standard. The Construction General Permit is not required if stormwater runoff:

1. Is not contaminated by contact with, or does not come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products;
2. Is contaminated by or only comes into contact with sediment; and
3. Does not contribute to a water quality violation.

Since stormwater runoff at EHOF does not enter jurisdictional waters, a Construction General Permit is not required for construction activities at EHOF. However, as part of OEHI's ongoing operations, a Storm Water Compliance Plan was created to implement requirements of the 2009 General Construction Permit throughout the property.

4.8.4 Impacts and Mitigation Measures

4.8.4.1 Methodology

This section analyzes impacts on hydrology and water quality from the implementation of the proposed Project based on changes to the environmental setting described above within the CEQA guidelines for the thresholds of significance.

4.8 HYDROLOGY AND WATER QUALITY

4.8.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on hydrology and water quality if it would:

Violate any water quality standards or waste discharge requirements;

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 that would not support existing land uses or planned uses for which permits have been granted);

Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on-site or off-site;

Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on-site or off-site;

Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

Otherwise substantially degrade water quality;

Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

Place within a 100-year hazard area structures that would impede or redirect flood flows;

Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or

Expose people or structures to a significant risk of loss, injury, or death due to inundation by seiche, tsunami, or mudflow.

4.8.4.3 Project Impacts

IMPACT HYD-1 Violate Any Water Quality Standards or Waste Discharge Requirements

Construction activities would disturb soils in the proposed Project Site, making them more susceptible to erosion and more likely to be transported by stormwater runoff into nearby drainages. Hazardous materials such as transportation fuel, hydraulic fluid, and paint are also potential pollutants during construction. OEHI will implement measures to minimize and contain erosion and sedimentation as

well as other pollutants as outlined in the OEHI Storm Water Compliance Plan and in accordance with the Kern County Grading Ordinance.

Normally, for a proposed Project that would disturb more than one acre, the applicant would be required to obtain coverage under the Construction General Permit for Discharges of Storm Water Related to Construction Activities (Order 2009-0009-DWQ). However, oil and gas construction activities discharging sediment only are subject to NPDES permitting requirements only if discharge of sediment contributes to a violation of a water quality standard. The OEHI Storm Water Compliance Plan demonstrates that storm water runoff from the EHOF does not have the potential to violate a water quality standard or impact Waters of the United States. Therefore, the Project will have a less than significant impact on water quality standards.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-2 Deplete Groundwater Supplies or Interfere with Groundwater Recharge

The Project proposes the use of five existing make-up water wells with the permitted capacity of producing 50,000 barrels of water per day each. OEHI anticipates that approximately 10,000 barrels of water for each well per day will be produced to support the Project. There are no other pre-existing wells located nearby that could be affected by OEHI's proposed use of the five groundwater production wells such that production rates of other wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted. The proposed Project will therefore not 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 which would have the potential to adversely affect other existing or planned uses of the Tulare Aquifer. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.8 HYDROLOGY AND WATER QUALITY

IMPACT HYD-3 Result in Impacts on the Existing Drainage Patterns

Potential project impacts to the natural drainage ways, associated riparian vegetation, and the wildlife that depend on them include but are not limited to: increased sediment input from storm water runoff and impervious areas and altered drainage patterns at Project facility locations.

As discussed above, short-term increases in erosion (including sedimentation build-up caused by access roads) as a result of ground disturbance would be minimized via implementation of the project-specific OEHI Storm Water Compliance Plan. Construction and operation of the proposed Project would not require permanently altering the course of any of the drainages. Therefore, there would be no long-term effect on drainage patterns from the proposed Project that could result in substantial erosion and siltation on- or off-site.

The project will be designed to minimize the footprint of new disturbed area by attempting to use as many existing wells and pipelines in previously disturbed acreage as much as possible. In addition, the project will comply with Kern County grading and drainage ordinances. Therefore, this is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-4 Alter Existing Drainage Patterns of the Site or Area, Causing Flooding

The project will not alter drainage patterns and therefore will not cause flooding. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-5 Result in Impacts on Runoff Water and Drainage Capacity

The proposed Project will not substantially increase impervious surfaces that will affect runoff water and drainage capacity. The proposed Project would comply with the goals, policies, and implementation measures of Kern County requirements. Therefore, this impact is less than significant.

4.8 HYDROLOGY AND WATER QUALITY

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-6 Place Housing within a 100-year Flood Hazard Area

The proposed Project does not involve placement of housing within a FEMA flood zone. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impacts.

IMPACT HYD-7 Place within a 100-Year Hazard Area Structures that would Impede or Redirect Flood Flows

Flooding is not a concern on the Project site as it is outside the FEMA designated 100-year flood zone. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT HYD-8 Expose People or Structures to a Significant Risk of Loss, Injury, or Death involving Flooding.

The proposed Project will not change the existing drainage patterns and will not increase offsite flooding. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.8 HYDROLOGY AND WATER QUALITY

IMPACT HYD-9 Result in Impacts Caused by Seiche, Tsunami, or Mudflow

Because of the inland location of the proposed Project Site and elevation, the potential for tsunami-related damage or a seismic seiche is low. The lands within and surrounding the proposed Project Site are not subject to mudflows or other forms of natural slope instability because of the dense, relatively hard, and massive nature of the crystalline bedrock underlying the mountainous portion of the proposed Project Site. The proposed Project would comply with the goals, policies, and implementation measures of the Kern County General Plan. No impacts would occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.8.5 Cumulative Impacts

OEHI has designed the proposed Project to minimize impacts on hydrology and water quality by limiting the area of disturbed land and utilizing as many existing wells, drilling pads, and existing pipeline corridors as possible. The Project would add limited amounts of impervious areas to the watershed, but the Project does not directly discharge to surface water. Therefore, the proposed Project would not contribute to a significant cumulative impact on hydrology and water quality and no significant cumulative impacts are anticipated.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

In view of the applicability of ordinances, laws, and regulation that would avoid the occurrence of significant hydrological and water quality impacts, it is concluded that cumulative hydrology and water quality impacts would not be significant. The proposed Project would have less than significant cumulative impacts.

4.9 LAND USE AND PLANNING

4.9 Land Use and Planning

4.9.1 Introduction

This section describes the potential environmental impacts of the proposed Project related to land use.

4.9.2 Environmental Setting

Existing Land Uses

Kern County

Kern County is the third largest county (8,142 square miles) in California, behind Inyo and San Bernardino Counties, with a population of more than 810,000 residents (California Department of Finance, 2008). Agriculture, mineral extraction, petroleum production, recreation, and urban development are the predominant land uses. Kern County (County) has the distinction of producing more oil than any other County in California. In addition, borate minerals, cement production, and construction aggregates constitute major economic mineral resources. Furthermore, the development of major water projects has greatly increased the amount of land in agricultural production during the last two decades.

Kern County's varied geomorphic terrains, devotion to agricultural land uses, and preservation of mineral resources has resulted in the development of many population centers throughout the County. However, most of the residential, commercial and industrial development is located in the City of Bakersfield and its surrounding metropolitan area. The Bakersfield metropolitan population was 503,800 in 2010, according to the Bakersfield Planning Department.

Within Kern County, the Federal government owns and manages a large amount of land. Major Federal land holdings within the area include the Sequoia National Park, Sequoia National Forest and Los Padres National Forests, Kern National Wildlife Refuge, Edwards Air Force Base (EAFB), and China Lake Naval Weapons Center. In addition, the Bureau of Land Management (BLM) manages extensive Federal land holdings, especially in the eastern portion of the County and along the northern edge of the Subject property. The mountain, desert, and valley environments provide a variety of recreational opportunities such as camping, hiking, hunting, and biking.

The County is connected by major transportation corridors that include Interstate 5 (I-5), California State Route 99 (SR 99), and a network of other state, County, and local roads. In addition, the Governor Edmund G. Brown California Aqueduct (California Aqueduct), which is located approximately one mile north of the Project, is a system of canals, tunnels, and pipelines that conveys water collected from the Sierra Nevada Mountains and valleys of Northern- and Central California to Southern California.

4.9 LAND USE AND PLANNING

Elk Hills Project Area

The EHOF is located approximately 26 miles west of the City of Bakersfield in Kern County and has been used for petroleum extraction and processing since the early 1900s. Oil production, gathering, and processing dominate the land uses within the Project. It is anticipated that the Project will continue to be used for petroleum extraction and processing for several decades.

EHOF contains various state, county and private roads. For example, State Route 119 extends through the southeastern section of the EHOF, and Elk Hills Road (County) and Skyline Road (private) intersect towards the center of the EHOF in a north to south and east to west direction, respectively. In addition, many paved and unpaved access roads run throughout the EHOF. However, the entire EHOF is restricted from public access and is accessible from locked gates located throughout the Project.

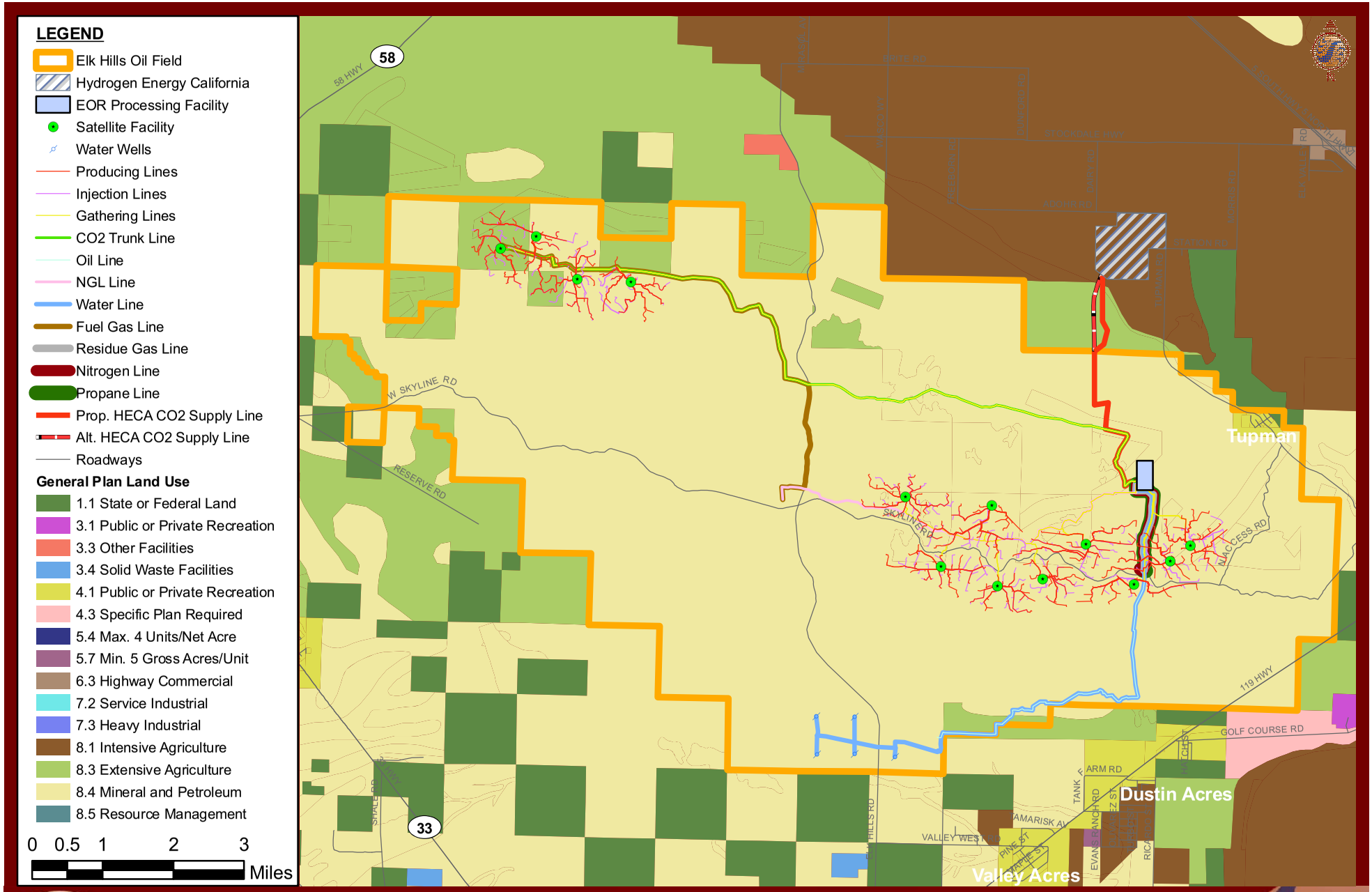
The primary land use designation for the Project as established by the Kern County Land Use, Open Space and Conservation Element of the General Plan is 8.1 (Intensive Agriculture), 8.3 (Extensive Agriculture) and 8.4 (Mineral and Petroleum). Land use and zoning designations for the Project and surrounding area are shown in Figures 4.9-1 and 4.9-2, respectively.

The following is a description of the above land use designations:

Map Code 8.1 (Intensive Agriculture) - Areas devoted to the production of irrigated crops or having a potential for such use. Other agricultural uses, while not directly dependent on irrigation for production, may also be consistent with the intensive agriculture designation. Minimum parcel size is 20 acres gross.

Map Code 8.3 (Extensive Agriculture) - Agricultural uses involving large amounts of land with relatively low value-per-acre yields, such as livestock grazing, dry land farming, and woodlands. Minimum parcel size is 20 acres gross, except lands subject to a Williamson Act (officially, the California Land Conservation Act of 1965) Contract/ Farmland Security Zone Contract, in which case the minimum parcel size shall be 80 gross acres.

Map Code 8.4 (Mineral and Petroleum) - Areas which contain producing or potentially productive petroleum fields, natural gas, and geothermal resources, and mineral deposits of regional and Statewide significance. Uses are limited to activities directly associated with the resource extraction. Minimum parcel size is five acres gross. Uses shall include, but are not limited to, the following: Mineral and petroleum exploration and extraction, including aggregate extraction; extensive and intensive agriculture; mineral and petroleum processing (excluding petroleum refining); natural gas and geothermal resources; pipelines; power transmission facilities; communication facilities; equipment storage yards; and borrow pits.



Cartographic Design By: C. Flinders | Environmental Remediation

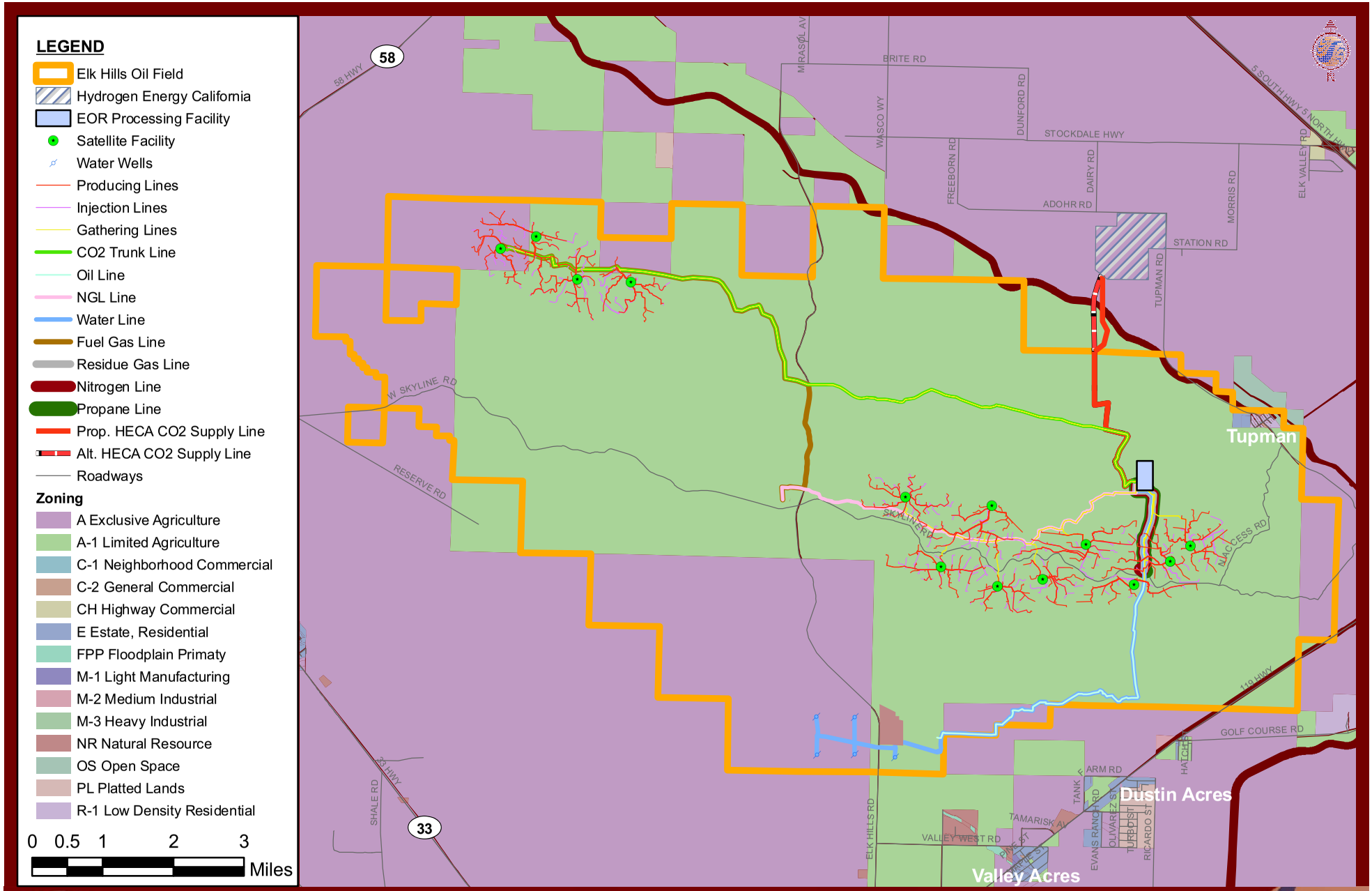
Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Fig. 4.9-1

Project Site General Plan Land Use

OEHI CO2 EOR Project - Supplemental Environmental Information

Stantec
2590 Venture Oaks Way, Sacramento, CA 95833
Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185802314



Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Fig. 4.9-2

Project Site Zoning

OEHI CO2 EOR Project - Supplemental Environmental Information

Stantec
2590 Venture Oaks Way, Sacramento, CA 95833
Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185802314

4.9 LAND USE AND PLANNING

Portions of the Project area have combined land use designations including 2.1 (Seismic Hazard) defined as Alquist-Priolo Special Study Zone and other recently active fault zones as well as 2.4 (Steep Slope) defined as land with an average slope of 30 percent or steeper. Special considerations should be taken when developing these areas (see Section 4.6 – Geology and Soils).

The Project is zoned primarily as A-1 (Limited Agriculture) and partly as A (Exclusive Agriculture) per the Kern County Zoning Ordinance Map. Oil and gas exploration and production is a permitted use in the A-1 and A zones, provided the activity is conducted in accordance with Chapter 19.98 (Oil and Gas Production) of the Kern County Zoning Ordinance.

Military review requirements are established for large portions of the Project. The majority of the Project requires a review of all structures over 200 feet in height; the eastern portion of the Project requires a review of all structures over 500 feet in height. Additionally, a small private airport runway (Elk Hills-Buttonwillow Airport) is north of EHOF.

Habitable and commercial structures are located adjacent to the north eastern corner of the Project Area in the community of Tupman. However, the nearest residence is located approximately 1.5 miles from the nearest proposed infrastructure associated with the proposed Project.

Surrounding Land Uses

Land uses in the area surrounding the Project are dominated by agriculture and oil and gas extraction and production. Surface and mineral rights on lands surrounding the Project are owned primarily by major oil companies, The Kern County General Plan (Kern County Planning Department 2007) acknowledges the economic importance of petroleum and agricultural resources and states that one of its goals is "The County will support programs and policies that provide tax and economic incentives to ensure the long-term retention of agriculture, timber, and other resource lands".

The major types of land uses surrounding the Project are presented below:

Agriculture and Open Space

Much of the area surrounding the Project consists of agricultural land and open space, with oil extraction occurring as a compatible land use. Intensively irrigated agriculture occurs to the north and east of the Project near the California Aqueduct. Numerous canals, ditches, drains and wells serve the farms in this area. The BLM's land holdings in the area are leased for grazing and numerous oil extraction facilities coexist with these agricultural activities.

Oil and Gas Production

Since the early 1900's, the area surrounding the Project has been a major oil producer. Currently this area supplies about two-thirds of California's total oil production and over one-third of the state's natural gas. The Buena Vista Oil Field (previously referred to as the Naval Petroleum Reserve # 2 [NPR-2]) lies immediately to the south of the Project. Several large and extensively developed oil

fields, each covering thousands of acres, are located east, south and west of the Project. Elements of the infrastructure associated with petroleum production are found throughout this area. For example, drilling rigs, pumps, pipelines, storage tanks, processing facilities, utility lines and communication towers are prevalent.

Water Banking

Water management and storage (known as water banking) is an important activity in Kern County. The Kern Water Bank Plan is part of the California State Water Project for recharging, extracting, and storing State Water Project water.

Parks and Recreation

Sequoia National Park (94.8 miles northeast of the Project), Sequoia National Forest (73.3 miles northeast of the Project) and the Los Padres National Forest (74.0 miles west of the Project) of the Subject Property are located within the County. The Kern National Wildlife Refuge is located near the Project. In addition, the two major parks in the vicinity of the Project are the 1,585-acre Kern County Buena Vista Aquatic Recreation Area and the 955-acre Tule State Reserve. The Tule Elk State Reserve shelters a small herd of elk and is considered ecologically sensitive. The Kern County Buena Vista Aquatic Recreation Area, located about two miles east of the Project, is an extremely popular local recreational area, featuring boating on two lakes, camping, picnicking, swimming and fishing. Fishing also occurs along portions of the California Aqueduct and the Kern River. A 165-acre golf course and park complex is located west of the recreational area at.

Local Community Development

Development surrounding the Project includes the City of Taft and numerous unincorporated communities of Tupman, Buttonwillow, Derby Acres, McKittrick, Dustin Acres and Valley Acres. The city of Taft had a population of 6,400 in 2000 (U.S. Census Bureau, 2000).

4.9.3 Regulatory Setting

4.9.3.1 Local

The Kern County General Plan provides a general and comprehensive statement of land use policies that will guide future growth of the County. The County's ordinances, in contrast, provide a specific regulatory mechanism used by the County to implement its land use policies. Zoning ordinances give jurisdictional properties a zoning classification, which corresponds to a set of "permitted" and "conditional" uses. Each of the County's land use zones, or districts, is subject to specific development standards and restrictions. In addition to these basic land use policies, there may be regional land use controls, such as Airport Land Use Plans, Regional Transportation Plans, and Regional Housing Allocation Plans.

4.9 LAND USE AND PLANNING

The General Plan contains goals, objectives, and policies and provides an overall foundation for establishing land use patterns. For this land use impact analysis, this section lists all relevant goals, objectives, policies, and implementation measures related to the proposed Project from the Kern County General Plan.

The Zoning Ordinance contains regulations through which the General Plan's provisions are implemented. The most relevant regulations pertaining to the proposed Project are presented below.

Kern County General Plan

The State of California Government Code 65300 requires the County to prepare and adopt a general plan. The Kern County General Plan was originally adopted in 2004 and most recently updated in 2007. Its purpose is to give long-range guidance to county officials making decisions affecting the growth and resources of unincorporated Kern County. The range of the Kern County General Plan is set at 25 years. The Kern County General Plan helps to ensure that day-to-day planning and land use decisions are in conformance with the long-range program designed to protect and further the public interest. It will be periodically reviewed and updated as the goals and requirements of the County evolve and change (Kern County 2004a). Following are goals, policies and implementation measures applicable to the proposed Project.

Chapter 1. Land Use Open Space and Conservation Element

1.3 Physical and Environmental Constraints

Policies

Policy 1. The County will ensure that new developments will not be sited on land that is physically or environmentally constrained ((Map Code 2.1 (Seismic Hazard), Map Code 2.2 (Landslide), Map Code 2.3 (Shallow Groundwater), Map Code 2.5 (Flood Hazard), Map Codes from 2.6 – 2.9, Map Code 2.10 (Nearby Waste Facility), and Map Code 2.11 (Burn Dump Hazard)) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.

Policy 6. Regardless of percentage of slope, development on hillsides will be sited in the least obtrusive fashion, thereby, minimizing the extent of topographic alteration required and reducing soil erosion while maintaining soil stability.

Policy 7. Ensure effective slope stability, wastewater drainage, and sewage treatments in areas with steep slopes are adequate for development.

Implementation Measures

Implementation Measure E. Development proposed in areas with steep slopes will be reviewed for conformity to the adopted Hillside Development Ordinance to ensure that appropriate soil stability, drainage, and sewage treatment will result.

4.9 LAND USE AND PLANNING

3.2 Noise Sensitive Areas

Policies

Policy 4. Utilize good land use planning principles to reduce conflicts related to noise emissions.

Implementation Measures

Implementation Measure A. Utilize zoning regulations to assist in achieving noise-compatible land use patterns.

Airport Land Use Compatibility Plan (ALUCP)

Objective. The County's public-use airports, military bases, and military airspace complex represent a major public investment and contribution to the County's economy. Kern County has adopted an Airport Land Use Compatibility Plan (ALUCP) and alternative process to comply with the State Aeronautics Act (Public Utilities Code commencing with Section 21670).

Issues. Public-use airports and military bases are important to the economic future of communities, but incompatible development can create public safety issues and adverse noise impacts. Encroachment of incompatible uses can adversely affect airport and military base operations and even result in the curtailment of their use. It is imperative that property near airports be developed with compatible uses and that there be clear guidance and information for affected property owners.

Goals

Goal 1. Plan for land uses that are compatible with public airport and military bases and mitigate encroachment issues.

Policies

Policy 1. To the extent legally allowable, prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measures

Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Coordinate and cooperate with airport operators, the County Department of Airports, the California Department of Transportation, Division of Aeronautics, affected cities, EAFB, NAWS China Lake and the Department of Defense (DOD) on the ALUCP, review of land use applications, public education and encroachment issues.

4.9 LAND USE AND PLANNING

4.9.3.2 State

State laws and regulations that apply to the proposed Project and land use include:

California Aeronautics Act

The California Aeronautics Act, Public Utilities Code Section 21001 et seq., sets out requirements for Airport Land Use Commissions and authority to regulate land uses surrounding public use airports and the requirement of a comprehensive airport land use plan.

4.9.4 Impacts and Mitigation Measures

4.9.4.1 Methodology

Land use issues for the proposed Project have been identified and evaluated based on onsite reconnaissance surveys, a review of current U.S. Geological Survey (USGS) 7.5–minute topographic quadrangle maps, aerial photography, a review of local land use ordinances, a review of the land use goals and policies identified in Kern County General Plan, and associated land use and zoning maps. The proposed Project was evaluated with respect to the existing and planned land uses in the surrounding area to determine whether the significance thresholds would be exceeded.

4.9.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on land use if it would:

Physically divide an established community;

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; or

Conflict with any applicable habitat conservation plan or natural community conservation plan.

4.9.4.3 Project Impacts

IMPACT LU-1 Physically Divide an Established Community

Much of the area surrounding the proposed project area consists of agricultural land and open space, with oil extraction and habitat conservation occurring as compatible land uses. The proposed Project would not alter existing land uses and does not include any component that has the potential to physically divide an established community. No impact will result.

Mitigation Measures

No mitigation measures are required.

4.9 LAND USE AND PLANNING

Level of Significance after Mitigation

No Impact.

IMPACT LU-2 Conflict with any Applicable Land Use Plan, Policy, or Regulation of an Agency with Jurisdiction over the Project

The proposed Project is consistent with the land use and zoning designation for the area. The proposed Project would also comply with the applicable sections of the Kern County Zoning Ordinance's Oil and Gas Production Chapter (Chapter 19.98). The Kern County General Plan's Land Use, Open Space and Conservation Element states that petroleum exploration and extraction are "compatible" uses with agricultural designations. As all project activities are proposed to occur on lands already designated for oil extraction activities and agricultural purposes, the proposed Project is not expected to conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT LU-3 Conflict with any Applicable Habitat Conservation Plan or Natural Community Conservation Plan

The proposed Project is within the jurisdictional boundaries of the Elk Hills Habitat Conservation Plan (HCP). The construction of the Project is within the covered land use activities detailed in the HCP. The proposed Project will not be in conflict with the Land Use within the HCP.

The Northern edge of the Subject property is against the Lokern Area of Critical Concern (ACEC) boundary. The Lokern area has been identified by the US Fish and Wildlife Service, California Department of Fish and Game and in the Kern County HCP as a location important for the management of lands to promote the conservation and recovery of endangered species. These land use stipulations will also include stipulations detailed in the Elk Hills HCP for the protection of listed species. The proposed Project will not conflict with the BLM ACEC stipulations, Elk Hills HCP, or the Kern County HCP. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.9 LAND USE AND PLANNING

4.9.5 Cumulative Impacts

Under cumulative conditions, the proposed Project, in combination with other reasonably foreseeable projects in the County would be generally consistent with the Kern County General Plan and Zoning Ordinance provisions. Changes to existing land use patterns as a result of cumulative project implementation could result in conflicts with adjacent land uses and cumulative land use impacts. However, the proposed Project would not require a change in existing land uses nor will it include any residential component that has the potential to add the cumulative impacts of urban sprawl in the County leading to the premature conversion of open space and agricultural lands. Therefore, the proposed Project is not expected to substantially contribute to a cumulative land use impact. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.10 MINERAL RESOURCES

4.10 Mineral Resources

4.10.1 Introduction

This section of the SEI addresses potential impacts of the proposed Project on mineral resources. Kern County's (the County) abundant mineral resources have contributed greatly to the history and development of the San Joaquin Valley. The yearly value of petroleum fuels alone, about 75 percent of the value of all mineral products, typically exceeds the value of agricultural products from the County. Borate minerals, cement, clay, gold, gypsum, pumice, halite, sand and gravel, silver, and tungsten are important mineral products of the County, exclusive of petroleum. Among these, gold ranks first in total value of the metallic mineral products. The two largest gold mines that have operated in the County were the Golden Queen Mine located within the Soledad Mountain district near Mojave and the Yellow Aster Mine near Randsburg. It is estimated that 276 gold mines have operated in Kern County from 1880 to 1957 (Kern County Mining history 2010). Clay, limestone, boron, sand and gravel are the most highly valued non-metallic minerals. Additionally, the County has yielded a significant proportion of California's roofing granules. Kern County's mineral deposits, excluding petroleum, are grouped into 16 individual Mining Districts as illustrated on Figure 4.10-1, Kern County Mining Districts.

4.10.2 Environmental Setting

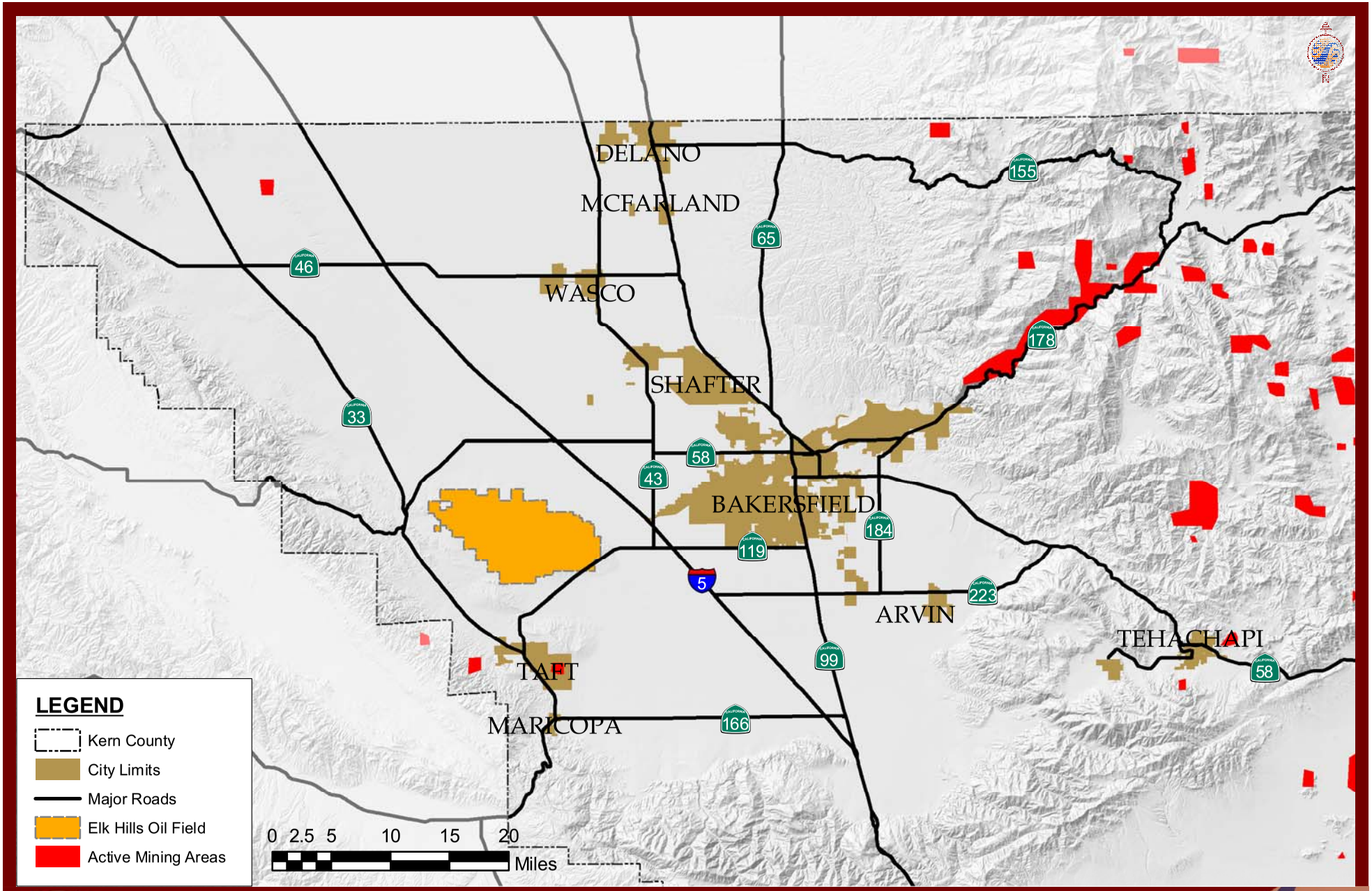
Kern County Regional Setting

Public policy states that the non-renewable characteristic of mineral deposits necessitates the careful and efficient development of mineral resources, in order to prevent the unnecessary waste of these deposits due to careless exploitation and uncontrolled urbanization. Management of these mineral resources will protect not only future development of mineral deposit areas, but will also guide the exploitation of mineral deposits so that adverse impacts caused by mineral extraction will be reduced or eliminated.

The mineral resources addressed in this section pertain to those resources that are classified under the Surface Mining and Reclamation Act of 1975 (SMARA). The SMARA requires the California State Mining and Geology Board (SMGB) to adopt State policy for the reclamation of mined lands and the conservation of mineral resources. The SMARA provides a comprehensive surface mining and reclamation policy with the regulation of surface mining operations to assure that adverse environmental impacts are minimized. The SMARA also encourages the production, conservation, and protection of the State's mineral resources. The SMARA was amended in 1980 to provide for the classification of non-urban area subject to land-use threats incompatible with mining. The classification of land within California takes place according to a priority list that was established by the SMGB in 1982, or when the SMGB is petitioned to classify a specific area. Currently, the State Geologist's SMARA classification activities are carried out under a single program for urban and non-urban areas of the state. Mineral lands are mapped using the California Mineral Land Classification

4.10 MINERAL RESOURCES

System. Priority is given to areas where future mineral resource extraction could be precluded by incompatible land use or to mineral resources likely to be mined during the 50-year period following their classification. Detailed mineral land classification and designation reports provided by the SMGB are on file at the County.



Cartographic Design By: C. Flinders | Environmental Remediation

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Fig. 4.10-1

Kern County Mining Districts

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4.10 MINERAL RESOURCES

Pursuant to SMARA, the California Geological Survey within the State of California, Department of Conservation designates Mineral Resource Zones (MRZ) in portions of the State that are considered to have potentially significant mineral deposits. "Mineral resources" are those economical mineral concentrations in such form and amount that the economic extraction of a commodity from the concentrations is currently potentially feasible. A "reserve" is that part of the resource base which could be economically extracted or produced within the foreseeable future. For any given mineral resource, an area may be classified as follows:

MRZ-1: Areas where the available geologic information indicates that no significant mineral deposits are present, or where it is judged that no significant likelihood exists for their presence.

MRZ-2a: Areas where the available geologic information indicates that significant mineral deposits are present.

MRZ-2b: Areas where the available geologic information indicates that there is likelihood for the presence of significant mineral deposits.

MRZ-3a: Areas where the available geologic information indicates that mineral deposits exist, the significance of which cannot be evaluated from existing data.

MRZ-3b: Areas where the available geologic information indicates that mineral deposits are likely to exist, the significance of which cannot be determined from available data.

MRZ-4: Areas where available geologic information is inadequate for assignment into any other MRZ, or where there is not enough information available to determine the presence or absence of mineral deposits.

The MRZ classifications are applied based on available geologic information and upon geologic appraisal of the mineral resource potential of the land, including geologic mapping and other information on surface exposures, drilling records, and mine data; and on socioeconomic factors such as market conditions and urban development patterns. Within the Bakersfield production-consumption region (including the EHOF) only MRZ-1 through MRZ-3 are used.

Kern County is one of the largest producers of mineral products in California with a production value of almost one-quarter of the State's total. The primary mineral product of the County is petroleum and related products, which contribute approximately 75 percent of the total valuation of all County mineral products. The remaining 25 percent is comprised of sand and gravel, borax, cement products, and other construction and gem-like minerals, such as gold. The Kern County General Plan Land Use designation for areas that produce or could potentially produce productive petroleum fields, natural gas, geothermal resources, and/or mineral deposits is 8.4 – Mineral and Petroleum (minimum parcel size restricted to 5 gross acres). Land uses within the 8.4 General Plan land use designation are limited to activities directly associated with the resources that are extracted.

4.10 MINERAL RESOURCES

Oil Resources

Kern County produces more oil than any other county in California, and is one of the nation's leading petroleum-producing counties. Oil is found in 15 of the 58 counties in California. Mineral and petroleum resources are essential to the County's economy. As new recovery technologies are introduced, petroleum extraction should continue to be of economic importance to the County. And as long as new urbanization is restricted in areas having important mineral and petroleum resources, the future production of these resources remains promising.

The oil industry dates backs to the nineteenth century. The first developed oil field in the County was at the McKittrick Field in 1898. Development was facilitated by existence of the Southern Pacific Railroad from Bakersfield to McKittrick Field.

The Kern River Oil Field was established in 1899 and by 1903, 796 wells produced almost 17 million barrels of oil from the Kern River Field. In 1911, the EHOF was discovered, and in 2008 the EHOF was ranked fifth in recovery of California's Giant oil fields. In the mid-1930's, several valley oil fields were found in large anticlines in Miocene oil sands beneath the valley floor. These discoveries were made following the advent of the reflection seismograph. Discoveries included the Ten Section, Greeley, Rio Bravo North, Coles Levee, South Coles Levee, and Strand oil fields. A summary of oil fields and their total production through 2008 is provided below in Table 4.10-1, Summary of Kern County Oil Fields.

TABLE 4.10-1: SUMMARY OF KERN COUNTY OIL FIELDS

Rank	Field	Date Established	Total Production Through 2008
3	Kern River	1899	2,035 million barrels
5	Elk Hills	1911	1,316 million barrels
29	Kern Front	1912	212 million barrels
38	Edison	1928	149 million barrels
42	Fruitvale	1928	125 million barrels
43	Rio Bravo	1937	118 million barrels
46	Greeley	1936	116 million barrels
47	Round Mountain	1927	113 million barrels

Source: Division of Oil, Gas and Geothermal Resources (2008 Annual Report)

A significant portion of the oil extracted from Kern County is known as "heavy oil", which is very thick and is difficult to pump from the ground. One of the innovations of the industry is to inject steam into the well in order to heat up the oil, thus making it easier to pump out of the ground. This extends the life of the oil fields, but is also expensive. Drilling activity in Kern County hit its peak in the 1950's, and has now stabilized with the number of new wells being drilled.

In 2008, the County produced approximately 162.2 million barrels of oil, representing approximately 68 percent of the total 214.6 million barrels of oil produced statewide, which includes

4.10 MINERAL RESOURCES

the Outer Continental Shelf (2008 Annual Report, Division of Oil, Gas and Geothermal Resources [DOGGR]). According to the BLM, if Kern County were a state, it would be the fourth most productive state in the nation in terms of oil production, and if it were a country, its production figures would qualify it for membership within the Organization of the Petroleum Exporting Countries (OPEC).

Kern County is located within District #4 of the State Department of Conservation, Division of Oil, Gas, and Geothermal Resources. With the exception of about one percent, which comes from Tulare, Kings and San Luis Obispo Counties, all resources produced in District #4 listed in State publications are from Kern County.

The proposed Project Site is located within the EHOF, an active operating oil field (Figure 4.10-2: Kern County Oil Fields Map).

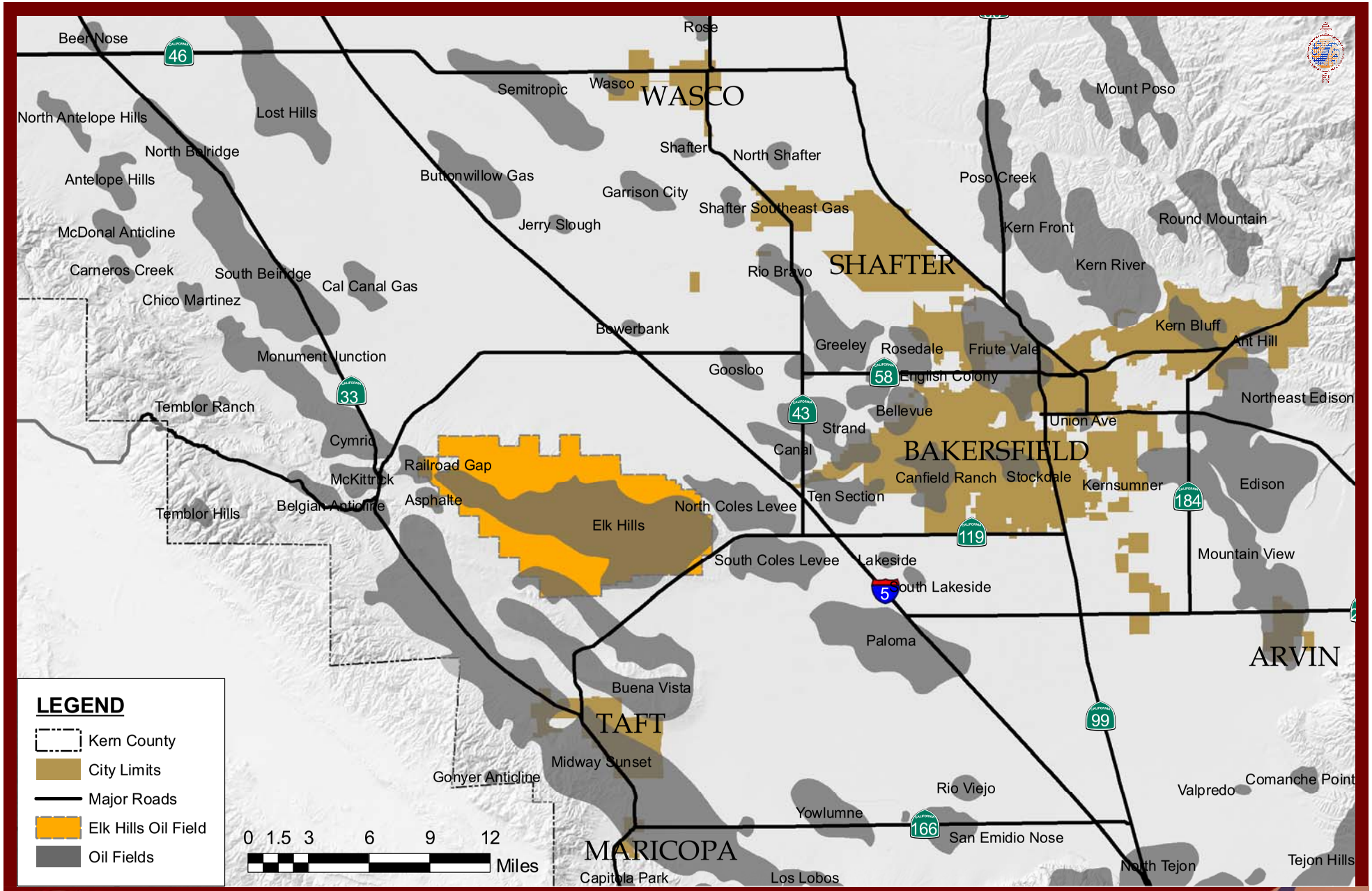

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Fig. 4.10-2

Kern County Oil Fields Map

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4.10 MINERAL RESOURCES

Natural Gas

Natural gas is produced in two basic forms. Associated gas is produced along with crude oil while non-associated gas is produced from gas fields that do not produce any crude oil. Natural gas is produced from reservoirs underground and compressed for transportation through pipelines. Because natural gas usually has no odor and cannot be seen, it is mixed with a chemical that gives it an easy to detect smell in the event of an accidental leak. Natural gas is distributed through underground pipes to its ultimate destination to residential, commercial, manufacturing and utility customers.

California is a major producer of natural gas and Kern County produces more than half of the gas produced in the state. California's net natural gas production in the year 2008 reportedly totaled approximately 296.9 billion cubic feet. According to the 2008 DOGGR report, the EHOF is the largest producer of associated natural gas in California, with a net gas production of 100 billion cubic feet in 2008. The State of California uses over six times the amount of natural gas than it produces.

Sand and Gravel Resources

Major sand and gravel deposits are concentrated primarily along the floodplain and alluvial fan of the Kern River, where clean, coarse deposits have been left by major floods over geologic time. With increasing distance from the Kern River, alluvial deposits tend to become finer grained, and have been harvested to a lesser degree. Sand and gravel are an important resource for construction, development, and physical maintenance of structures. The availability of sand and gravel affects construction costs, tax rates, and affordability of housing and commodities. The State has statutorily required the protection of sand and gravel operations. As transportation costs are a significant portion of the cost of sand and gravel, the long-term availability of local sources of this resource is an important factor in maintaining the economic attractiveness of a community to residents, business and industry.

The major resources of sand and gravel within the County are in the stream deposits along the eastern side of the San Joaquin Valley and in the Sierra Nevada foothills, and in alluvial fan deposits along the north flank of the San Emidio and Tehachapi Mountains. Most of the recent alluvium in the San Joaquin Valley floor is composed of sand used as a source of road base material. The Buttonwillow Compaction Products Mine is located northwest of the Project Site and is designated MRZ-2 for base and fill material.

The proposed Project Site is state-designated as MRZ-3 (PCC) on the 2009 production/consumption region for portland cement concrete grade aggregate (sand and gravel) resources; therefore, it is located within an area containing mineral deposits the significance of which cannot be evaluated from available data (Special Report 210, 2009). The proposed Project Site is located within a currently active oil field and does not contain sand and gravel resources that are currently being extracted. In addition, there was no evidence of past or current sand and gravel extraction occurring within the proposed Project Site.

4.10 MINERAL RESOURCES

Other Mineral Resources

Gold has been the most important metallic mineral mined in Kern County, in terms of the total dollar value. It has been recovered by both placer and lode mining mainly in the Sierra Nevada and desert regions. Associated with gold in the veins are silver, copper, antimony, and lead minerals. While fluctuation in gold prices has caused a reactivation of interest in the commodity over the last two decades, continuous mining activity has been somewhat limited. Placer gold was first mined prior to 1900, with the greatest number of deposits being mined during the late 1920's and 1930's. Principal placer deposits are in the Rand District, El Paso Mountains and along the Kern River. About 1,500 gold claims have been registered in Kern County with approximately 280 of those claims activated as either lode or placer mines. The total amount of gold that was extracted from the Kern County sites is not available, as records were not kept during the more active lode mining activities prior to 1900.

There is no evidence of gold or other precious metal mineral resources located within the proposed Project Site.

Site Characteristics

The general geologic conditions in the proposed Project Site are described in Section 4.6, Geology and Soils. Although portions of Kern County are rich in mineral deposits, the proposed Project Site is not located in an area known for mineral resources of statewide or regional importance (Stickney 2006). There are no mining districts in the proposed Project Site. The closest gold mine is approximately 75 miles southeast of the proposed Project Site, between Rosamond and Mojave known as the Soledad Mountain Mine operated by Golden Queen Mining Company, Ltd.

4.10.3 Regulatory Setting

Oil, gas, and minerals, like land, are considered forms of property. The mineral resources that are beneath a parcel of land (i.e., the mineral estate or subsurface estate) can be owned, and the ownership provides the holder with the mineral rights or subsurface rights; whereas, surface rights refer to ownership of the land, the surface estate, and the right to use that surface. When different parties own the surface and subsurface estates, it is referred to as a "split estate" or "severed estate lands".

The separation of surface and subsurface rights can occur through a mineral reservation. Severance by mineral reservation may occur if a party owning both surface and subsurface rights sells the land, but retains (or reserves) all or a portion of the mineral, oil, and/or gas rights. To preserve title to the subsurface estate, the mineral owner has to record their mineral reservation with the county clerk and recorder's office or some other government land title office. Mineral reservations often occur when lands are originally patented (i.e., the federal government sells the land, but remains the owner of the mineral rights).

4.10 MINERAL RESOURCES

The owners (OEHI and Chevron) of the EHOF own both the surface and mineral rights of the project Site.

The following regulatory discussion provides applicable Federal, State, and County goals, policies, regulations, pertinent to development and operation of the proposed Project.

4.10.3.1 Kern County

Kern County General Plan

The goals, policies, and implementation measures in the Kern County General Plan for mineral resources that are applicable to the proposed Project Site are provided below. In addition, the Kern County General Plan does contain other goals and policies that are more general in nature and are not specific to development such as the proposed Project. Therefore, these goals and policies are not listed below.

Goals

Goal 1. To contain new development within an area large enough to meet generous projections of foreseeable need, but in locations that will not impair the economic strength derived from the petroleum, agriculture, rangeland, or mineral resources or diminish the other amenities that exist in the County.

Goal 2. To protect areas of important mineral, petroleum, and agricultural resource potential for future use.

Goal 3. To ensure that the development of resource areas minimizes effects on neighboring resource lands.

Policies

Policy 14. Emphasize conservation and development of identified mineral deposits.

Implementation Measures

Implementation Measure H. Use the California Geological Survey's latest maps to locate mineral deposits until the regional and statewide importance mineral deposits map has been completed, as required by the SMARA.

Implementation Measure K. Protect oilfields and mineral extraction areas through the use of appropriate implementing zone districts: A (Exclusive Agriculture), DI (Drilling Island), NR (Natural Resource), or PE (Petroleum Extraction).

4.10 MINERAL RESOURCES

4.10.3.2 State

Surface Mining and Reclamation Act of 1975

SMARA, Chapter 9, Division 2 of the Public Resources Code, requires the SMGB to adopt State policy for the reclamation of mined lands and the conservation of mineral resources. These policies are prepared in accordance with the Administrative Procedures Act (Government Code) and are found in California Code of Regulations, Title 14, Division 2, Chapter 8, Subchapter 1.

The intent of the SMARA is to promote production and conservation of mineral resources, minimize environmental effects of mining, and to ensure that mined lands will be reclaimed to conditions suitable for alternative uses. In accordance with SMARA, permits are required for all mining industries commencing operation on or after January 1, 1976.

SMARA mandates the classification of valuable lands in order to protect mineral resources within the State of California subject to urban expansion or other irreversible actions. SMARA also allows the State to designate lands containing mineral deposits of regional or statewide significance.

State Geological Survey

The State Geological Survey has the responsibility to identify and assist in the utilization of mineral deposits, and to identify geological hazards, including fault locations.

Special Publication 51

This publication contains the policies and procedures outlined in the SMARA. This publication is prepared by the SMGB in cooperation with the Office of Mine Reclamation and the California Geological Survey.

Division of Oil, Gas, and Geothermal Resources

DOGGR within the State of California, Department of Conservation supervises the drilling, operation, maintenance, and abandonment of oil, gas, and geothermal wells in order to protect the environment, public health and safety, and encourage good conservation practices. DOGGR collects data on the location of groundwater, oil, gas, and geothermal resources as well as records the location of all drilled and abandoned wells.

4.10.3.3 Federal

Bureau of Land Management (BLM)

The BLM is an agency within the United States Department of the Interior, which administers 261 million surface acres of America's public lands, located primarily in the Western States. The BLM preserves the health, diversity and productivity of public lands for the use and enjoyment of present and future generations. The public lands provide a myriad of opportunities for commercial activities.

4.10 MINERAL RESOURCES

Commercially valuable natural resources include energy and mineral commodities, forest products, grazing forage and special uses such as rights-of-way for pipelines and transmission lines.

The BLM is responsible for managing commercial energy and mineral production from the public lands in an environmentally responsible manner. The BLM is responsible for the leasing of Federal oil, gas and geothermal minerals, as well as for supervising the exploration, development and production operations of these resources on both Federal and Native American Lands. The proposed Project Site is privately owned and is not, in part or whole, under ownership of the BLM.

4.10.4 Impacts and Mitigation Measures

4.10.4.1 Methodology

An assessment of the potential for mineral loss as a result of the proposed Project was performed by assessing the proposed Project Site with respect to California Geological Survey maps, the Kern County General Plan.

4.10.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on mineral resources if it results in the following:

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; or

Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

4.10.4.3 Project Impacts

IMPACT MIN-1 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

The proposed Project Site is located within an area that currently produces oil and natural gas that have economic value. As described above, the proposed Project Site is located within the active EHOF (see Figure 4.10-2: Kern County Oil Fields above) with no other current resource mining operations located within the Project Site. The Project Site is designated MRZ-3 (PCC) and is not located in any of the County's designated sand and gravel aggregate areas or Mining Districts. According to the Department of Conservation California Principal Mineral – Producing Localities 1990-2000, the proposed Project Site is within an area that has the potential to contain Silica (Si), and Shale (SH). Given the Project Site is already an active oil field and does not have the potential to adversely impact other mineral resources, development of the proposed Project Site will result in a less than significant impact to mineral resources.

4.10 MINERAL RESOURCES

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT MIN-2 Result in the Loss of Availability of a Locally Important Mineral Resource Recovery Site Delineated on a Local General Plan, Specific Plan, or other Land Use Plan

As mentioned in IMPACT MIN-1 above, the proposed Project Site would not be located in an area that is identified in the SMARA maps for mineral resources. In the past, the proposed Project Site has been and is currently used for oil exploration and the proposed development is designed to enhance those activities. The proposed Project Site is not used for extracting sand and gravel. Therefore, the proposed Project will not result in a loss of locally important mineral resources upon implementation resulting in a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.10.5 Cumulative Impacts

As discussed above, the proposed Project is limited to utilizing CO2 enhanced oil recovery within an existing oil and gas field. The proposed project does not include any component that will contribute to a substantial cumulative impact to mineral resources. Therefore, implementation of the proposed Project will result in a less than significant cumulative mineral resources impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.11 NOISE

4.11 Noise

4.11.1 Introduction

The purpose of this section is to analyze the potential noise impacts associated with construction and operation of the Project. It describes the existing noise conditions at the EHOF, the regulatory setting, and the potential impacts of the Project. Sources of information used for the preparation of this section included data from the *Kern County General Plan-Noise Element*, the *Kern County Code*, and ambient noise levels measured by Stantec at sensitive receptors located in close proximity to the Project Site.

Terminology and Fundamentals of Environmental Acoustics

The measurement of any sound level requires language used specifically for the measurement of acoustical conditions. Table 4.11-1 defines technical terms that are used in this section.

4.11 NOISE

TABLE 4.11-1: DEFINITIONS OF ACOUSTICAL TERMS	
Term	**Definition**
dB, Decibel	Unit of measurement of sound level
dBA, decibel A-Weighted	A unit of measurement of sound level corrected to the A–weighted scale, as defined in ANSI S1.4–1971 (R1976), using a reference level of 20 micropascals (0.00002 Newtons per square meter).
A – Weighted Scale	A sound measurement scale, which corrects the pressures of individual frequencies according to human sensitivities. The scale is based upon the fact that the region of highest sensitivity for the average ear is between 2,000 and 4,000 Hz. Sound levels are measured on a logarithmic scale in decibels, dB. The universal measure for environmental sound is the A–weighted sound level, dBA.
Hz, Hertz	Unit of measurement of frequency, numerically equal to cycles per second.
Loudness	A listener's perception of sound pressure incident in his ear.
L01, L10, L50, L90	The A–weighted noise levels that are exceeded 1 %, 10 %, 50 %, and 90 % of the time during the measurement period.
Leq, Equivalent Noise Level	Also called the equivalent continuous noise level. It is the continuous sound level that is equivalent, in terms of noise energy content, to the actual fluctuating noise existing at the location over a given period, usually one hour. Leq is usually measured in hourly intervals over long periods in order to develop 24–hour noise levels.
CNEL, Community Noise Equivalent Level	The CNEL is a measure of the cumulative noise exposure in the community, with greater weights applied to evening and night time periods. This noise descriptor is the equivalent noise level over a 24–hour period mathematically weighted during the evening and night when residents are more sensitive to intrusive noise. The daytime period is from 7:00 a.m. to 7:00 p.m.; evening from 7:00 p.m. to 10:00 p.m.; and nighttime from 10:00 p.m. to 7:00 a.m. A weighting factor of 1 dB is added to the measured day levels defined as 7 a.m. to 7 p.m., evening levels (7 p.m. to 10 p.m.) have a weighting factor of three and 10 dB to the night time levels (10 p.m. to 7 a.m.). The weighted levels over a 24–hour period are then averaged to produce the single number CNEL rating.
Ldn, Day/Night Noise Level	The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Measurements of both CNEL and Ldn in the same residential environments reveal that CNEL is usually slightly higher (by less than 1 dB) than Ldn due to the evening factor weighting.
Lmin, Lmax	The minimum and maximum A–weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

The decibel (dB) is the preferred unit used to measure sound levels utilizing a logarithmic scale to account for large range in audible sound intensities. A general rule for the decibel scale is that a 10 dB increase in sound is perceived as a doubling of loudness by the human ear. For example, a 55

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dB sound level will sound twice as loud as a 45 dB sound level. The average healthy person cannot detect differences of 1dB whereas a 5 dB change is clearly noticeable.

Several sound measurement descriptors are used to assess the effects of sound on the human environment. These include the equivalent sound level, Leq, which is the level of a constant sound that has the same sound energy as the actual fluctuating sound. It is similar to the average sound level. The day-night sound level, Ldn, is similar to the 24-hour Leq except that a 10 dB penalty is added to sound levels between 10 p.m. and 7 a.m. to account for the greater sensitivity of people to sound at night. The Community Noise Equivalent Level (CNEL) also places a weighted factor on sound events occurring in the evening hours. The L90 value is the sound level (L) that is exceeded 90 percent of the time and is often used to describe the background or residual sound level. Each of these sound level descriptors is found within the *Kern County General Plan Noise Element* or the *Kern County Code Title 8 Health and Safety, Chapter 8.36 Noise Control* describing noise regulation or policy.

Acoustics is defined as the science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible. Noise, on the other hand, is generally defined as loud, unpleasant, unexpected or undesired sound that disrupts or interferes with normal human activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The objectionable nature of sound is caused by its *pitch* or *loudness*. *Pitch* is the height or depth of a tone or sound wave, depending on the relative rapidity (frequency) of the sound vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. *Intensity* is a measure of the amplitude or height of the sound wave. *Frequency* describes the sound's pitch and is measured in Hertz (Hz), while intensity describes the sound's loudness and is measured in dB.

The *dB* is the preferred unit for measuring sound that indicates the relative amplitude (height) of a particular sound wave. The zero (0) on the decibel scale is based on the lowest sound level that a healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic scale. Thus an increase of 10 dB represents a ten–fold increase in acoustic energy, while a 20 dB increase is 100 times more intense, and a 30 dB increase is 1,000 times more intense. There is a direct relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10dB increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. The A–weighted decibel (dBA) is a method of sound measurement which assigns weighted values to selected frequency bands in an attempt to reflect how the human ear responds to sound. The range of human hearing is from 0 dBA (the threshold of hearing) to about 140 dBA which is the threshold of pain. Examples of noise and their A–weighted decibel levels are shown in Table 4.11–2. In general, a 3 to 5 dBA change in community noise levels starts to become noticeable, while 1 to 2 dBA changes are generally not perceived. Quiet suburban areas typically have noise levels in the range of 40–50 dBA, while those along arterial streets are in the 50–60 dBA or greater range. Normal conversational levels are in the 60–65 dBA ranges.

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In addition to the actual instantaneous measurements of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. To analyze the overall noise levels in an area, noise events are combined for an instantaneous value or averaged over a specific time period. The time–weighted measure is referred to as equivalent sound level and represented by energy equivalent sound level (Leq). The percentage of time that a given sound level is exceeded also can be designated as L10, L50, and L90. The subscript denotes the percentage of time that the noise level was exceeded during the measurement period. Namely, an L10 indicates the sound level is exceeded 10 percent of the time and is generally taken to be indicative of the highest noise levels experienced at a location. The L90 is that level exceeded 90 percent of the time and this level is often called the base level of noise at a location. The L50 sound (that level exceeded 50 percent of the time) is frequently used in noise standards and ordinances. The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within ±1 dBA.

Since the sensitivity to noise increases during the evening and at night (because excessive noise interferes with the ability to sleep) 24–hour descriptors have been developed that incorporate artificial noise penalties that are added to quiet–time noise events. The *CNEL* is a measure of the cumulative noise exposure in a community during a 24–hour period. The *Day/Night Average Sound Level (Ldn)* is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three–hour period are grouped into the daytime period.

Effects of Noise

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

According to the California Department of Industrial Relations, Division of Occupational Safety and Health, which enforces California Occupation Safety and Health Administration (Cal/OSHA) Occupational Noise Exposure Standard is set at the noise threshold where hearing loss may occur from long–term exposures. The maximum allowable level is 90 dBA averaged over an eight (8)-hour time period.

Sleep and Speech Interference

The thresholds for speech interference indoors are 45 dBA if the noise is steady and 55 dBA if the noise is fluctuating. Outdoor thresholds are 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA), and fluctuating noise levels above 45 dBA have been shown to affect sleep. Interior residential standards for multi–family residences are set by the State of California at 45 dBA Ldn.

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Typically, the highest steady traffic noise level during the daytime is equal to the Ldn, and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12–17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is 20 dBA for an older structure and 25 dBA for a newer structure. Sleep and speech interference is therefore possible when exterior noise levels are 57–62 dBA Ldn with open windows and 65–70 dBA Ldn if the windows are closed. Levels of 55–60 dBA are common along collector streets and secondary arterials, while 65–70 dBA is a typical value for a primary/major arterial. Levels of 75–80 dBA are normal noise levels at the first row of development outside a freeway right–of–way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed and those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noise intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio, and television, house vibrations, and interference with sleep and rest. The Ldn as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is 55 dBA Ldn. At an Ldn of 60 dBA, approximately 2 percent of the population is highly annoyed. When the Ldn increases to 70 dBA, the percentage of the population increases to 12 percent highly annoyed. This corresponds to an increase of 1 percent per dBA between an Ldn of 60–70 dBA. Between an Ldn of 70–80 dBA, each increase in decibels increases the population highly annoyed by 2 percent.

People appear to respond more adversely to aircraft noise as opposed to general community noise levels. When the Ldn is 60 dBA; approximately 10 percent of the population is highly annoyed. Each decibel increase to 70 dBA adds 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in a 3 percent increase in the percentage of the population highly annoyed. Representative outdoor and indoor noise levels in units of dBA are shown in Table 4.11-2.

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TABLE 4.11-2 TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT

At a Given Distance from Noise Source	A–Weighted Sound Level in dBA	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100′)	130	Rock Music Concert	
Jet Takeoff (200′)	120		
	110		Pain Threshold
Diesel Pile Driver (100′)	100		
	90	Boiler Room Printing Press Plant	Very Loud
Freight Cars (50′)			
Pneumatic Drill (50′)	80		
Freeway (100′)	70		
Vacuum Cleaner (10′)		In Kitchen With Garbage Disposal Running	Moderately Loud
	60		
Light Traffic (100′)	50	Data Processing Center	
Large Transformer (200′)			
	40	Department Store	Quiet
Soft Whisper (5′)	30		
	20	Private Business Office Quiet Bedroom	
	10	Recording Studio	Threshold of Hearing
	0		

Source: USEPA 1971, Barnes, et al., 1976.

4.11.2 Environmental Setting

Affected Noise Environment

The Project Site is located primarily within an area used for mineral and petroleum extraction. The eastern portion of the Project Site is located approximately 1.5 miles west of the unincorporated community of Tupman and 0.8 mile northwest of Taft Highway (State Highway 119) and extends approximately 5 miles to the west. The western portion of the Project Site is located approximately 3.4 miles to the northwest of the intersection of Skyline Road and Elk Hills Road and extends approximately 3 miles to the northwest (Northwest Stevens).

The primary noise sources at and around the Project Site are vehicular traffic from Skyline Road and Elk Hills Road and petroleum extraction operations.

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Project Noise Setting

The "acceptable" guideline level is an Ldn (or CNEL) of 65 dBA for outdoor noise levels in residential districts. If existing levels are found to be above the guideline up to 65 dBA, then the level is considered to be "conditionally acceptable" and additional acoustical analyses are required to demonstrate that noise impacts will be mitigated to a less than significant level by appropriate project design.

Noise levels generated from highway and roadway traffic on State Highway 119 and Tupman Road do not vary significantly from month to month or from season to season. Noise generated from vehicular highway traffic in the Project Site is a constant "white" noise. The steady flow of traffic does not produce sharp unsteady noises, but rather constant sounds which may increase or decrease slightly with changes in traffic flow. According to Caltrans, Traffic Operations Program-Traffic and Vehicular Data Systems (http://traffic-counts.dot.ca.gov/2009all/Route118-133i.htm), State Highway 119 (between Elk Hills Road and Aqueduct Service Road) and Tupman Road (which are less than 2 miles from the Project Site) have changes in monthly traffic levels from the peak month to the average month which are approximately 7 percent. This relatively small level of traffic volume change from month to month will not have a significant overall impact on the seasonal noise generation from the adjacent State Highway 119.

As a general rule, sound from localized or point sound sources spreads out as it travels away from the source, and the sound level drops at a rate of 6 dB for each doubling of distance. Any solid structure such as a berm, wall, or building that blocks the line of sight between a source and a receiver serves as a sound barrier and will result in additional sound attenuation. The amount of additional attenuation is a function of the difference between the length of the sound path over the barrier and the length of the direct-line-of-sight path. Thus, the sound attenuation of a barrier between a source and a receiver that are very far apart will be much less than the attenuation that would result if either the source or the receiver is very close to the barrier.

Sensitive Receptors

Seven sensitive receptors (residential land uses) are located within areas that could be potentially impacted by noise generated by the Project. Stantec measured the daytime ambient noise levels at each of the seven identified sensitive receptors on September 21, 2010 using a Bruel & Kjaer Type 2236 noise meter. The sensitive receptors, proximity to the Project Site, and the ambient noise level are presented in Table 4.11-3 *Sensitive Receptors in Close Proximity to Project Site*. The locations of the sensitive receptors are shown in Figure 4.11-1 *Sensitive Noise Receptor Map*.

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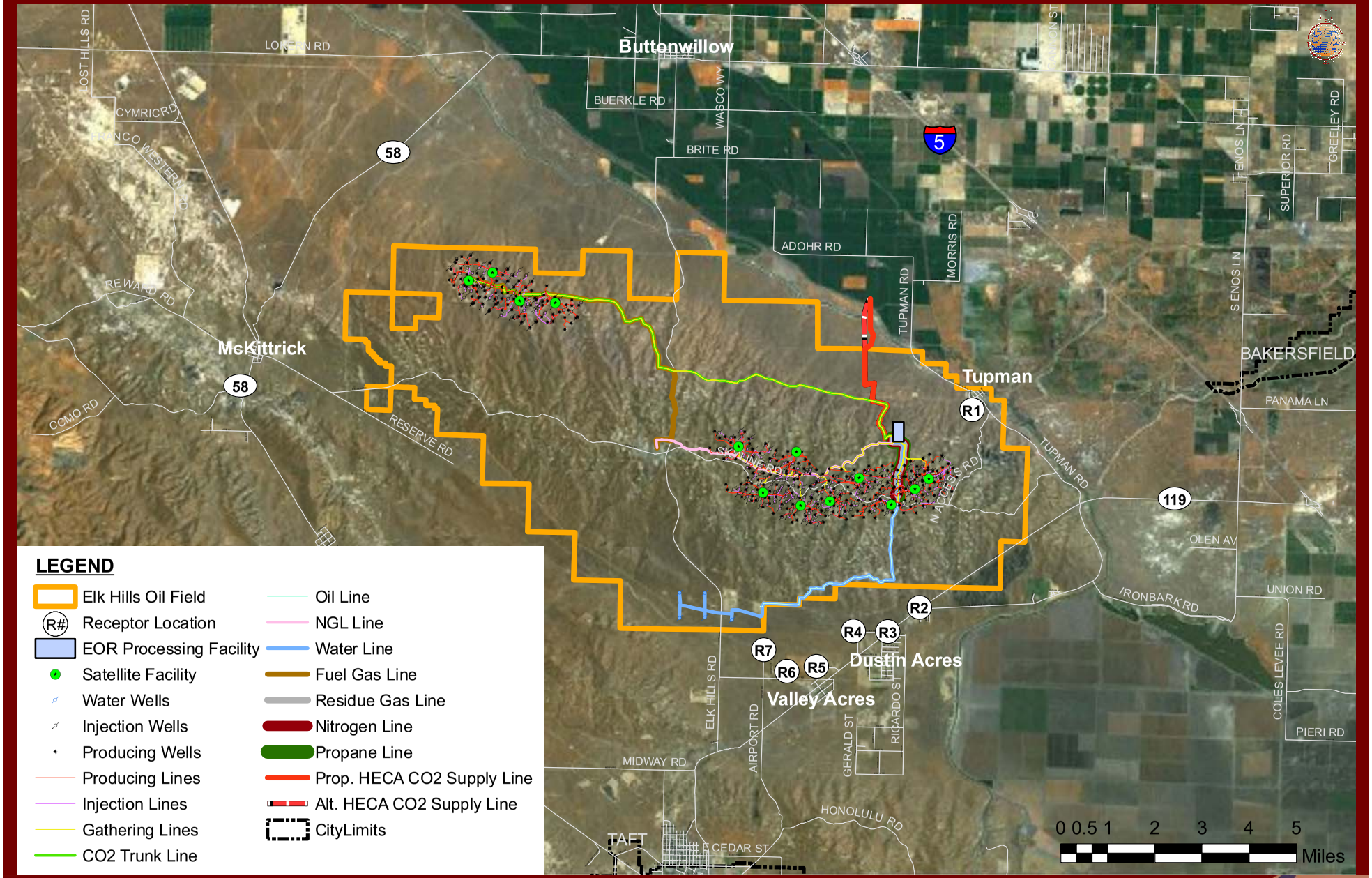
TABLE 4.11-3: SENSITIVE RECEPTORS IN CLOSE PROXIMITY TO PROJECT SITE			
Receptor Identification	**Receptor Description**	**Receptor Location**	**Daytime Ambient Noise Level (Leq)***
R1	**Tupman**: Intersection of Grace Avenue and Kern Street	East of construction (~1.5 miles) Northeast of operations (~1.5 miles)	62.2 dBA
R2	North of **Dustin Acres**: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Southeast of construction (~1 mile) Southeast of operations (~3.5 miles)	73.2 dBA
R3	**Dustin Acres**: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Southwest of construction (~1 mile) Southeast of operations (~4 miles)	71.9 dBA
R4	**Dustin Acres**: Intersection of Tank Road and Tank Farm Road	Southeast of construction (~1 mile) South of operations (~4 miles)	66.8 dBA
R5	**Valley Acres**: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	South of construction (~1.2 miles) Southwest of operations (~5 miles)	63.8 dBA
R6	**Valley Acres**: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	South of construction (~1.2 miles) Southwest of operations (~5.3 miles)	61.2 dBA
R7	**Valley Acres**: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	South of construction (~1 mile) Southwest of operations (~5.4 miles)	76.0 dBA
*Data collected by Stantec Personnel on September 21, 2010 during daytime hours.			



Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Fig. 4.11-1

Sensitive Noise Receptor Map

OEHI CO2 EOR Project - Supplemental Environmental Information

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Project # 185802314

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4.11.3 Regulatory Setting

Local agencies may regulate noise levels of most sources not regulated by the Federal government, may provide standards for insulation of noise receivers either within the structure or by placement of noise barriers such as wall, and, through land use decisions, may reduce noise impacts by separating noise generator from noise sensitive uses.

4.11.3.1 Local

Kern County General Plan

The goals and policies set forth by the *Kern County General Plan Noise Element* have been established in order to protect the acoustical environment for Kern County and to assure a comfortable and calming quality of life for residents. The *Kern County General Plan Noise Element* requires indoor noise levels in habitable rooms be limited to 45 dBA Ldn. The typical attenuation factor for structures with closable windows is 20 dBA, the maximum noise level in outside living areas, such as yards, is required to be less than 65 dBA Ldn. A noise level of 65 dBA Ldn is considered the upper limit for noise-sensitive land uses such as residential areas, schools, convalescent and acute care hospitals, parks and recreation areas and churches. The Project will have to meet the goals and policies outlined in the *Kern County General Plan Noise Element.*

3.0 Noise Element

Goals

Goal 1. Ensure that residents of Kern County are protected from excessive noise and that moderate levels of noise are maintained.

Goal 2. Protect the economic base of Kern County by preventing the encroachment of incompatible land uses near known noise producing roadways, industries, railroads, airports, oil and gas extraction, and other sources.

Policies

Policy 1. Review discretionary industrial, commercial, or other noise-generating land use projects for compatibility with nearby noise-sensitive land uses.

Policy 2. Require noise levels criteria applied to all categories of land uses to be consistent with the recommendations of the California Division of Occupational Safety and Health (DOSH).

Policy 3. Encourage vegetation and landscaping along roadways and adjacent to other noise sources in order to increase absorption of noise.

Policy 4. Utilize good land use planning principles to reduce conflicts related to noise emissions.

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Policy 5. Prohibit new noise-sensitive land uses in noise-impacted areas unless effective mitigation measures are incorporated into the project design. Such mitigation shall be designed to reduce noise to the following levels:

e. 65 dB Ldn or less in outdoor activity areas

f. 45 dB or less within interior living spaces or other noise sensitive interior spaces.

Policy 6. Ensure that new development in the vicinity of airports will be compatible with existing and projected airport noise levels as set forth in the ALUCP.

Policy 7. Employ the best available methods of noise control.

Implementation Measures

Implementation Measure A. Utilize zoning regulations to assist in achieving noise-compatible land use patterns.

Implementation Measure B. Require proper acoustical treatment of transportation facilities, including highways, airports, and railroads.

Implementation Measure C. Review discretionary development plans, programs and proposals, including those initiated by both the public and private sectors, to ascertain and ensure their conformance to the policies outlined in this element.

Kern County General Plan Land Use Categories

The Kern County General Plan Noise Element refers to L_{50} data as the typical criteria data, which is noise occurring 50 percent of the time, i.e., the median noise value for a data set. On the other hand, the Ldn represents a single value reflecting greater weight assigned to evening and nighttime readings to account for the sensitivity of receptors at night. As defined previously, noise values measured in the evening (7 p.m. to 10 p.m.) have 3 dB added and at night (10 p.m. to 7 p.m.) have 10 dB added to them before being averaged into the Ldn value (the noise is treated as being 3 and 10 times louder). Table 4.11-4, Kern County Noise Element Land Use Categories, divides land uses into four categories below and Table 4.11-5, Noise Level Standards, describes the permitted sound levels for each land use category.

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TABLE 4.11-4: KERN COUNTY NOISE ELEMENT USE CATEGORIES			
Insensitive Land Uses	**Moderately Sensitive Land Uses**	**Sensitive Uses**	**Highly Sensitive Uses**
Land Uses that are not adversely affected by any higher noise levels (no noise controls necessary). **Examples:** Agriculture Livestock Farms Mining and Extraction Water Areas Natural Open Space Railways and Terminals Transit Systems and Terminals Automobile Parking Warehouse Utilities Construction Yards	Included are those uses that are not adversely affected by moderate noise levels (some noise control measures should be established to control the higher level noises). **Examples:** Country Clubs Athletic Clubs Golf Courses Equestrian Clubs Scientific Testing Government Services Lodges, Community Associations Professional Offices	Those uses where noise controls are necessary (without noise control the uses would be greatly disrupted). **Examples:** Cemeteries Single-family Dwellings Mutli-family Dwellings Dormitories Resort Hotels Preschools Motor Inns Mobile Home Parks Professional Research	Includes uses where any noise would be greatly disruptive (effective noise control measures are very important for these uses). **Examples:** Rural Single-Family Dwellings Educational Facilities Hospitals Convalescent Homes Wildlife Sanctuaries Churches Auditoriums, Concert Halls

TABLE 4.11-5: NOISE LEVEL STANDARDS			
Land Use Category	**L_{50} Noise Levels dBA Ldn**		
	Day	**Night**	**CNEL**
Insensitive Uses	65	60	75
Moderately Sensitive Uses	60	55	70
Sensitive Uses	55	45	65
Highly Sensitive Uses	50	40	60

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Kern County Airport Land Use Compatibility Plan

The evaluation of airport/land use noise compatibility shall consider the future CNEL contours of each airport. According to the Kern County Airport Land Use Compatibility Plan, these contours are calculated based upon aircraft activity forecasts which are set forth in an airport master plan or which are considered by the local agency to be plausible.

Kern County Code

Kern County codes are intended to promote and protect public peace, health, safety, and welfare and to guide growth and development in the keeping with the Kern County General Plan. The following are prohibited sounds established by the Kern County Code, chapter 8.36.020.

It is unlawful for any person to do, or cause to be done, any of the following acts within the unincorporated areas of the County:

e. Operate any public address system in any event when the sound emanating there from can be heard beyond the confines of any permanent building to such degree that such sound constitutes a loud and raucous noise;

f. Operate any public address system when the sound emanating there from can be heard beyond the confines of a permanent building when such operation constitutes the promotion or advertisement of any private affair or business or commercial enterprise;

g. Operate any public address system when the sound emanating there from can be heard beyond the confines of a permanent building when such operation is for purposes other than the promotion or advertisement of any private affair or business or commercial enterprise unless such operation shall first be declared as hereinafter provided;

h. The provisions of subsection (D) of this section shall not prohibit the incidental sounding, between the hours of nine (9:00) a.m. and nine (9:00) p.m. of any day, of a musical sound apparatus consisting of bells or the sounding of a bell or horn when the sound thereof is not audible to a person of average hearing faculties or capacity at a distance of one hundred fifty (150) feet, when such incidental sounding is in connection with the ordinary use and operation of a tradesman's, peddler's, or huckster's cart, wagon or other vehicle; provided, however, that no such sounding in any event shall be permitted between the hours of nine (9:00) p.m. of any day and nine (9:00) a.m. of the following day;

i. Operate or permit to be operated any public address system or sound equipment so as to be audible to a person of average hearing faculties or capacity at a distance of:

    1. One hundred fifty (150) feet from the public address system or sound equipment, if operated on a public street, sidewalk or any other public property, or

2. If operated elsewhere, one hundred fifty (150) feet from the property line of the property on which the public address system or sound equipment is located, or

3. Between the hours of eight (8:00) a.m. and midnight (12:00) a.m., one thousand (1,000) feet from the public address system or sound equipment connected with either short-term events held on public property with the consent of the responsible public agency, short-term public events held historically and regularly, or short-term events authorized by any kind of permit or license issued by the county. This subsection shall not apply to acts proscribed by Section 27007 of the California Vehicle Code, as amended from time to time. (Ord. G-6301 §§ 4, 5, 1996; prior code § 6351).

j. To create noise from construction, between the hours of nine (9:00) p.m. and six (6:00) a.m. on weekdays and nine (9:00) p.m. and eight (8:00) a.m. on weekends, which is audible to a person with average hearing faculties or capacity at a distance of one hundred fifty (150) feet from the construction site, if the construction site is within one thousand (1,000) feet of an occupied residential dwelling except as provided below:

1. The development services agency director or his designated representative may for good cause exempt some construction work for a limited time.

2. Emergency work is exempt from this section.

4.11.3.2 State

Two state laws address occupational noise exposure for construction workers and vehicle noise that apply to the Project. The Cal-OSHA regulations, which are the same as the federal OSHA regulations, are described below under the *Federal* subheading. The regulations are contained in 8 California Code of Regulations (CCR), General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq. 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, the Kern County Sheriff's Office, within the Project Site area. The California State Government Code, Section 65302, requires local governments (Counties and Cities) to prepare plans that contain noise provisions and standards. Kern County conforms to the Government Code requirements with the *Kern County General Plan Noise Element* outlined above.

California Energy Commission

The CEC guidelines state that the area of impact to be studied should include areas where the noise of the project plus the background exceeds the existing background levels by 5 dBA or more at the sensitive receptor, including those receptors that are considered a minority population. The CEC has considered it reasonable to assume that an increase in background noise levels up to 5 dBA in a residential setting is considered insignificant, while an increase of more than 10 dBA in a residential

setting is considered significant. For projects where the increase is between 5 and 10 dBA, the level of an impact depends on the particular circumstances of a case. Factors to be considered in determining the significance of an impact for this plus 5 to plus10 dB situation include:

- Resulting noise level;
- Duration and frequency of the noise;
- Number of people affected;
- Land use designation of the affected receptor sites; and
- Public concern or controversy as demonstrated at workshops or hearings, or by correspondence.

4.11.3.3Federal

The federal government has no standards or regulations applicable to off-site noise levels from the Project. However, guidelines are available from the USEPA (1974) to assist state and local government entities in development of state and local LORS for noise.

On-site noise levels are regulated, in a sense, through the Occupational Safety and Health Act of 1970 and through the OSHA. The noise exposure level of workers is regulated at 90 dBA over an eight (8)-hour work shift to protect hearing (29 CFR 1910.95). On-site noise levels will generally be in the 70 to 85 dBA range. Areas above 85 dBA will be posted as high noise level areas and hearing protection will be required.

4.11.4 Impacts and Mitigation Measures

4.11.4.1 Methodology

Potential sources of noise associated with the Project include:

- Construction activities
  - Vehicles on roadways;
  - CO2 EOR Processing Facility construction;
  - Satellite station construction;
  - Pipeline installations; and
  - Well installations.
- Operational activities

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- Vehicles on roadways;
- Routine activities typical of existing oil field operation; and
- Pumps and compressors at the CO2 EOR Processing Facility.

Many of the above components are located in areas without the presence of nearby sensitive receptors and have not been considered further in this analysis. This analysis focuses on the potential noise impacts of the following:

- Vehicle use on roadways;
- CO2 EOR Processing Facility construction near the community of Tupman;
- Operation of the CO2 EOR Processing Facility near the community of Tupman;
- Pipeline construction near the community of Dustin Acres; and
- Pipeline construction near the community of Valley Acres.

Sound levels produced by these various sources are based on data from standard references, previous studies, and equipment manufacturers' data. Projected sound levels from these sources were estimated using a point source attenuation model. Noise from the source was assumed to attenuate at a rate of 6dB for each doubling of distance. To determine potential noise impacts, the noise levels of these activities were estimated at the closest sensitive receptor and compared to the Kern County standard noise level of 65 dBA. In addition, the Project's potential noise impacts were assessed and compared to the below significance thresholds. Where a noise level is predicted to exceed a threshold, the impact was considered significant and mitigation measures are as applicable.

4.11.4.2 Threshold of Significance

Appendix G of CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant noise impact if it would result in:

Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

Exposure of persons to, or generation of, excessive ground borne vibration or ground borne noise levels;

Substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

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For a project located within the Kern County Airport Land Use Compatibility Plan, exposure of people residing or working in the project area to excessive noise levels; or

For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

While CEQA does not specifically define what noise level increase is considered substantial, generally in high noise environments a project is considered by the County to have a significant impact if the project would: 1) substantially and permanently increase existing noise levels by more than three (3) dBA ldn (three decibels is the minimum increase generally perceptible by the human ear); or 2) would cause ambient noise levels to exceed the guidelines established in the Kern County General Plan Noise Element. In addition, the California Energy Commission has determined that a 5 dBA increase in noise levels at residential receptors is potentially significant.

4.11.4.3 Project Impacts

IMPACT NOISE-1 Expose Persons to Noise in Excess of Standards Established in the *Kern County General Plan* **or Noise Ordinances, or other Applicable Standards of Other Agencies**

Implementation of the Project will create an increase in noise levels both during construction and operation of the Project. Construction of the Project will require the use of conventional construction equipment which has the potential to generate noise levels at sensitive receptors that exceeds Kern County's general 65 dB Ldn exterior noise level standard. The noise level would vary during the construction period, and is dependent upon the construction phase and types of equipment in use.

The closest sensitive receptor to the Project site is R1, the intersection of Grace Avenue and Kern Street in the Town of Tupman located approximately 1.5 miles northeast of the Project Site. The noise levels associated with installation of the CO2 EOR Processing Facility installation and CO2 EOR Processing Facility operation were modeled at sensitive receptor R1. In addition, noise levels associated with piping installation were modeled at sensitive receptors R2, R3, R4, R5, R6, and R7. The estimated noise levels were then compared to the Kern County exterior noise level standard of 65 dB Ldn to determine if the standard would be exceeded. A summary of the modeling results is presented in Table 4.11-6. The ambient noise levels at the sensitive receptors and a comparison of the Project additive noise impacts are summarized in Table 4.11-7. The noise model spreadsheets for each modeled scenario are included as Appendix B.

4.11 NOISE

TABLE 4.11-6: ESTIMATED NOISE LEVELS AT SENSITIVE RECEPTORS

Sensitive Receptor	Noise Scenario Modeled	Estimated Ldn at Receptor	Exceedance of County Standard?
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Installation	61.2	No
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Operation	61.2	No
R2 - North of Dustin Acres: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Pipeline Installation	72.0	Yes
R3 - Dustin Acres: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Pipeline Installation	70.7	Yes
R4 - Dustin Acres: Intersection of Tank Road and Tank Farm Road	Pipeline Installation	65.6	Yes
R5 - Valley Acres: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	Pipeline Installation	62.6	No
R6 - Valley Acres: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	Pipeline Installation	60.1	No
R7 - Valley Acres: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	Pipeline Installation	74.8	Yes

4.11 NOISE

TABLE 4.11-7: AMBIENT NOISE LEVELS AND PROJECT INCREASE

Sensitive Receptor	Noise Scenario Modeled	Ambient Noise Level at Sensitive Receptor		Estimated Noise Level at Sensitive Receptor with Project		Project's Estimated Additive Noise	
		Leq (dBA)	Ldn (dBA)	Leq (dBA)	Ldn (dBA)	Leq (dBA)	Ldn (dBA)
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Installation	62.2	61.0	62.4	61.2	0.2	0.2
R1 - Tupman: Intersection of Grace Avenue and Kern Street	CO2 EOR Processing Facility Operation	62.2	61.0	62.2	61.2	0	0.2
R2 - North of Dustin Acres: Intersection of Taft Highway (State Highway 119) and Golf Course Road	Pipeline Installation	73.2	72.0	73.2	72.0	0	0
R3 - Dustin Acres: Intersection of Taft Highway (State Highway 119) and Tank Farm Road	Pipeline Installation	71.9	70.7	71.9	70.7	0	0
R4 - Dustin Acres: Intersection of Tank Road and Tank Farm Road	Pipeline Installation	66.8	65.6	66.8	65.6	0	0
R5 - Valley Acres: Intersection of Mesquite Street (unpaved) and Tamarisk Avenue (unpaved)	Pipeline Installation	63.8	62.6	63.8	62.6	0	0
R6 - Valley Acres: Intersection of Escudo Drive (unpaved) and Gibbs Street (unpaved)	Pipeline Installation	61.2	60.0	61.3	60.1	0.1	0.1
R7 - Valley Acres: Airport Road (unpaved) approximately 0.5 miles South of the Intersection of Airport Road and Valley West Road	Pipeline Installation	76.0	74.8	76.0	74.8	0	0

4.11 NOISE

Construction

As shown in Table 4.11-6, the Kern County exterior noise standard is expected to be exceeded in Dustin Acres and Valley Acres during pipeline construction. Construction related noise impacts in Tupman will be below the Kern County standards and are therefore less than significant. However, as shown in Table 4.11-7, the ambient Ldn noise levels at all four sensitive receptors projected to exceed the Kern County exterior noise standard with inclusion of the Project already exceed the standard under baseline conditions. The existing high noise environment near the sensitive receptors in Dustin Acres and Valley Acres is attributable to vehicular traffic on State Highway 119.

The noise modeling performed as part of this analysis further demonstrates that noise from the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and 0.1 dBA at R6 during pipeline installation. This increase will not result in an exceedance of the Kern County exterior noise standard of 65 dBA Ldn. Due to distance, Project related noise will not increase any noise level at the other receptors considered in this analysis. As such, noise from the Project will not cause an exceedance or measurably contribute to an existing exceedance of the Kern County exterior noise level standard.

The Kern County Code prohibits noise from construction, between the hours of nine (9:00) p.m. and six (6:00) a.m. on weekdays and nine (9:00) p.m. and eight (8:00) a.m. on weekends, which is audible to a person with average hearing faculties or capacity at a distance of one hundred fifty (150) feet from the construction site, if the construction site is within one thousand (1,000) feet of an occupied residential dwelling. As shown in Table 4.1-3, the closest residential dwelling to construction sites is 5,000 feet; five times the distance threshold considered in the Kern County Code. As such, construction noise from the Project is not expected to violate the Kern County Code.

Considering the above, the Project will not expose persons to construction noise in excess of standards established by Kern County. This is a less than significant impact.

Operation

A majority of facility operations will occur many miles from sensitive receptors and will have no contribution to noise at sensitive receptor locations. Operation of the CO2 EOR Processing Facility is the only operational Project component that has the potential to impact a sensitive receptor R1. Noise associated with CO2 EOR Processing Facility operation was modeled to determine its potential affect on noise levels at R1. As shown in Table 4.11-3, noise from CO2 EOR Processing Facility operation is expected to result in a 61.2 dBA Ldn at R1 which is 0.2 dBA above ambient noise levels. As the Ldn is expected to be below the 65 dBA County standards, operation of the CO2 EOR Processing Facility is not expected to contribute to a substantial increase in noise levels at R1.

Operation of the Project is anticipated to create up to 25 full-time employment positions and the potential to add up to 25 vehicle roundtrips to area roadways. This incremental increase is not

expected to substantially affect existing roadway noise levels or expose persons to noise levels in excess of established standards.

Considering the above, the operation of the Project will not expose persons to noise in excess of standards established by Kern County. This is a less than significant impact.

Mitigation Measure

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-2 Expose Persons to Excessive Ground Borne Vibration or Ground Borne Noise Levels

Excessive ground borne vibration or noise levels are not anticipated during either construction or operation of the proposed Project. The most likely project component to result in ground borne vibrations would be from the operation of conventional construction equipment involved in installation of pipelines and the CO2 EOR Processing Facility. Vibration from typical construction and earthmoving activity is generally below the threshold of perception at distances of more than about 50 feet (U.S. Fish & Wildlife Service, 2006). Given the one mile distance of the nearest construction site to a sensitive receptor, excessive ground borne vibration or noise levels are not anticipated. Project operation does not include any component that has the potential to produce ground borne vibration or noise levels. The Project will have a less than significant ground borne vibration and noise level impact.

Mitigation Measure

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-3 Cause a Substantial Permanent Increase in Ambient Noise Levels in the Project Vicinity above Levels Existing

As shown in Table 4.11-7, noise modeling performed as part of this analysis demonstrates that the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and operation and 0.1 dBA at R6 during pipeline installation. The Project will have no affect on ambient noise levels at other sensitive receptors or during other activities. As persons are generally only able to detect at least a 1 dBA noise level change, the 0.2 dBA (R1) and 0.1 dBA (R6) Project-related increases in noise levels will be unnoticeable. In addition, the

incremental increase in noise levels at R1 and R6 will be temporary during construction near the receptor. Considering the above, the Project will not cause a substantial permanent increase in ambient noise levels in the Project vicinity above existing levels. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-4 Cause a Substantial Temporary or Periodic Increase in Ambient Noise Levels in the Project Vicinity above Levels Existing

As shown in Table 4.11-7, noise modeling performed as part of this analysis demonstrates that the Project will only incrementally increase noise levels by 0.2 dBA at R1 during CO2 EOR Processing Facility installation and operation and 0.1 dBA at R6 during pipeline installation. The Project will have no affect on ambient noise levels at other sensitive receptors or during other activities. As persons are generally only able to detect at least a 1 dBA noise level change, the 0.2 dBA (R1) and 0.1 dBA (R6) Project-related increases in noise levels will be unnoticeable. Considering the above, the proposed Project will not cause a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above existing levels. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-5 Expose People Residing or Working in the Project Area to Excessive Noise Levels for a Project Located within the Kern County Airport Land Use Compatibility Plan

There are five public airport facilities within the immediate vicinity of the Project Site:

1. Elk Hills – Buttonwillow Airport –approximately 5 miles northwest of the Project Site.
2. Taft Airport – approximately 12 miles southwest of the Project Site
3. Minter Field – approximately 17 miles northeast of the Project Site
4. Meadows Field – approximately 20 miles northeast of the Project Site
5. Bakersfield Municipal – approximately 21 miles east of the Project Site

4.11 NOISE

The Project Site is not within an area identified within the Kern County Airport Land Use Compatibility Plan nor is it within an area affected by airport noise. Therefore, the Project will not expose people residing or working in the Project area to excessive noise levels for a project located within the Kern County Airport Land Use Compatibility Plan. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT NOISE-6 Expose People Residing or Working in the Project Area to Excessive Noise Levels for a Project within the Vicinity of a Private Airstrip

A private airstrip is located in the vicinity of the Project Site; however, this airstrip is no longer used. Therefore, the proposed Project will not expose people residing or working in the Project area to excessive noise levels from a private airstrip. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.11.5 Cumulative Impacts

The HECA Project is the only cumulative project considered in this analysis that has the potential to combine with noise impacts from the proposed Project to result in cumulative noise impacts in Tupman (R1). The HECA Project is located approximately 1.5 miles northwest of Tupman, while the proposed Project is located approximately 1.5 miles southwest of Tupman. Based on the construction noise modeling results of each project, noise levels are not individually or cumulatively expected to substantially increase noise levels in Tupman. Operation of the proposed Project is expected to generate an attenuated noise level of 39.2 dBA Leq at R1. Operation of the HECA Project is expected to generate an attenuated noise level of approximately 25 dBA Leq at R1. The additive noise levels of these two sources in consideration of existing ambient noise levels was estimated to be 62.2 dBA Leq (see Appendix B).

As 62.2 dBA Leq is the existing daytime ambient noise level at R1, operation of the Project and HECA Project will not measurably increase noise levels at R1. Therefore, the Project will not substantially contribute to a cumulative noise impact. This is a less than significant impact.

4.11 NOISE

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.12 POPULATION AND HOUSING

4.12 Population and Housing

4.12.1 Introduction

This section addresses potential impacts of the proposed Project on population and housing in the area and provides an overview of the regulatory setting as well as projected population growth and future housing needs.

Sources of information and data provided in this section include the *Kern County General Plan* and Housing Element, the 2007 Regional Housing Assessment Plan, and demographic information from the U.S. Census Bureau and the California Department of Finance (DOF).

4.12.2 Environmental Setting

Existing Conditions

Population

At 8,202 square miles, Kern County is the third largest county in California. Because of its size, the Kern County Housing Element divides the County into nine subareas; the proposed Project Site lies within the Westside subarea. The Westside subarea encompasses the western portion of the County. The City of Taft is located in the area, along with the unincorporated communities of Derby Acres, Dustin Acres, Fellows, McKittrick, Tupman, and Valley Acres.

Derby Acres

As of 2000, there were 376 people, 125 households, and 101 families residing in Derby Acres. The population density was 102.8 people per square mile. There were 145 housing units at an average density of 39.6 per square mile (US Census Bureau, 2000).

Dustin Acres

As of 2000, there were 585 people, 199 households, and 161 families residing in Dustin Acres. The population density was 159.7 people per square mile. There were 215 housing units at an average density of 58.7 per square mile (US Census Bureau, 2000).

Fellows

As of 2000, there were 153 people, 56 households, and 39 families residing in Fellows. The population density was 232.4 people per square mile. There were 58 housing units at an average density of 88.1 per square mile (US Census Bureau, 2000).

4.12 POPULATION AND HOUSING

McKittrick

As of 2000, there were 160 people, 54 households and 48 families residing in McKittrick. The population density was 63.8 per square mile. There were 61 housing units at an average density of 24.3 per square mile (US Census Bureau, 2000).

Taft

As of 2000, there were 6,400 people, 2,233 households, and 1,565 families residing in the city. The population density was 422.6 people per square mile. There were 2,478 housing units at an average density of 163.6 per square mile (US Census Bureau, 2000).

Tupman

As 2000, there were 227 people, 66 households, and 53 families residing in Tupman. The population density was 426.0 people per square mile. There were 75 housing units at an average density of 140.8 per square mile (US Census Bureau, 2000).

Valley Acres

As of 2000, there were 512 people, 183 households, and 144 families residing in Valley Acres. The population density was 124.6 people per square mile. There were 194 housing units at an average density of 47.2 per square mile (US Census Bureau, 2000).

Table 4.12-1 presents population trends in Kern County based on 1990 and 2000 U.S. Census Bureau. Total population includes persons from both household and group quarters.

TABLE 4.12-1: POPULATION TRENDS BASED ON U.S. CENSUS BUREAU DATA

Area	1990 Population	2000 Total Population	Percent Change 1990 to 2000
Incorporated	282,379	396,645	40.7%
Unincorporated	262,602	265,000	0.57%
Total	544,981	661,645	21.4%

Sources: U.S. Census Bureau 1990; 2000.
Note:
[a]1990 U.S. Census data were updated, and revised numbers were issued in California Department of Finance Report E-4 (California Department of Finance 2006c).

As shown in Table 4.12-1 above, population growth in Kern County is heavily concentrated in the incorporated cities. The increase in population during this period can be partially attributed to the numerous state prisons constructed and opened in Kern County during this time. The new prisons also led to increased housing and employment during the 1990s.

4.12 POPULATION AND HOUSING

Housing

Table 4.12-2 presents housing trends in Kern County based on 1990 and 2000 U.S. Census Bureau data. Housing includes single family, multiple family, and mobile homes.

Mirroring population growth, housing growth primarily occurred in the incorporated cities of Kern County. Table 4.12-3 provides housing data based on DOF estimates and projections.

TABLE 4.12-2: HOUSING TRENDS BASED ON U.S. CENSUS BUREAU DATA

Area	1990 Total Housing Units	2000 Total Housing Units	Percent Change 1990 to 2000
Incorporated *(Percent Vacant)*	99,835 *(No data)*	130,873 *(6.64 %)*	31.1% *(Unknown)*
Unincorporated *(Percent Vacant)*	99,101 *(No data)*	100,694 *(14.12 %)*	1.6% *(Unknown)*
Total *(Percent Vacant)*	**198,936** *(No data)*	**231,567** *(9.89 %)*	**16.4%** *(Unknown)*

Source: U.S. Census Bureau 1990, 2000 data
Note: Population estimates are projections and subject to change.

TABLE 4.12-3: HOUSING TRENDS BASED ON CALIFORNIA DEPARTMENT OF FINANCE ESTIMATES AND PROJECTIONS

Area	2000 Total Housing Units	2005 Total Housing Units	2006 Total Housing Units	Percent Change 2000 to 2006	Percent Change 2005 to 2006
Incorporated Percent Vacant	130,873 6.64	148,233 6.45	155,079 6.45	18.5	4.6%
Unincorporated Percent Vacant	100,694 14.12	106,182 14.23	107,855 14.29	7.1	1.5%
Total (Percent Vacant)	**231,567 9.89**	**254,415 9.70**	**262,934 9.66**	**13.5**	**3.3%**

Source: California Department of Finance 2006e.

Employment

Kern County has a year-round labor force of nearly 305,000 persons, which has been growing at an average annual rate of 1.43 percent since 1994. This percentage is slightly lower than the California average of 1.48 percent; however, Kern County's annualized total employment growth of 1.78 percent was greater than California's growth of 1.71 percent between 1993 and 2004. The total

employment in Kern County grew faster than the growth of its labor force during the same period, which suggests that the economy was adding jobs faster than new labor. Table 4.12-4 below provides an employment profile of Kern County.

TABLE 4.12-4: EMPLOYMENT PROFILE

Class	Percent
Private Wage and Salary	71.2
Government	20.6
Self-employed	7.8
Unpaid family workers	0.5
Source: U.S. Census Bureau 2000.	

Kern County's unadjusted unemployment rate has ranged from a low of 6.3 percent in September/October 2007 to a high of 18.3 percent in March 2010. The unadjusted unemployment rate in Kern County was 16.5 percent in April 2010, down from 18.3 percent in March 2010, and up from 14.8 percent one year ago in April 2009 (Dancing Engineer, 2010).

4.12.3 Regulatory Setting

4.12.3.1 Local

Kern County General Plan

The goals and policies outlined in the Kern County General Plan for population and housing that are applicable to the proposed Project are provided below.

1.0 General Provisions

Goal 1 Ensure that the County can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving viable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.

1.6 Residential

Goals

Goal 2 Minimize land use conflicts between residential and resource, commercial, or industrial land uses.

4.12 POPULATION AND HOUSING

Housing Element 2008–2013

The Housing Element is one of seven elements in the Kern County General Plan. Each city and county is required by the California Housing Law to develop a housing element in order to qualify for allocation of state regional housing funding. To receive regional housing funds, each city and county must update its General Plan Housing Element on a regular basis (generally, every five years). The Housing Element must incorporate policies and identify potential sites that would accommodate the city or county's share of the regional housing needs. Kern County adopted its current Housing Element in December 2008. The housing element incorporates the Regional Housing Needs Assessment numbers assigned by the Kern Council of Governments.

Kern Council of Governments

A council of governments (COG) acts as an area wide planning agency. COGs assist local governments with multi-jurisdictional issues such as air quality, transportation, water quality, energy, and housing. The Kern COG serves this purpose for Kern County. The primary function of the Kern COG is to address regional transportation issues, but it also functions as the state-designated Census Data Center Affiliate. The Kern COG and its member agencies include the County of Kern and the 11 incorporated cities within Kern County (Kern Council of Governments 2006). The Kern COG facilitates comprehensive planning and intergovernmental coordination.

The Kern COG has determined the additional housing construction needed by 2013 is 41,640 dwelling units county wide. The unincorporated area of Kern County has been allocated 8,602 dwelling units for the time period (Kern Council of Governments 2007).

4.12.3.2 State

California State Law requires each city and county to adopt a general plan for future growth. This plan must include a housing element that identifies housing needs for all economic segments and opportunities for housing development to meet those needs identified. At the state level, the Housing and Community Development Department (HCD) is responsible for estimating the relative share of California's projected population growth that will occur in each county. These estimates are based on the Department of Finance population projections as well as historical growth trends. HCD provides population projections to the local Councils of Governments, which then assign a share of the regional housing amount each county and each of its cities.

Each city and county is required by statute (California Government Code §65583) to update its general plan housing element on a regular basis, usually about every five years. Among other responsibilities, the housing element must incorporate policies and identify potential sites that will accommodate the city's or county's share of the regional housing need. Before adopting a housing element update, the county must submit a draft of the document to the HCD for review. HCD will then inform the local jurisdiction whether its housing element complies with the provisions of the California Housing Element Law.

4.12 POPULATION AND HOUSING

4.12.4 Impacts and Mitigation Measures

This section describes the impact analysis relating to the proposed Project's impact on population and housing. It describes the methods used to determine the proposed Project's impacts and lists the thresholds used to conclude whether an impact would be significant.

4.12.3.1 Methodology

Potential impacts on population and housing are based on the potential for construction and operation of the proposed Project to affect the population and housing resources, as described under the Environmental Setting Section above.

4.12.3.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have significant impacts on population and housing if it would:

Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure);

Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; or

Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

4.12.3.3 Project Impacts

IMPACT POP-1 Induce Substantial Population Growth

The proposed Project is limited to utilizing CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. The proposed Project does not include a growth inducing element that would substantially increase population. Personnel will be required to construct the Project over its projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees or contractors already involved in existing facility operations. Some additional personnel are expected to intermittently relocate to the area during construction. This would result in a temporary, incremental increase in population to the Project region during construction. It is anticipated that these personnel will utilize temporary lodging facilities and will return to their point of origin upon conclusion of their construction tasks.

Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project. It is expected that a majority of these positions will be filled by individuals already residing in the Project region. It was assumed for purposes of this analysis, as a worst-case scenario, that the 25 employment positions result in the addition of 25 families to the Project region. However, this

incremental increase is not considered substantial direct population growth. The Project does not have any component that will contribute to indirect population growth. Therefore, impacts to population and housing would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT POP-2 Cause a Displacement of a Substantial Number of Existing Housing, Necessitating the Construction of Replacement Housing Elsewhere

The proposed Project Site and surrounding areas are primarily used in support of crude oil and natural gas production activities. There are no residences within the proposed Project Site. Therefore, no existing households would be displaced and the proposed Project would not require construction to replace housing elsewhere. Impacts would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT POP-3 Cause a Displacement of a Substantial Number of People, Necessitating the Construction of Replacement Housing Elsewhere

The proposed Project would not require the removal of any existing households or displace existing residents. As described above, the proposed Project is located in an active oil field and therefore there are no residents to displace. Consequently, implementation of the proposed Project would result in a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.12 POPULATION AND HOUSING

4.12.5 Cumulative Impacts

The proposed Project does not include residential development or other component with the potential to substantially increase population or demand for housing. A limited number of out of area personnel are anticipated to be required during construction of the Project. However, these individuals are expected to result in only an incremental, short-term population increase. The Project is expected to create demand for up to 25 full-time employment positions. It is expected that a majority of these positions will likely be filled by individuals already residing in the Project region. It was assumed for purposes of this analysis that the 25 employment positions result in the addition of 25 families to the Project region. However, this incremental population increase is not cumulatively significant. In addition, the proposed Project will not contribute to any cumulative displacement.

Therefore the Project's contribution to cumulative impacts on population and housing, in combination with other reasonable foreseeable projects within the Project area, would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significant after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.13 PUBLIC SERVICES

4.13 Public Services

4.13.1 Introduction

This section analyzes the proposed Project's potential impacts on public services. Unlike public facilities and utilities, public services are provided to the community as a whole, usually from a central location or from a defined set of nodes. The resource base for delivery of these services, including the physical service delivery mechanisms, is financed on a community-wide basis, usually from a unified or integrated financial system. The service delivery agency can be a city, county, service or other special district. Usually, new urban development will create an incremental increase in the demand for these services; the amount of demand will vary widely, depending on both the nature of the development (residential vs. commercial, for instance) and the type of services, as well as on the specific characteristics of the development (such as senior housing vs. family housing).

CEQA analysis is required if the increased demand is of sufficient size to trigger the need for a new or physically altered facility (such as a school or fire station), since the new or physically altered facility would have a physical impact on the environment. CEQA requires that an EIR then identify and evaluate the physical impacts on the environment that such a facility would have. The impact that must be analyzed in an EIR is the impact that would result from constructing a new public facility (should one be required), not the fiscal impact of a development on the capacity of a public service system.

4.13.2 Environmental Setting

Fire Protection/ Emergency Services

Kern County Fire Department

The Kern County Fire Department (KCFD) provides fire suppression and emergency medical services for Kern County. The area serviced by the KCFD varies from rural to metropolitan, and covers large portions of wildland and wildland/urban interface areas. The joint Kern County/Bakersfield City dispatching facility provides dispatch and emergency communications for the unincorporated areas of Kern County and all cities except Taft city. Mutual assistance agreements between the County and the cities of Bakersfield, Taft, and California City provides for protection and assistance as need and proximity dictates. The County also has service agreements with the BLM.

The KCFD staffs 46 full-time fire stations, divided into seven battalions, with 546 firefighters (KCFD 2010). Each battalion covers a large geographical area and includes seven to nine fire stations. There are four KCFD stations within the surrounding areas of the proposed Project. The following table lists the station number, location, distance from proposed Project Site, and population served for each of the four stations:

4.13 PUBLIC SERVICES

TABLE 4.13-1: FIRE DEPARTMENT RESOURCES IN THE VICINITY OF THE PROJECT AREA

Station Number	Address	Distance from Project (mi)	Response Area	Population Served
21	Taft 303 10th Street, Taft, CA	6	172 miles	9,200
23	Fellows 100 Broadway, Fellows, CA	5.5	66 miles	153
24	McKittrick 23246 2nd Street, McKittrick	5	218 miles	160
25	Buttonwillow 100 Mirasol Ave, Buttonwillow, CA	5	220 miles	1,266

Source: KCFD, 2010

KCFD delivers a range of emergency services. These include, but are not limited to, fire and life safety education, fire prevention, emergency care, rescue, community assistance (civil defense, tourist information, weather monitoring), and arson investigation.

In addition, KCFD also manages and directs the Kern County Office of Emergency Services. This office oversees disaster preparedness and mitigation for Kern County. In a major emergency or disaster, the KCFD Office of Emergency Services oversees all emergency operations and recovery operations.

Sheriff Protection/Law enforcement

California Highway Patrol

The California Highway Patrol (CHP) provides traffic regulation enforcement; oversees response to emergency incidents on California's highways or assists other public agencies responding to emergency incidents; and promotes the safe and efficient movement of people and goods on California highways to minimize loss of life, injuries, and property damage. CHP officers patrol 102,000 miles of roadway and implement the CHP's other law enforcement activities (e.g., drug interception, vehicle theft investigation and prevention, vehicle inspections, accident investigations, and public awareness campaigns), with the support of the non-uniformed personnel assigned to area and division offices (California Highway Patrol 2006).

4.13 PUBLIC SERVICES

The CHP has eight divisions that provide services in eight areas in California. Kern County is located in both the Central and Southern County of Kern Division service areas. The Central Division includes 15 area offices, six resident posts, two commercial inspection facilities, 696 uniformed officers, and 230 non-uniformed personnel. The Southern Division includes ten area offices, one commercial inspection facility, one traffic management center, 1,135 uniformed officers, and 416 non-uniformed personnel.

Kern County Sheriff's Department

The Kern County Sheriff provides law enforcement and public safety services in unincorporated Kern County. Formed in 1866, the Kern County Sheriff's Department is the oldest law enforcement agency in the County. The Kern County Sheriff's Department mission is to "work in partnership" with the community to enhance safety, security, and quality of life for residents and visitors alike in Kern County through their professional public safety services. In addition to providing police services to the unincorporated portions of the County, the Sheriff has the responsibility for the jail system, providing bailiff service and prisoner transportation to the courts, search and rescue, coroner services, and civil process (serving lawsuit papers).

The Sheriff's Office has 1,239 sworn and civilian employees. There are 572 authorized deputy sheriff positions deployed in patrol, substations, detectives, courts services, and special investigations units. There are 336 detention deputy positions deployed in the detention facilities, and 331 Sheriff's professional support staff assigned throughout Kern County (KCPD, 2010). There are two substations within the surrounding areas of the proposed Project:

TABLE 4.13-2: POLICE DEPARTMENT RESOURCES IN THE VICINITY OF THE PROJECT AREA

Substation	Address	Distance from Project (mi)
South Area Substation	311 North Lincoln Street, Taft, CA	5.5
North Area Substation	181 E. First, Buttonwillow, CA	5
Source: KCPD, 2010		

4.13 PUBLIC SERVICES

Other Public Facilities and Services

Libraries

The Kern County Library System provides library service for Kern County. Library resources and services for the proposed Project Site are provided at the Buttonwillow and Taft Branch Libraries, along with 23 other branches, and two bookmobiles serving Kern County. The Kern County Library System has created an environment for connecting people and ideas by providing residents of all ages with the resources to pursue their educational, civic, business and personal interests. The Kern County Library system's mission is to allow for the accessibility of knowledge and ideas to the public in an "efficient and effective manner that provides for their educational, informational, cultural, and recreational needs." Each library in the system maintains a collection of reference materials, books, videos, CDs, DVDs, audio books, and periodicals designed to meet the needs of the local community. The Buttonwillow Branch is open 14 hours per week (Wed / Fri 11am to 6pm), and houses approximately 10,757 materials in its collection. The Taft Branch is open 24 hours per week (Tue/Thurs 11am to 7pm, and Sat 9am to 5pm), and houses approximately 34,846 materials in its collection.

The Division of Library Development Services of the State of California currently uses the State average of .35 square feet of library facility per capita, and 1.5 volumes per capita as standard.

Schools

Kern County contains 47 kindergarten through 12th (K-12) grade school districts (Kern County Superintendent of Schools 2006). The proposed Project is located near six Unified School Districts.

Belridge Elementary School District

Belridge Elementary

19447 Wagonwheel Rd, McKittrick, CA 93251

Buttonwillow Union School District

Buttonwillow Union Elementary

42600 Highway 58, Buttonwillow, CA 93206

Elk Hills School District

Elk Hills Elementary

501 Kern St.,(P.O. Box 129), Tupman, CA 93276

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McKittrick School District

McKittrick Elementary

23250 2nd St. (P.O. Box 277), McKittrick, CA 93251

Midway School District

Midway Elementary

259 F St. (P.O. Box 39) Fellows, CA 93224

Taft City School District

Conley Elementary

623 Rose Ave. Taft, CA 93268

Jefferson Elementary

300 Taylor St., Taft, CA 93268

Lincoln Junior High

810 N. Sixth St. Taft, CA 93268

Parkview Elementary

520 A St. Taft, CA 93268

Roosevelt School (Taft)

811 N. Sixth St. Taft, CA 93268

Taft Primary School

212 Lucard St. Taft, CA 93268

Taft Union High School District

Buena Vista High School (Continuation)

901 San Emidio St. Taft, CA 93268

Taft Union High School

701 Seventh St. Taft, CA 93268

4.13 PUBLIC SERVICES

Westside Independent Study High School

701 Seventh St. Taft, CA 93268

During the 2007-08 school year, the total number of students enrolled in Kern County schools between grades K-12 was 174,180. Of adults 25 and over, 71 percent had graduated high school and 14 percent had completed a bachelor's degree or an additional graduate degree. Nearly one-third of the population left high school before graduating. Kern County ranks second in the state for increase in school enrollment and is projected to maintain that level of growth for the next 10 to 20 years according to the California DOF.

Medical Facilities

The Emergency Medical Services Department (EMS) is the lead agency for the emergency medical services system in Kern County and is responsible for coordinating all system participants in the County. Participants include the public, fire departments, ambulance companies, other emergency service providers, hospitals, and EMT training programs throughout the County (Table 4.13-3: Kern County Hospitals and Ambulance Services). The department also provides certification and re-certification for EMT's, paramedics, specialized nurses (MICN), and specialized dispatchers (EMD).

4.13 PUBLIC SERVICES

TABLE 4.13-3: KERN COUNTY HOSPITALS AND AMBULANCE SERVICES	
KERN COUNTY EMS SYSTEM HOSPITALS	
Bakersfield Heart Hospital	Ambulance receiving hospital
Bakersfield Memorial Hospital	Paramedic base hospital
Delano Regional Medical Center	Paramedic base hospital
Kern Medical Center	Paramedic base hospital / trauma center
Kern Valley Hospital	Ambulance receiving hospital
Mercy Hospital	Paramedic base hospital
Mercy Southwest	Ambulance receiving hospital
Ridgecrest Regional Hospital	Ambulance receiving hospital
San Joaquin community Hospital	Paramedic base hospital
Tehachapi Valley Healthcare District	Ambulance receiving hospital
KERN COUNTY AMBULANCE PROVIDERS	
Care Ambulance Service	EOA 6 – all ground services
Delano Ambulance Service	EOA 3 – all ground services
Golden State Air Ambulance	Fixed-wing interfacility services
Hall Ambulance Service	EOAs 2,4,5,9,8,11 – all ground services
Hall Critical Care Transport	EOA A – all air services
Kern Ambulance Service	EOA 1 – all ground services
Liberty Ambulance Service	EOA 7 – all ground services
Mercy Air	EOA B – all air services
EOA – Exclusive Operating Area *Reference: County of Kern Emergency Medical Services, January 27, 2011* *http://www.co.kern.ca.us/ems/hospital.asp*	

The proposed Project would utilize medical services within the Bakersfield area. The closest hospital would be Mercy Southwest located at 400 Old River Road in Bakersfield, California, approximately 20-miles southeast of the proposed Project Site. The Southwest Campus was built in 1992, and is the only acute care hospital in Bakersfield west of the 99 Freeway. The Southwest Campus offers a full range of services including emergency services, obstetrics and women's care and medical/surgical care. In 2009, the Orthopedic and Hand Center opened offering comprehensive orthopedic services to the community.

Parks and Recreation

Please refer to Section 4.14 (Recreation) for details on parks and recreation.

4.13 PUBLIC SERVICES

4.13.3 Regulatory Setting

4.13.3.1 Local

Below are the applicable policies, goals, and implementation measures for public services found in the Kern County General Plan. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below, but, as stated in Section 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

Kern County General Plan

Public Services for

General Public Facilities and Services

Policy 2. The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur within or adjacent to areas with adequate public service and facility capacity.

Policy 3. Individual projects will provide availability of public utility service as per approved guidelines of the serving utility.

Fire Protection Services

Policy 6. The County will ensure adequate fire protection to all Kern County residents.

Law Enforcement

Policy 7. The County will ensure adequate police protection to all Kern County residents.

4.13.4 Impacts and Mitigation Measures

4.13.4.1 Methodology

The analysis contained in the following section addresses the project-specific impacts of the proposed Project on public services within Kern County. This analysis is based on information and analysis contained in applicable The Kern County General Plan and other research performed by Stantec.

4.13.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a proposed Project would have significant impacts on public services if it would:

4.13 PUBLIC SERVICES

Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which would cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or to other performance objectives for any of the following public services:

1. Fire Protection
2. Police Protection
3. Schools
4. Parks
5. Other Public Facilities (medical and libraries)

4.13.4.3 Project Impacts

IMPACT PUB-1 Adversely Affect Fire Protection Services

The Project area will remain rural, and is already considered a high to moderate fire hazard area (Fire Hazard Severity Zones; frap.cdf.ca.gov). Project activities have the potential to result in fires and releases of hazardous materials that could require response by local fire departments. However, these potential response needs are already present as part of the existing EHOF operations and are not expected to substantially increase with Project implementation. The proposed Project does not include the construction of residential, commercial, or substantial industrial structures that could significantly increase demand for fire protection services that would require the provision of new or physically altered fire protection facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-2 Adversely Affect Police Protection/Law Enforcement Services

The proposed Project does not include a residential component or other development that would substantially increase population growth that could require police/law enforcement services. There is a potential that crime such as theft or vandalism could occur during both the construction and operation phases of the proposed Project which could increase demand on local law enforcement services. However this is anticipated to be minor and infrequent in nature as OEHI controls contractor selection, site access and maintains 24 hours/day security operations on-site. As such, the

proposed Project will not significantly increase demand for police protection services that would require the provision of new or physically altered police protection facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-3 Adversely Affect School Capacity

Construction personnel are largely expected to be from the Project region and will not increase demand for school services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not increase demand for school services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental demand placed on regional school services. However, this increase is not expected to significantly increase demand for school services that would require the provision of new or physically altered school facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT PUB-4 Adversely Affect Parks and Recreational Facilities and Services

Please refer to Section 4.14 (Recreation) for a detailed discussion on the project's potential to impact recreational facilities and resources.

IMPACT PUB-5 Adversely Affect Medical Services

Construction personnel are largely expected to be from the Project region and will not increase demand for medical services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not substantially increase demand for medical services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental

demand placed on medical services. However, this increase is not expected to significantly increase demand for medical services that would require the provision of new or physically altered medical facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

This impact would be less than significant.

IMPACT PUB-6 Impact to Library Services

Construction personnel are largely expected to be from the Project region and will not increase demand for library services. The limited number of personnel needed for project construction that are anticipated to come from out of the area are expected to reside in the Project area for short durations and will not substantially increase demand for library services. Operation of the project is expected to create 25 additional employment positions. Assuming a conservative scenario, one in which the Project increases regional population growth by 25 families, there will be an incremental demand placed on library services. However, this increase is not expected to significantly increase demand for library services that would require the provision of new or physically altered library facilities, the construction of which would cause significant environmental impacts. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.13.5 Cumulative Impacts

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The proposed Project does not include any residential development or other component that will substantially increase population growth and demand for public services. As such, the Project is expected to have a less than significant contribution to cumulative public services impacts.

4.13 PUBLIC SERVICES

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.14 RECREATION

4.14 Recreation

4.14.1 Introduction

This section discusses potential impacts to recreation resources and open space in the vicinity of the proposed Project. As a basis for evaluation, the environmental setting section summarizes existing conditions related to site characteristics and recreation providers. Documents and regulations reviewed for this analysis include the Kern County General Plan and the Quimby Act (California Government Code §66477). This section also describes the environmental and regulatory settings and discusses mitigation measures to reduce impacts, where applicable.

4.14.2 Environmental Setting

Local/Regional

The Kern County Parks and Recreation Department manages 40 neighborhood parks, 8 regional parks, and performs landscape maintenance at 76 county buildings. Further, it administers use of 28 public buildings and 3 county golf courses. A current staff of 130 assumes these responsibilities.

The Kern County Parks and Recreation Department operates and maintains eight regional parks—the Buena Vista Aquatic Recreational Area, Greenhorn Mountain Park, Leroy Jackson Park, Kern River County Park, Lake Isabella, Lake Woollomes, Metro Recreation Center, and Tehachapi Mountain Park. These parks provide more than 19,422 acres of parkland for recreational purposes.

Located approximately 5 miles southeast of the proposed Project Site, the closest regional park to the proposed Project Site is the Buena Vista Aquatic Recreation Area. Recreational opportunities include fishing, boating, jet-skiing, camping, picnicking, and bicycling. Amenities include children's play equipment, two concession buildings, three covered picnic areas reserved for large groups, numerous other picnic spots throughout the park, campsites, three boat- launching sites and an RV dump station.

The municipal Buena Vista Golf Course is located to the south of the proposed Project. The golf facility is equipped with an 18-hole regulation length course and a 25 tee driving range.

The City of Taft has five (5) parks maintained by Kern County Parks and Recreation Department including A Street Park, Civic Center Park, Cougar Sports Taft, Ford City Park, and Franklin Field.

State

The California State Parks Service owns, maintains, and operates one state park (Red Rock Canyon), two state historic parks (Fort Tejon and Tomo-Kahni), and one state reserve (Tule Elk) in Kern County. Of these parks, the Tule Elk State Reserve is the closest to the Project Site (located near Tupman) which is located approximately 1.5 miles to the northeast of the Project Site. The others are located a significant distance from the proposed Project.

4.14 RECREATION

The Tule Elk State Reserve is a 956 acre fenced enclosure and is part of what was once the historical range of free roaming tule elk (*Cervus canadensis nannodes*).

National Parks and Trails

Several national parks are located in California's Central Valley, southern California, and southern desert region, which are accessible from Kern County and the proposed Project Site, although a significant distance away. These include Sequoia National Park, Death Valley National Park, Joshua Tree National Park, Kings Canyon National Park, Channel Islands National Park and Mojave National Preserve. The Pacific Crest Trail also passes through eastern Kern County near the City of Tehachapi.

4.14.3 Regulatory Setting

4.14.3.1 Local

Below are the applicable policies, goals, and implementation measures for recreation services found in the Kern County General Plan.

Kern County General Plan

Chapter 1. Land Use Open Space and Conservation Element

Public Facilities and Services

Goals

Goal 8. Provide recreation opportunities for all citizens of Kern County while avoiding duplication between jurisdictions.

Goal 12. Provide a balanced system of parks and recreational facilities to meet Kern County's diverse needs, and clearly define responsibility for the provision of these facilities.

Goal 13. Provide a variety of park and recreation programs that offer safe, equitable, and balanced recreation opportunities for all residents and visitors.

Policies

Policy 4. The provision of parks and recreational facilities of varying size, function, and location to serve Kern County residents will be encouraged. Special attention will be directed to providing linear parks along creeks, rivers, and streambeds in urban areas.

Policy 5. Seek to provide recreational facilities where deficiencies have been identified.

4.14 RECREATION

Implementation Measures

Implementation Measure F. Continue to use the accepted California and National Design Standards for both passive and active park development to accommodate programmed and spontaneous activities. Some usable area should be held as open turf for free play and community festivals.

Implementation Measure G. Continue to encourage coordination between appropriate jurisdictions in the acquisition (including cooperative agreements), development, and use of parks to avoid duplication of facilities and provide economic use of public funds.

Implementation Measure H. Continue to pursue federal, State, and private grant funding for the rehabilitation and acquisition of parks and recreation facilities.

Implementation Measure II. The Kern County Parks and Recreation Department will evaluate the possibility of alternative funding sources for the development, rehabilitation, and operation of park and recreational facilities. These funding sources shall include the possible implementation of development fees and/or special assessment districts such as used for lighting and landscaping, under a County Service Area (CSA).

4.14.3.2 State

Quimby Act of 1975

The 1975 Quimby Act (California Government Code §66477) authorized cities and counties to pass ordinances requiring that developers set aside land, donate conservation easements, or pay fees for park improvements. The goal of the Quimby Act was to require developers to help mitigate the impacts of property improvements. The Act gave authority for passage of land dedication ordinances to cities and counties, and established a State standard of five acres of parkland per 1,000 residents.

4.14.4 Impacts and Mitigation Measures

4.14.4.1 Methodology

Impacts to open space and recreation facilities were assessed based on the potential for the proposed Project to either reduce the amount of existing open space, generate an increased demand on open space and recreation facilities (which would result in the deterioration of those facilities), or conflict with the open space and recreation requirements in the General Plan.

4.14.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on recreation if it would:

Increase the use of existing neighborhood and regional parks or other recreational facilities such that

substantial physical deterioration of the facility would occur or be accelerated; or

Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

4.14.4.3 Project Impacts

IMPACT REC-1 Result in Increased Use of Parks

The proposed Project does not include a growth inducing element that would substantially increase population or demand for recreational facilities. Personnel will be required to construct the Project over its projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees or contractors already involved in existing facility operations. Supplemental personnel mobilized to the site during construction events are expected to be local contractors. As a majority of site personnel required during construction will already be from the local area, it is anticipated that no increased demand for recreational facilities will result. The addition of a limited amount of personnel expected to intermittently relocate to the Project area during construction is not expected to substantially increase demand on recreational resources beyond existing capacity.

Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project. It is expected that a majority of these positions will likely be filled by individuals already residing within cities located in the Project region. It was assumed for purposes of this analysis that the 25 employment positions result in the addition of 25 families to the Project region. This addition of 25 families would increase demand for existing recreational facilities. However, this is not expected to increase demand on recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

As a result, impacts to recreational facilities and services would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT REC-2 Include Recreational Facilities or Require the Construction or Expansion of Recreational Facilities that Might Have an Adverse Physical Effect on the Environment

The proposed Project does not include recreational facilities or require the construction of recreational facilities that might have an adverse physical effect on the environment. In addition, the proposed Project does not include a growth inducing element that would substantially increase population or

demand for recreational facilities. The addition of a limited amount of personnel expected to relocate to the Project Site area during construction and operation of the Project is not expected to substantially increase demand on recreational resources beyond existing capacity.

As the proposed Project does not include recreation facilities or require the construction or expansion of recreation facilities no impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.14.5 Cumulative Impacts

As defined in Section 15130 of the CEQA Guidelines, cumulative impacts are the incremental effects of an individual project when viewed in connection with the effects of past, current, and probable future projects within the cumulative impact area for recreation. The cumulative impact area for recreation and open space for this Project is the area within 6 miles of the EHOF. The population and associated demand for parks, trails, and open space that could increase as a result of the Project is expected to be low. The Project does not include residential development or other component with the potential to substantially increase population or demand for recreational facilities.

Therefore the Project's contribution to cumulative impacts on park and recreational facilities, in combination with other reasonable foreseeable projects within the project area, would be less than significant.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.15 TRANSPORTATION AND TRAFFIC

4.15 Transportation and Traffic

4.15.1 Introduction

This section contains information on the existing transportation system present in the Project area and assesses the potential impacts of the proposed Project.

4.15.2 Environmental Setting

Traffic Impact Study Area

Vehicular traffic associated with the proposed Project will originate from numerous regional locations and has the potential to primarily impact the following intersections and roadway segments within the Project vicinity:

Taft Highway (State Route 119 [SR 119]) and North Access Road;

Taft Highway (SR 119) and Tupman Road;

Taft Highway (SR 119) and Elk Hills Road;

Elk Hills Road and Skyline Road;

North Access Road and Tupman Road;

Tupman Road and Grace Avenue;

Tupman Road and Station Road;

Adohr Road and Dairy Road;

Stockdale Highway and Morris Road;

Stockdale Highway and Dairy Road;

Stockdale Highway and Wasco Way;

Wasco Way and Brite Road;

State Route 58 and Wasco Way;

State Route 33/58 and 'E' Street (access to Skyline Road);

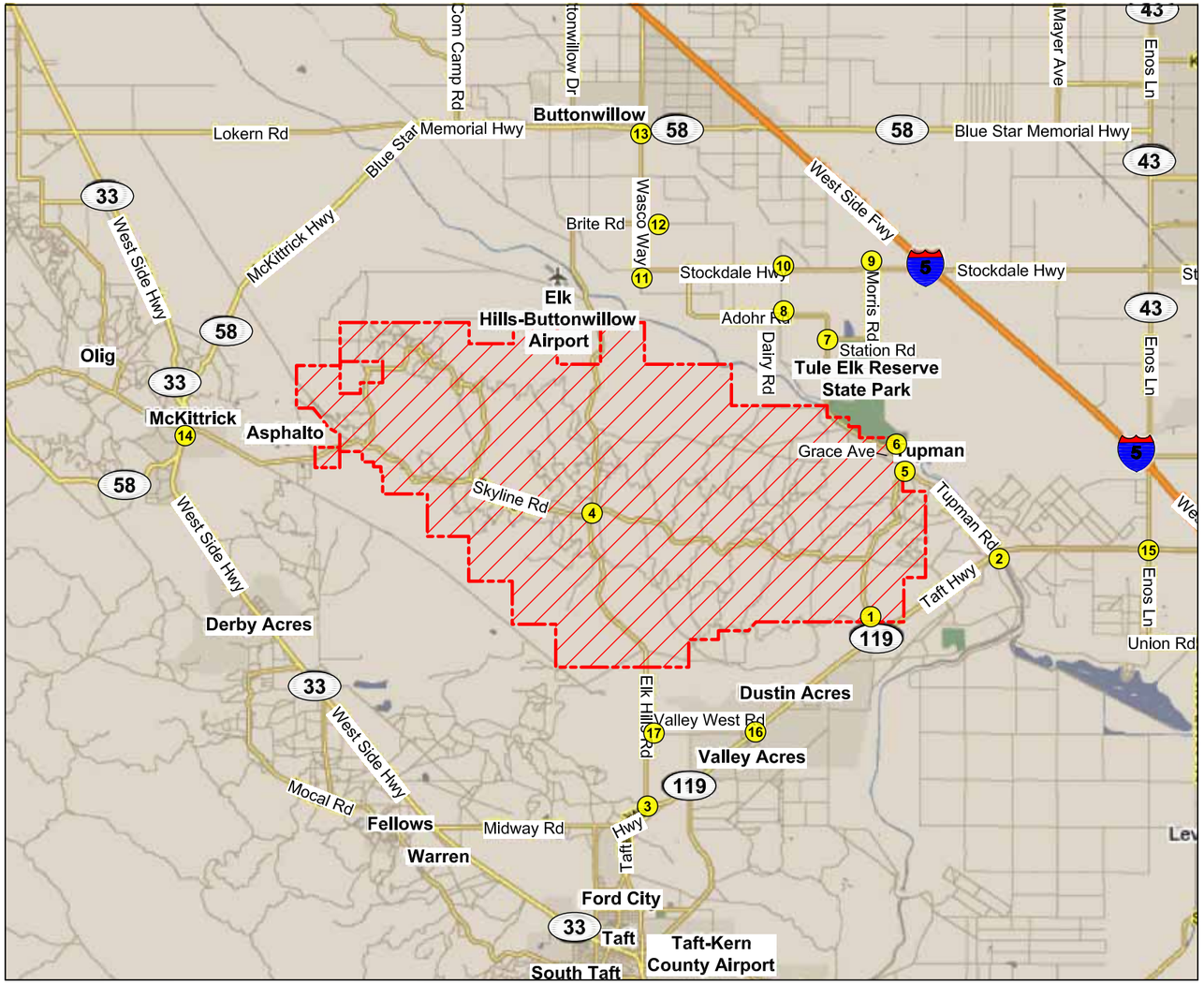
Enos Lane (SR 43) and Taft Highway (SR 119);

Highway 119 and Valley West Road; and

Valley West Road and Elk Hills Road.

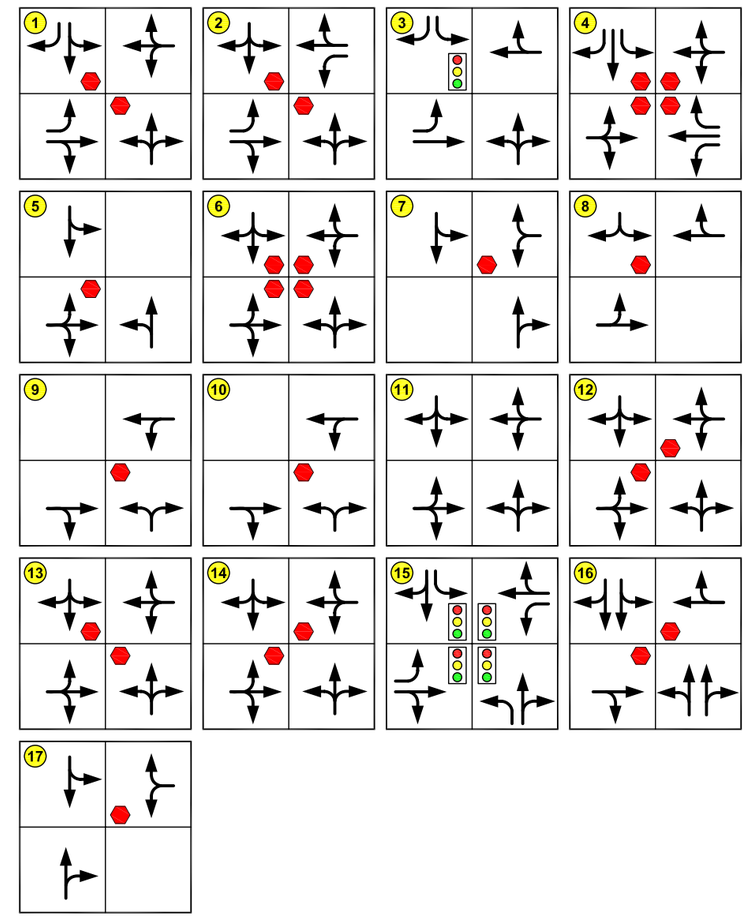
4.15 TRANSPORTATION AND TRAFFIC

Figure 4.15-1 Traffic Study Intersections and Existing Lane Configuration, illustrates the intersections/roadway segments evaluated as part of this analysis. California Department of Transportation (Caltrans) District 6 has jurisdiction over Interstate 5 (I-5), SR 33, SR 43, SR 58, and SR 119. Kern County has jurisdiction over all of the roads identified in Figure 4.15-1, except for Skyline Road, North Access Road, and Tank Farm Road, which are private roadways.



LEGEND

- Approximate Site Boundary
- Lane Configuration
- Stop Light
- Existing Stop Controlled
- Study Intersection



NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

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FOR:
OEHI CO2 EOR Project
Supplemental Environmental Information
Kern County, CA

Traffic Study Intersections and Existing Lane Configuration

FIGURE: **4.15-1**

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185802314.200.0004	R. Roman	S. Edblad	M. Weber	12/06/10

4.15 TRANSPORTATION AND TRAFFIC

Project Site Access

The Project area is served by an extensive transportation system, including major freeways, highways, and airport and rail facilities. Figure 4.15-2 illustrates the regional transportation setting. The primary transportation corridors in or near the proposed Project Site include I-5 and SR 119, 99, 58, 43, and 33. The closest of these to the proposed Project Site is SR 119, located south of the Project Site and generally runs in a northeast to southwest direction from the community of Taft, intersects I-5, and continues to SR 99. A highway, such as SR 119 is defined by Caltrans as "high-speed, high-capacity, limited-access transportation facility serving regional and county-wide travel." Interstate 5, located east of the Project Site, generally runs in a northwest to southeast direction from SR 119 to SR 58. State Route 58, located north of the Project Site, generally runs in an east to west direction from I-5 to Lokern Road and then in a northeast to southwest direction from Lokern Road to the community of McKittrick. Within the community of McKittrick (which is located west of the Project Site), SR 58 and SR 33 are joined within the same roadway. South of McKittrick, SR 58 continues west and SR 33 continues south to the community of Taft. State Routes 33 and 119 intersect in the community of Taft, which is located south of the Project Site.

The local transportation network near the proposed Project Site and the interior circulation is illustrated in Figure 4.15-3. The proposed Project Site can be accessed from SR 119 and then along a variety of private roads. The most commonly used access routes are described below.

From Bakersfield: Travel south on SR 99 for 6.2 miles. Exit and travel west on SR 119 for19.4 miles. Turn right onto North Access Road and proceed to Gate 2 for Project Site access. Continue on North Access Road for 1.5 miles and turn left onto Skyline Road.

From Taft [including surrounding communities Ford City, Valley Acres, and Dustin Acres]: Travel north/east on SR 119 for 7.8 miles. Turn left onto North Access Road and proceed to Gate 2 Project Site access. Continue on North Access Road for 1.5 miles and turn left onto Skyline Road.

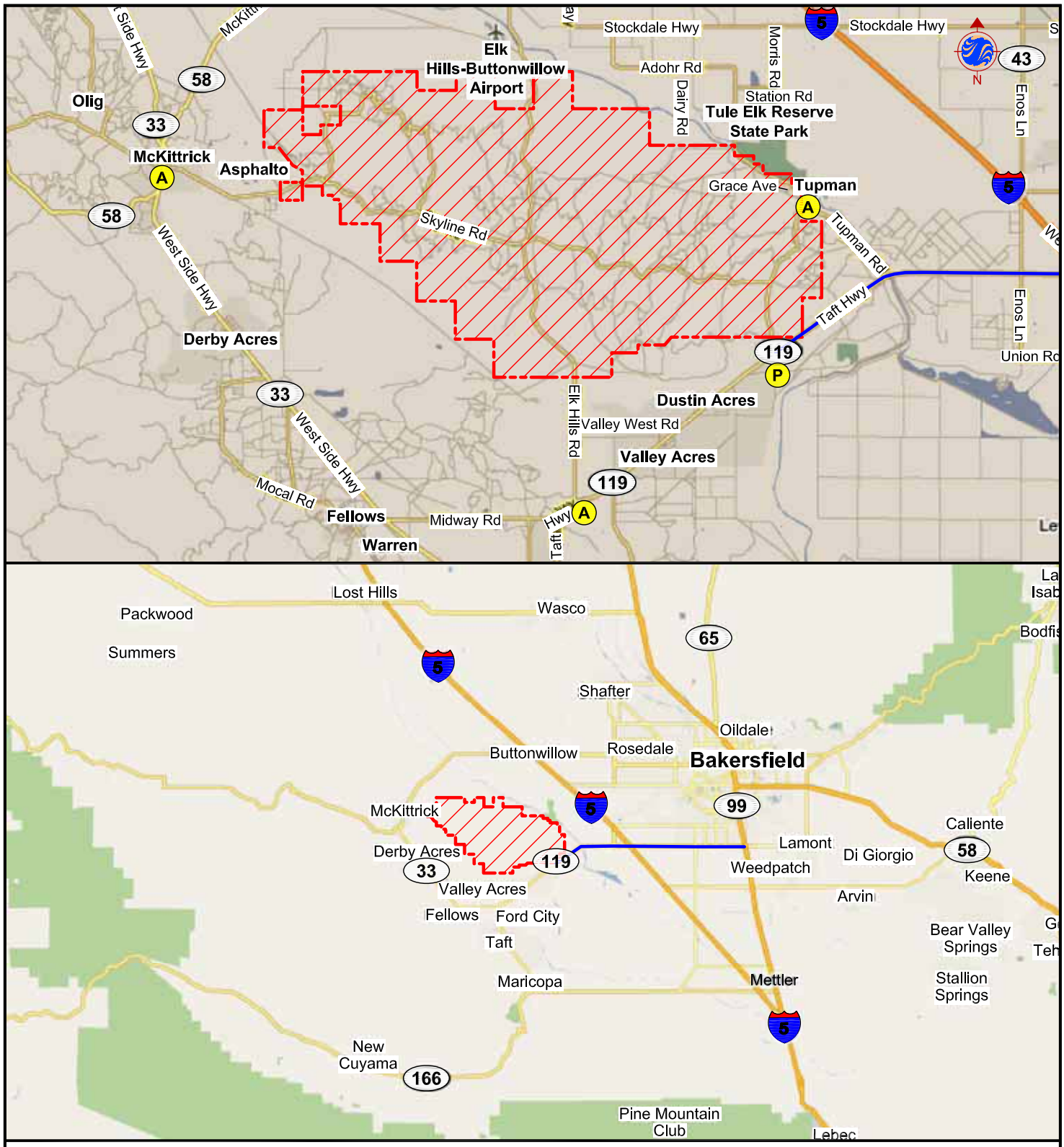
The Project Site may be accessed from personnel residing in the surrounding communities accessed by SR 58 (Buttonwillow), SR 33 (McKittrick or Derby Acres), and I-5 (other communities to the north and south). The mobilization of specific construction equipment or delivery of large equipment and supplies may periodically require alternative security access points on the Project Site. The most likely alternative security access points for the mobilization of construction equipment and supplies (other than from SR 119) are detailed below.

Tupman Road Entrance: North Access Road can be accessed from Tupman Road. North Access Road intersects Tupman Road (Gate 1) approximately 0.3 miles south of Tupman or 2.9 miles north of SR 119.

4.15 TRANSPORTATION AND TRAFFIC

Elk Hills Road and Skyline Road: Skyline Road can be accessed from Elk Hills Road (Gates 3 and 4). Skyline Road intersects Elk Hills Road approximately 6.8 miles north of SR 119 or 6.6 miles south of the intersection of Elk Hills Road (Buttonwillow Drive) and Brite Road.

McKittrick Entrance: Skyline Road can be accessed from the community of McKittrick. 'E' Street intersects SR 33/SR 58 in the center of the community and becomes Reserve Road outside of the eastern portion of McKittrick (Gate 5).



LEGEND

- Approximate Site Boundary
- Primary Route
- (P) Primary Entrance
- (A) Alternative Entrances

NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

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FOR:
OEHI CO2 EOR Project
Supplemental Environmental Information
Kern County, CA

Regional Transportation Setting

FIGURE: **4.15-2**

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185802314.200.0004	R. Roman	S. Edblad	M. Weber	12/06/10

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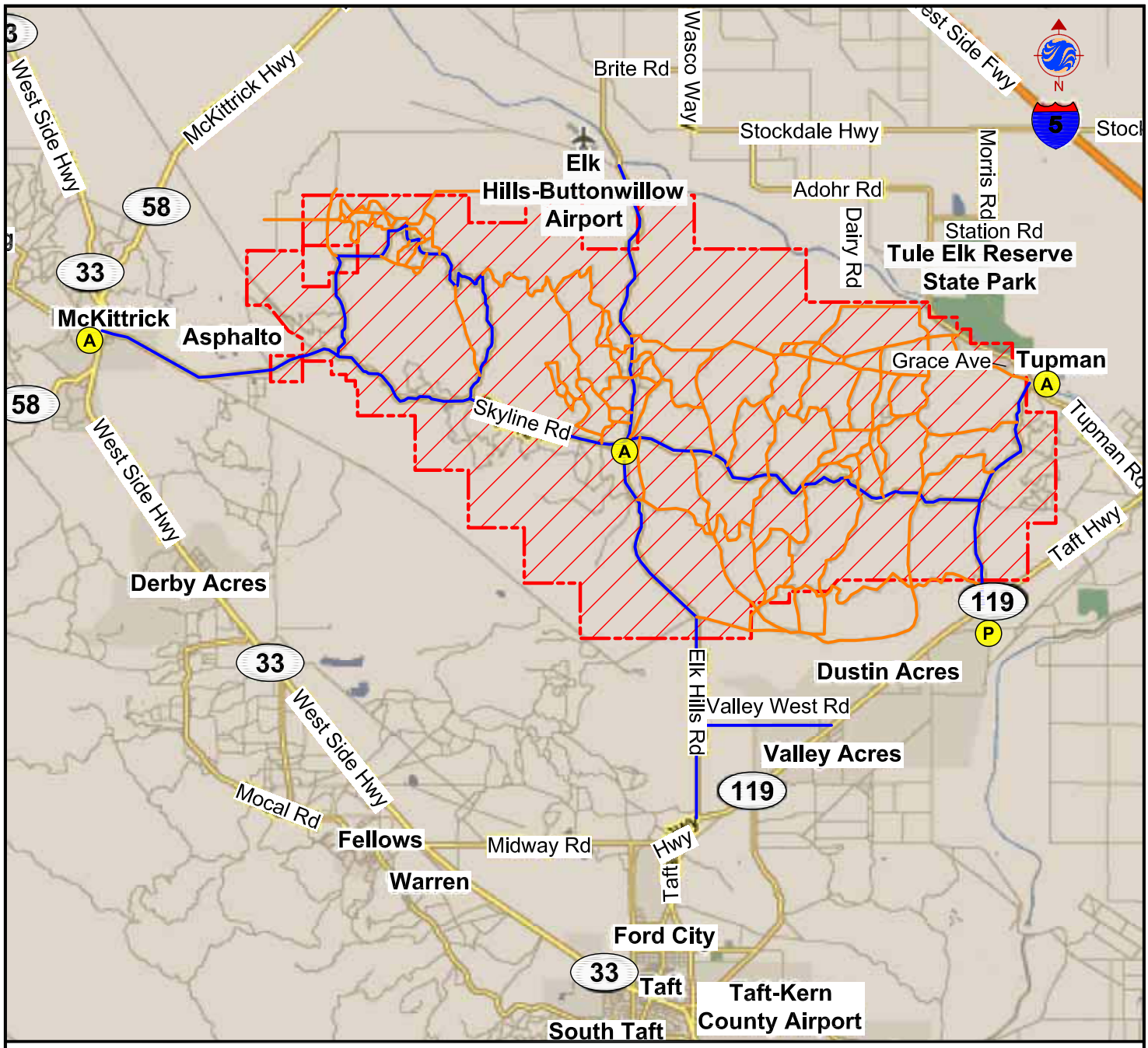

LEGEND

- Approximate Site Boundary
- Paved Access Roads
- Dirt Access Roads
- (P) Primary Access Point
- (A) Alternative Access Point

NOTES:

1. Map Source; Google Earth Pro/Map Image, Dated 2010.
2. Site features and locations are approximate.

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FOR:
OEHI CO2 EOR Project
Supplemental Environmental Information
Kern County, CA

Project Site Circulation Plan/ Local Transportation Network

FIGURE: **4.15-3**

PROJECT NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
185802314.200.0004	R. Roman	S. Edblad	M. Weber	12/06/10

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4.15 TRANSPORTATION AND TRAFFIC

Regional and Local Roadway Characteristics

Kern County contains major transportation corridors representing diverse modes. Passenger vehicles, motor-homes, and trucks cross Kern County in route to out-of-county and interstate destinations. Automobile routes include freeways, highways, and county roads. The proposed Project Site is served directly by SR 119 which provides freeway access to the major north south routes within Kern County. The following provides a description of the regional and local roadways which service the proposed Project Site.

Interstate 5 is the major 1,381-mile north-south freeway through California (796 miles), Oregon (308 miles), and Washington (277 miles). The southern terminus is at the Mexican Border in Tijuana. The northern terminus is at the Canadian Border in White Rock. Interstate 5 connects Kern County to northern and southern California. The *I-5 Transportation Concept Report (District 6)* dated July 2005, divides the District 6 portion of this interstate into segments. Segment 5 contains the interchange with SR 119. The 2005 Annual Average Daily Traffic (AADT) along I-5 in this location is approximately 51,100.

State Route 99 runs parallel to Interstate 5 through Kern County. The southern terminus is at Interstate 5 approximately 20 miles south of Bakersfield. State Route 99 continues north and terminates at Interstate 5 in Red Bluff approximately 130 miles north of Sacramento. The *SR 99 Transportation Concept Report (District 6)* dated November 2003 divides the District 6 portion of this highway into segments. Segment 3 contains the interchange with SR 119. The 2003 AADT along SR 99 in this location is approximately 44,000.

State Route 119 is a 31-mile highway running east to west in Kern County. The western terminus is at the SR 33 junction in Taft and the eastern terminus is at the SR 99. The *SR 119 Transportation Concept Report (District 6)* dated September 2006 divides the highway into segments. Segment 5 contains the intersection of North Access Road and segment 4 contains the intersection of Elk Hills Road. The 2006 AADT along SR 119 in segments 4 and 5 are approximately 11,400.

State Route 58 is a limited access highway. The western terminus is US Highway 101 in San Luis Obispo County west of the town of Santa Margarita and north of the Cuesta Grade. The eastern terminus is Interstate 15 at Barstow in San Bernardino County. The *SR 58 Transportation Concept Report (District 6)* dated December 2004 divides the District 6 portion of this highway into segments. Segments 2 through 6 encompass the area from McKittrick to I-5. The 2004 AADT along SR 58 is approximately 800 (segment 2); 3,500 (segment 3); 4,700 (segment 4); 5,600 (segment 5); and 7,400 (segment 6).

State Route 33 is a limited access highway. The western terminus is US Highway 101 near the City of Ventura in Ventura County. The eastern terminus is Interstate 5 just southeast of the community Tracy in San Joaquin County. The *SR 33 Transportation Concept Report (District 6)* dated March 2007 divides the District 6 portion of this highway into segments. Segments 3 through 8 encompass the area from Taft to McKittrick. Segment 3 contains the intersection of SR 119, segments 4 and 5

are in the City of Taft, segments 6 and 7 are near the communities of Fellows and Derby Acres, and segment 8 is in the community of McKittrick. The 2006 AADT along SR 33 is approximately 8,600 (segment 3); 12,900 (segment 4); 10,600 (segment 5); 10,600 (segment 6); 3,100 (segment 7); and 2,900 (segment 8).

State Route 43 is a limited access highway. The southern terminus is the junction of SR 119 in Kern County. The northern terminus is the junction of SR 99 in the City of Selma in central Fresno County. The *SR 43 Transportation Concept Report (District 6)* dated December 2006 divides the District 6 portion of this highway into segments. Segment 1 contains the junctions of I-5 and SR 119. The 2006 AADT along SR 43 is approximately 4,800.

Tupman Road is a local, two-lane county road, extending from the junction of SR 119 to the south and terminating at Adohr Road to the north. This north/south roadway accesses the community of Tupman. The SR 119 intersection is controlled by stop signs on Tupman Road and left-hand turning lanes on SR 119. The North Access Road junction is an uncontrolled three-way intersection with preferential right of way on Tupman Road. The Grace Avenue four-way intersection is controlled with stop signs on both Grace Avenue and Tupman Road. The Station Road junction is a three-way intersection controlled with a stop sign on Station Road. Tupman Road becomes Adohr Road with a western turn within the road (Figure 4.15-1).

Station Road is a local, two-lane county road, extending from the intersection of Tupman Road to the west and terminating at Morris Road to the east. This east/west roadway defines the northern boundary of the Tule Elk Reserve State Park. The Tupman Road junction is a three-way intersection controlled with a stop sign on Station Road. Station Road becomes Morris Road with a northern turn within the road (Figure 4.15-1).

Morris Road is a local, two-lane county road, extending from the Station Road to the south and terminating at Stockdale Highway to the north. Morris Road becomes Station Road with a western turn within the road. The Stockdale Highway three-way intersection is controlled with a stop sign on Morris Road (Figure 4.15-1).

Adohr Road is a local, two-lane county road, extending from Freeborn Road to the west and Tupman Road to the east. Adohr Road becomes Freeborn Road with a northern turn within the road. Adohr Road becomes Tupman Road with a southern turn within the road. The Dairy Road three-way intersection is controlled with a stop sign on Dairy Road (Figure 4.15-1).

Dairy Road is a local, two-lane county road, extending from Stockdale Highway to the north and Adohr Road to the south. Both the Adohr Road and Stockdale Highway three-way intersections are controlled with stop signs on Dairy Road (Figure 4.15-1).

Stockdale Highway is a local, two-lane county road, extending from Wasco Way to the west and terminating at SR 99 to the east. The I-5 junction is controlled with stop signs on the northern and southern route off-ramps to Stockdale Highway. The Morris Road three-way intersection is controlled

with a stop sign on Morris Road. The Dairy Road three-way intersection is controlled with a stop sign on Dairy Road. The Wasco Way junction is an uncontrolled four-way intersection where the western continuation of Stockdale Highway and the southern continuation of Wasco Way both terminate into private property (not through roads) (Figure 4.15-1).

Wasco Way is a local, two-lane county road, extending from Stockdale Highway to the south and 7th Standard Road to the north. The Stockdale Highway junction is an uncontrolled four-way intersection where the western continuation of Stockdale Highway and the southern continuation of Wasco Way both terminate into private property (not through roads). The four-way intersection of Brite Road is controlled by stop signs on Brite Road. The four-way intersection of SR 58 is controlled by stop signs on Wasco Way (Figure 4.15-1).

Brite Road is a local, two-lane county road, extending from Buttonwillow Drive to the west and Wasco Way to the east. The Wasco Way four-way intersection is controlled with stop signs on Brite Road. Brite Road becomes Buttonwillow Drive with a southern turn within the road. Buttonwillow Drive continues south and becomes Elk Hills Road once the road crosses the aqueduct (Figure 4.15-1).

Elk Hills Road is a local, two-lane county road, extending from SR 119 to the south, transitioning to Buttonwillow Drive north of the aqueduct and terminating at Brite Road to the north. Buttonwillow Drive becomes Brite Road with an eastern turn within the road. The Skyline Road four-way intersection is controlled with four-way stop signs on Skyline and Elk Hills Roads. There are right and left-hand turn lanes on Elk Hills Road for both the north and southbound directions. The SR 119 three-way intersection is controlled on Elk Hills Road with a stop sign for left-hand turns and a yield sign for right-hand turns onto SR 119. State Route 119 has a left-hand turn lane and has a wide berth on the shoulder for right-hand turns onto Elk Hills Road (Figure 4.15-1).

Skyline Road is a private, two-lane road, extending from Reserve Road to the west and North Access Road to the east. Skyline Road extends east of North Access Road to SR 119, and consists of a dirt road for most of this section. The North Access Road three-way intersection is controlled by a stop sign on Skyline Road. The Elk Hills Road four-way intersection is controlled with four-way stop signs on Skyline and Elk Hills Roads. There are right and left-hand turn lanes on Elk Hills Road for both the north and southbound directions (Figure 4.15-1).

Valley West Road is a local two lane county road, transitioning east of SR 119 to Walnut Street, extending from SR 119 to the west, and terminating at Elk Hills Road. The Valley West Road and Elk Hills Road intersection is controlled with a stop sign at Valley West Road (Figure 4.15-1).

Traffic Volumes

Traffic volume information was obtained from the Traffic Data Branch of Caltrans for State maintained highways and the Kern County Roads Department and Kern Council of Governments for local roads.

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All traffic volumes are Annual Average Daily Traffic (AADT) and may be thought of as the total number of vehicles in both directions, passing a point during the year, divided by 365 days.

Traffic counts available for the intersections most likely to be impacted by the proposed Project are presented in Table 4.15-1. Traffic counts listed consist of the highest AADT count consisting of the most currently available data for a location nearest the intersection.

TABLE 4.15-1: LOCAL AREA INTERSECTION NETWORK TRAFFIC VOLUMES

Intersection	AADT	Year
SR 119 and North Access Road	11,400	2006
SR 119 and Tupman Road	11,800	2009
SR 119 and Elk Hills Road	11,400	2006
Elk Hills Road and Skyline Road	1,200	2006
Tupman Road and Station Road	230	2007
Stockdale Highway and Morris Road	370	2006
Stockdale Highway and Wasco Way	1,050	2007
SR 58 and Wasco Way	5,000	2009
SR 33/58 and 'E' Street	2,750	2009
SR 43 and SR 119	10,600	2009

Methodology

Operation of signalized and unsignalized intersections is measured in terms of level of service (LOS). LOS is directly related to average control delay per vehicle. LOS for a signalized intersection is defined in terms of the intersection as a whole. The LOS for a two-way stop controlled (TWSC) intersection is defined for both the intersection as a whole and the individual approaches. Table 4.15-2 explains the signalized and unsignalized intersection LOS criteria.

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TABLE 4.15-2: LEVEL OF SERVICE CRITERIA INTERSECTIONS

Level of Service (LOS)	Signalized Intersections		Unsignalized Intersections
	Control Delay Per Vehicle (seconds)	Description	Total Delay Per Vehicle (seconds)
A	≤ 10.0	Very low control delay. Occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10
B	> 10.0 and ≤ 20.0	Generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS "A," causing higher levels of average delay.	> 10 and ≤ 15
C	> 20.1 and ≤ 35.0	These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.	> 15.1 and ≤ 25
D	> 35.1 and ≤ 55.0	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 25.1 and ≤ 35
E	> 55.1 and ≤ 80.0	These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.	> 35.1 and ≤ 50
F	> 80.0	This level, considered to be unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.	> 50

Source: Highway Capacity Manual (2000)

The *Kern County General Plan* Circulation Element of 2005 identifies objectives for intersection and segment operations. Circulation Element Objective #5 is to "Maintain a minimum LOS D for all roads throughout the County." However, Kern County Roads Department prefers Traffic Engineers to evaluate roadway impacts utilizing an LOS C.

Caltrans *Guide for the Preparation of Traffic Impact Studies*, page 1, states "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 appropriate target LOS."

Existing Level of Service

Most major study intersections currently experience unacceptable levels of service (D), during peak hours. Table 4.15-3 presents the existing levels of service that are available for the intersections most likely to be impacted by the proposed Project.

TABLE 4.15-3: EXISTING AND PROJECTED INTERSECTION LOS

INTERSECTION	2004 OR 2006		2015		2030	
	Peak Hour	LOS	Peak Hour	LOS	Peak Hour	LOS
SR 119 and North Access Road	1,050	D	1,400	E	1,800	E
SR 119 and Tupman Road	1,150	D	1,400	D	2,000	E
SR 119 and Elk Hills Road	1,050	D	1,400	D	1,900	E
SR 58 and Wasco Way	1,110	D	1,630	D	2,390	E
SR 33/58 and 'E' Street	330	C	430	C	560	D
SR 43 and SR 119	1,150	D	1,500	D	2,000	E
Source: Transportation Concept Reports – Caltrans Highways						

4.15.3 Regulatory Setting

4.15.3.1 Local

Kern County General Plan

The policies, goals, and implementation measures in the Kern County General Plan for transportation applicable to the proposed Project are provided below. The Kern County General Plan contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed Project. Therefore, they are not listed below, but, as stated in Chapter 2, "Introduction," all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference. The design LOS for Kern County is LOS C. The minimum LOS for conformance with the Kern County General Plan is LOS D.

4.15 TRANSPORTATION AND TRAFFIC

2.0 Circulation Element

Goals

Goal 5. Maintain a minimum LOS D.

Future Growth

Policies

Policy 2. The County should monitor development applications as they relate to traffic estimates developed for this plan. Mitigation is required if development causes affected roadways to fall below LOS D. Utilization of the CEQA process would help identify alternatives to or mitigation for such developments. Mitigation could involve amending the Land Use, Open Space, and Conservation Element to establish jobs/housing balance if projected trips in any traffic zone exceed trips identified for this Circulation Element. Mitigation could involve exactions to build off-site transportation facilities. These enhancements would reduce traffic congestion to an acceptable level.

Policy 5. When there is a legal lot of record, improvement of access to county, city or State roads will require funding by sources other than the County. Funding could be by starting a local benefit assessment district or, depending on the size of a project, direct development impact fees.

Airport Land Use Compatibility Plan (ALUCP)

Policies

Policy 1. Review land designations and zoning near public and private airports for compatibility.

Policy 2. To the extent legally allowable prevent encroachment on public airport and military base operations from incompatible, unmitigated land uses.

Implementation Measure

Implementation Measure A. Review discretionary land use development applications within the airports influence area and the military base operating area as shown in the ALUCP for consistency.

Implementation Measure B. Coordinate and cooperate with airport operators, the County Department of Airports, Caltrans, the Division of Aeronautics, affected cities, Edwards Air Force Base, Naval Air Weapons Station (NAWS) China Lake and the Department of Defense on ALUCP, review of land use applications, public education and encroachment issues.

4.15 TRANSPORTATION AND TRAFFIC

4.15.3.2 State

California Department of Transportation

Caltrans has jurisdiction over state highways and sets maximum load limits for trucks and safety requirements for oversized vehicles that operate on highways. Caltrans requires that a project-specific traffic analysis be conducted if a project generates:

More than 100 peak-hour trips on a state highway;

Between 50 and 100 peak-hour trips on a state highway with LOS C or D conditions; or

1 to 49 peak-hour trips on a state highway with LOS E or F conditions.

California Streets and Highways Code

Under the California Streets and Highways Code, Division 2, Chapter 5.5, Sections 1460-1470, an encroachment permit is required if there is an opening or excavation for any purpose in any state highway or county roadway.

4.15.4 Impacts and Mitigation Measures

4.15.4.1 Methodology

The proposed Project has construction and operational phases that overlap over the projected 20 year Project life span. As such, average annual vehicle trips were quantified for each year of the Project and collectively evaluated for potential impacts to the intersections and roadway segments most likely to be impacted by the Project. The additional vehicle trips associated with the Project were then compared to existing traffic volumes and LOS. In some cases, the traffic volumes and LOS of potentially affected intersections and roadways are not available. Establishing traffic counts and LOS for these intersections and roadway segments is beyond the scope of this analysis. In these cases, 50 additional vehicle trips through any intersection during peak hours were assumed to be a potentially significant impact requiring mitigation.

4.15.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on transportation and traffic if it would:

Conflict with an applicable plan, ordinance, or policy, establishing, measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;

4.15 TRANSPORTATION AND TRAFFIC

Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency. Specifically, would implementation of the project cause the level of service for roadways and/or intersections to decline below the following threshold or further degrade already degraded segments(s);

Kern County General Plan LOS D;

Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

Substantially increase hazards as a result of a design feature (such as sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

Result in inadequate emergency access; or

Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance of safety of such facilities.

4.15.4.3 Project Impacts

IMPACT TRAF-1 Conflict with an applicable plan, ordinance, or policy, establishing, measures of effectiveness for the performance of the circulation system

Project Generated Traffic

There will be one primary and three alternative access points to the Project Site for construction activities: the SR 119 and North Access Road (Gate 2) entrance (primary), the Tupman Road and North Access Road (Gate 1) entrance (alternative), Elk Hills Road and Skyline Road (Gates 3 and 4) entrance (alternative), and McKittrick (Gate 5) entrance (alternative). All access points are currently paved and specific project locations can be access from dirt roads once personnel are on the property. Secured gates will control access into the Project Site. Vehicular traffic into and out of the proposed Project Site will be limited as much as practical to daylight hours. Lay down of materials during the construction period will take place on site.

Construction of the proposed Project will take place over a projected 20-year execution schedule. A large number of personnel required during the construction phase will be employees already involved in existing facility operations (75 percent for piping/well installations and 25 percent for facility installations). Supplemental personnel mobilized to the Site during construction events are expected to largely be comprised of local contractors.

The Project will also generate vehicle trips as a result of Project operation. Operation of the Project is anticipated to create 25 full-time positions over the 20 year life of the Project which is assumed to add 25 vehicle trips to EHOF each day. It is expected that a majority of these positions will be filled by individuals already residing in the Project region.

4.15 TRANSPORTATION AND TRAFFIC

The annual average vehicle trips estimated for the Project are presented below in Table 4.15-4.

TABLE 4.15-4: PROJECT ANNUAL AVERAGE VEHICLE TRIPS

Year	Construction Annual Average Daily Trips (one way)	Operational Annual Average Daily Trips (one way)
2014	140	–
2015	241	15
2016	25	25
2017	149	25
2018	161	25
2019	243	25
2020	21	25
2021	27	25
2022	2	25
2023	6	25
2024	48	25
2025	56	25
2026	3	25
2027	27	25
2028	64	25
2029	22	25
2030	3	25
2031	21	25
2032	3	25
2033	19	25

Note: Construction annual average daily trips were calculated based on total personnel requirements for each year of constriction. Assumes 75 percent of personnel required for piping/well installations and 25 percent of personnel requirements for facility installations are already present at EHOF for existing operations.

As shown above, the amount of construction worker vehicle trips is higher in the earlier years and then declines over the remaining years. As shown in Table 4.15-3, the existing LOS on potentially affected intersections and roadway segments is currently at a C or D and are projected to degrade to a D or E by 2030. Potentially affected intersections and roadway segments where an LOS has not been established have been assumed to operate at a similar LOS. As this assumption classifies these intersections and roadway segments as below the County standard of LOS D, this provides a conservative analysis to transportation impacts. This increase in traffic is substantial enough to result in further declines of the LOS of potentially affected intersections and roadways and conflict with established measures of effectiveness for the performance of the circulation system. This increase is

considered a potentially significant impact. Mitigation Measure TRAF-1 has been incorporated into the proposed Project design to reduce transportation and traffic impacts.

Transportation Concept Report Improvements

The Transportation Concept Report for SR 119 contains a listing of planned and programmed improvements which will be funded from the Metropolitan Bakersfield Transportation Impact Fee Program. Improvements include widening SR 119 from the two-lane conventional highway to a four-lane expressway. The widening of the roadway is projected to begin in 2010 for segment 4 (contains the intersection of Elk Hills Road) and segment 5 (contains the intersection of North Access Road). All other segments are projected to be widened in the year 2025.

Implementation of these planned improvements along SR 119 with Project mitigation measures will further reduce the Project's transportation impacts.

Mitigation Measures

Mitigation Measure TRAF-1 OEHI will schedule construction activities to occur between the hours of 6:30AM and 3:30PM to minimize Project related traffic during the AM peak hours of 7:00 – 9:00AM and PM peak hours of 4:00 – 6:00PM.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT TRAF-2 Exceed Level of Service Standards on County Roads or State Highways

The proposed Project has the potential to exceed LOS standards on County roads and State highways. This increase is considered a significant impact. Mitigation Measure TRAF-1 has been incorporated into the Project design to reduce transportation and traffic impacts.

Mitigation Measures

Implementation of mitigation measure TRAF-1.

Level of Significance after Mitigation

Increased project-related traffic would not cause a significant increase in congestion or affect the existing LOS on County roads or State Highways. As such, impacts after incorporation of the above mitigation measure will be less than significant.

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IMPACT TRAF-3 Result in a Change in Air Traffic Patterns, Including Either an Increase in Traffic Levels or a Change in Location that Results in Substantial Safety Risks

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any component that would result in a change in air traffic patterns, increase air traffic, or a change in location that would increase air safety risks. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT TRAF-4 Substantially Increase Hazards caused by a Design Feature (such as Sharp Curves or Dangerous Intersections) or Incompatible Uses (such as Agricultural Equipment)

The proposed Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any public roadway construction component that has the potential to increase public roadway hazards through design features nor does it present an incompatible use of public roadways. However, Project-related equipment and supply deliveries may consist of heavy loads which have the potential to damage roadways or present roadway hazards to the public. Kern County or DOT will permit heavy loads. These permits will have conditions that require evaluating if damage to roadways occurs and performing necessary repairs to minimize roadway hazards to the public. Considering the above, this is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT TRAF-5 Result in Inadequate Emergency Access

The Project would not alter any existing emergency access routes or change existing patterns of emergency access. The Project would not require closures of public roads, which could inhibit access by emergency vehicles. As described above, increased project-related traffic with Mitigation Measure TRAF-1 and improvements recommended would not cause a significant increase in congestion or affect the existing LOS on roads, which could indirectly affect emergency access. Therefore, this impact would be less than significant.

4.15 TRANSPORTATION AND TRAFFIC

Mitigation Measures

No mitigation measures are required.

Level of Impact after Mitigation

Impacts would be less than significant.

IMPACT TRAF-6 Conflict with Adopted Policies, Plans, or Programs Regarding Public Transit, Bicycle, or Pedestrian Facilities, or Otherwise Decrease the Performance or Safety of Such Facilities

The Project is consistent with the goals and policies of the Kern County General Plan. The Project does not include any component that will decrease the performance or safety of public transit, bicycle, or pedestrian facilities. As such, no impact will result.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.15.5 Cumulative Impacts

Vehicle trip growth is expected to occur within the Project area from various planned developments, as well as increases in corridor through travel. Table 4.15-3 presents current (2006) traffic volumes, shows the projected baseline (2015) traffic volumes and future (2030) traffic volumes that are expected to occur within the traffic impact study area at build-out of the Kern County General Plan.

Based on the analysis in Section 4.15.4, the contribution of the Project cumulative scenario to this significant cumulative impact will be considerable without mitigation. However, with the Mitigation Measure TRAF-1 presented above, the Project's contribution to cumulative traffic impacts will be substantially reduced. This reduction in combination with planned improvements to SR 119 will result in the Project having a less than significant cumulative traffic impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.16 UTILITIES AND SERVICE SYSTEMS

4.16 Utilities and Service Systems

4.16.1 Introduction

This section describes the Project's potential impacts on utilities and service systems (e.g., water, solid waste and wastewater). Existing urban development and services are limited due to the isolated location of the Project.

4.16.2 Environmental Setting

Water Supply

The Project is located within the West Kern Water District (WKWD). According to the WKWD website (http://wkwd.org/), the WKWD is located within the southern San Joaquin Valley and provides municipal and industrial water to a variety of consumers encompassing a 300 square mile area with 7,600 metered accounts. These accounts include commercial and domestic customers in western Kern County, oil companies and co-generation facilities. The mission of the WKWD is to provide its customers a reliable supply of excellent quality water in a planned, efficient, cost effective and environmentally responsible manner, while promoting public awareness of water issues.

The WKWD contracts with the Kern County Water Agency (KCWA) to receive water from the State Water Project. WKWD's State Water Project entitlement is 31,500 acre feet per year. Water purchased from the state through KCWA is used to replenish the groundwater basin beneath the vicinity of the WKWD's groundwater banking area, which lies adjacent to the Kern River. As a result of varying annual allocations, predetermined by the state, the WKWD may not receive all of its allotted annual state water supply; however payment of one hundred percent of its cost is required. Purchasing water and utilizing the WKWD's banking program, which is a concept of storing surplus water in wet years into an underground aquifer allows WKWD to compensate for annual shortfalls.

The WKWD's groundwater banking program is the oldest banking program in Kern County. The program began in the early 1960's as a partnership between WKWD and Buena Vista Water Storage District. The water supply is obtained from eight groundwater wells and is treated before it enters the distribution system of more than 250 miles of pipeline. The WKWD's infrastructure also includes 11 pumping plants and 25 water storage tanks. Potable water required for the Project will be provided by WKWD.

Wastewater

Sanitary Sewer and Wastewater Treatment Plant

Wastewater disposal is handled by both public agencies and private individual systems in this region of the County. Disposal of waste by public agencies is through County Service Areas and Public

4.16 UTILITIES AND SERVICE SYSTEMS

Utility Districts. Individual private disposal generally occurs through a septic tank and leach line or cesspool system. Individual private disposal systems are used in this area of Kern County.

Ford City-Taft Heights Sanitation District is the nearest public utility district to the Project Site. According to the Kern County Waste Management Department website (http://www.co.kern.ca.us/wmd/Services/Sewers-Who_We_Are/sewers-who_we_are.html) Ford City-Taft Heights is a Kern County Sanitation District staffed by Waste Management Department employees. The sanitation district manages wastewater from Ford City and Taft Heights (both unincorporated). Sewer collection for the two communities joins the City of Taft system and gravity flows to the Taft Wastewater Treatment Plants. The Taft Wastewater Treatment Plant, located at 1120 East Ash Street, is jointly owned by the City of Taft (52 percent) and the Ford City-Taft Heights Sanitation District (48 percent). The City of Taft operates the sewer plant via a contractor, Eco Resources, Incorporated. EHOF is not connected to this wastewater treatment plant.

Septic Tank Disposal Systems

Many domestic, industrial and commercial units in unincorporated Kern County are not served by a community (private or public) sewage entity. Disposal of liquid sewage is achieved using individual sewage disposal systems consisting of a septic tank and disposal field.

A septic tank is generally designed to provide a place for solids to settle out of the liquids, for bacterial action to decompose or "digest" the major portion of the solids, and to store residual solids. Liquids flow out of the septic tank into a leach field or into a seepage pit where it percolates into the soil. When septic tanks reach a designated capacity, solid wastes are removed to an approved field or sewage disposal facility.

Solid Waste

Solid Waste collection services in unincorporated Kern County are provided by private companies under contract to the Kern County Waste Management Department. The Kern County Waste Management Department (KCWMD) provides environmentally safe management of both liquid and solid waste. As such, the Department is responsible for operating seven Class III sanitary landfills, five transfer stations, and four transfer bin sites. In addition, the Department also operates two special waste facilities and provides information to residents of Kern County regarding recycling and ways to reduce waste. In the greater Taft region, Westside Waste Management provides garbage pickup services. The company also provides pickup service for recyclable materials. The Project Site is within the service area of Westside Waste Management.

Once collected, solid waste is transported to a local landfill. According to the State of California's Solid Waste Information System (http://www.calrecycle.ca.gov/SWFacilities/Directory/), the permitted capacity for the Taft Landfill (the closest landfill to the Project Site) is 8,787,547 cubic yards, the remaining capacity is approximately 4,308,676 cubic yards, the landfill will reach

permitted capacity in 2123, and the maximum permitted solid waste that may be accepted is 419 tons per day. The Taft Landfill is currently proposing to expand the landfill which will increase future capacitates. In addition to the Taft Landfill, there are other County landfills (such as Shafter) that are available for use if needed.

Electricity, Natural Gas, and Telephone Services

Some utilities that would serve the Project Site would be provided by private companies. The Project Site is within the service area of Pacific Gas & Electric Company (PG&E). PG&E generates, transmits, and distributes electricity and natural gas to 15 million people throughout a 70,000-square-mile service area in northern and central California, including Western Kern County.

Southern California Gas Company provides natural gas only service to Kern County. It is the nation's largest natural gas distribution utility, serving a population of 19.8 million customers in more than 500 communities. Headquartered in Los Angeles, the company buys natural gas on the open market for approximately 5.6 million residential and small commercial and industrial customers which compose its "Core" service group.

Telecommunications services are provided to the Project Site by AT&T. Several companies offer long distance telephone, wireless communication, and internet services region wide.

Cable services are provided by Comcast Cable. Founded in 1963, the Comcast Corporation is the nation's leading provider of cable, entertainment, and communications products and services, with 24.2 million cable customers.

4.16.3 Regulatory Setting

4.16.3.1 Local

Kern County General Plan

The goals, policies, and implementation measures in the *Kern County General Plan* for utilities and service systems that are applicable to the Project are provided below. In addition, the *Kern County General Plan* does contain other goals and policies that are more general in nature and are not specific to development such as the Project. Therefore, these goals and policies are not listed below.

Policies

Policy 1. New discretionary development will be required to pay for its proportional share of the local costs of infrastructure improvements required to service such development.

Policy 3. Individual projects will provide availability of public utility service as per approved guidelines of the serving utility.

4.16 UTILITIES AND SERVICE SYSTEMS

Policy 13. The County shall ensure landfill capacity for the residents and industry of Kern County.

4.16.3.2 State

Urban Water Management Planning Act

In 1983, the State Legislature enacted the Urban Water Management Planning Act (California Water Code Sections 10610-10656). The Act states that every urban water supplier that provides water to 3,000 or more customers, or that provides over 3,000 acre-feet of water annually, should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The Act describes the contents of Urban Water Management Plans to be prepared by the affected entities, as well as how urban water suppliers should adopt and implement the plans.

California Integrated Waste Management Act

To minimize the amount of solid waste that must be disposed of in landfills, the State Legislature passed the California Integrated Waste Management Act of 1989 (AB 939), effective January 1990. According to AB 939, all cities and counties are required to divert 25 percent of all solid waste from landfill facilities by January 1, 1995 and 50 percent by January 1, 2000. Solid waste plans are required to explain how each city's AB 939 plan will be integrated with the County plan. In order of priority, the plans must promote source reduction, recycling and composting, and environmentally safe transformation and land disposal.

California Energy Commission

The California Energy Commission (CEC) regulates the provision of natural gas and electricity within the state. The CEC is the state's primary energy policy and planning agency. Created in 1974, the CEC has five major responsibilities: forecasting future energy needs and keeping historical energy data, licensing thermal power plants 50 megawatts or larger, promoting energy efficiency through appliance and building standards, developing energy technologies and supporting renewable energy, and planning for and directing the state response to energy emergencies.

Wastewater

Wastewater is regulated by the following agencies:

State Water Resources Control Board;

Lahontan Regional Water Quality Control Board;

California Department of Health Services;

California Department of Pesticide Regulation;

California Department of Toxic Substances; and

California Department of Water Resources.

4.16.4 Impacts and Mitigation Measures

4.16.4.1 Methodology

The analysis contained in the following section addresses the proposed Project's potential impacts on public utilities and service systems. This analysis is based on information and analysis contained in applicable General Plans, Community Plans, and respective EIRs.

4.16.4.2 Thresholds of Significance

Appendix G of the CEQA Guidelines and the Kern County CEQA Implementation Document state that a project would have a significant impact on utilities and service systems if it results in the following:

Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;

Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

Have insufficient water supplies available to serve the Project from existing entitlements and resources, or are new expanded entitlements required;

Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has inadequate capacity to serve the Project's projected demand in addition to the provider's existing commitments;

Be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs; or

Conflict with federal, state, and local statutes and regulations related to solid waste.

4.16.4.3 Project Impacts

IMPACT UTIL-1 Exceeds Wastewater Treatment Requirements of the Regional Water Quality Control Board

No services from a wastewater treatment provider would be required. There would be no impact.

4.16 UTILITIES AND SERVICE SYSTEMS

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL 2 Require or Result in the Construction of New Water or Wastewater Treatment Facilities or Expansion of Existing Facilities, the Construction of Which Could Cause Significant Environmental Effects

No services from a water of wastewater treatment facility would be required. No such facility would be constructed or expanded as a result of the proposed Project. No impact would occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL-3 Have Insufficient Water Supplies Available to Serve the Project from Existing Entitlements and Resources or Require Expanded Entitlements

On February 1, 2007, a California State Supreme Court case (Vineyard Area Citizens for Responsible Growth, Inc. et al., v. City of Rancho Cordova and Sunrise Douglas Property Owners Assn. et al.) was handed down that found that CEQA documents must not only identify potential water sources according to SB 610, but must also, to the extent feasible, identify the environmental impacts from utilizing the various supply sources and how those impacts would be mitigated.

With regard to potable water, the Project will periodically increase the number of construction personnel working on-Site over the 20 year construction phase. Construction workers are expected to utilize portable sanitary facilities provided by an established portable sanitary facility service provider. To comply with San Joaquin Valley Air Pollution Control District (SJVAPCD) fugitive dust prohibitions, construction activities will require the use of water for dust suppression activities. OEHI expects to continue to utilize potable water for dust suppression. Use of potable water for dust suppression during grading activities is not expected to increase demand for potable water beyond that which occurs during existing oil field operations and is not expected to substantially increase demand for potable water beyond existing supply capacities.

The addition of up to 25 full-time employment positions at the EHOF to support operation of the Project facilities will slightly increase demand for potable water supply at the site. However, this increase is expected to be limited to an increase in use of existing sanitary facilities located on-site for

employees. The incremental increase in demand (during construction and operation) will not require new or expanded water entitlements. This is a less than significant impact.

Implementation of the Project will require the use of water for EOR. However, the source of this water will be produced water or non-potable water obtained from existing Tulare aquifer wells located within the EHOF. The use of non-potable water for EOR will have no effect on existing potable water service providers or systems. This is a less than significant impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT UTIL-4 Require or Result in the Construction of New Storm Water Drainage Facilities or Expansion of Existing Facilities, the Construction of which Could Cause Significant Environmental Effects

As discussed in Section 4.8 (Hydrology and Water Quality), storm water runoff does not have the potential to enter public storm water drainage systems or Waters of the United States. No impact to public storm water drainage systems will result from Project implementation.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT UTIL-5 Result in a Determination by the Wastewater Treatment Provider which Serves or may Serve the Project that it has Inadequate Capacity to Serve the Project's Projected Demand in Addition to the Provider's Existing Commitments

No services from a wastewater treatment provider would be required. There would be no impact.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

4.16 UTILITIES AND SERVICE SYSTEMS

IMPACT UTL-6 Served by a Landfill with Insufficient Permitted Capacity to Accommodate the Project's Solid Waste Disposal Needs

Activities at the EHOF generate many types of solid waste, most of which are non-hazardous waste streams. A total of approximately 4,000 tons/year (equivalent to one truck trip every three days) of non-hazardous solid waste, such as construction debris and domestic-type wastes and trash, are removed from the EHOF. The amount of solid waste generated as a result of the Project will not be significantly greater than that generated during existing construction and operations at the EHOF without CO2 EOR. Therefore, no substantial increase in the generation of solid wastes above existing baseline conditions are anticipated as a result of project implementation. As such, the Project is not expected to be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs. Considering the above, the project would have a less than significant impact on landfill capacities and facilities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT UTL-7 Conflict with Federal, State, and Local Statutes Related to Solid Waste

The proposed Project will utilize non-hazardous and hazardous solid waste landfills with capacity to serve the demand for the Project. OEHI will adhere to all applicable regulations pertaining to solid waste storage, transport, and disposal. The proposed Project will not conflict with any statutes. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No Impact.

4.16.5 Cumulative Impacts

The Project is limited to utilizing CO2 EOR at an active oil field. The Project does not include any residential development or other component that will substantially impact utilities and service systems beyond existing baseline conditions. As such, the proposed Project is expected to have a less than significant contribution to cumulative utilities and service systems impacts.

4.16 UTILITIES AND SERVICE SYSTEMS

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.17 ENVIRONMENTAL JUSTICE

4.17 Environmental Justice

4.17.1 Introduction

This section discusses the relevant demographic data for the vicinity of the proposed Project and assesses potential environmental justice impacts that could result from Project implementation.

Environmental justice considerations are not required to be addressed within a CEQA analysis, but must be specifically evaluated in NEPA documents pursuant to a Federal Executive Order. Per State law, environmental justice is defined as "the fair treatment of people of all races, cultures, and incomes with respect to development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

4.17 ENVIRONMENTAL JUSTICE

4.17.2 Environmental Setting

Regional Population and Demographics

County of Kern

Kern County is the third largest county (in acreage) in California with a population of more than 785,000 residents (U.S. Census Bureau, 2008). Kern County is in the heart of Central California with an economic base of agriculture and oil. The area ranges from scenic desert to snow-covered mountain landscapes. The County seat is Bakersfield which is about 115 miles north of Los Angeles and approximately 18 miles east of the Project Site.

The County's racial makeup consists of the following:

TABLE 4.17-1: KERN COUNTY RACIAL MAKEUP	
White	63.2%
Black or African American	5.7%
Native American	1.0%
Asian	3.8%
Pacific Islander	0.1%
From other races	22.5%
From two or more races	3.7%
Source: U.S. Census Bureau 2006-2008 3-year estimate *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf*	

The median income breakdown for the County of Kern is as follows:

TABLE 4.17-2: KERN COUNTY MEDIAN INCOME	
Household	$46,442
Family	$50,819
Full-time working Male	$41,718
Full-time working Female	$31,303
Source: U.S. Census Bureau 2006-2008 3-year estimate	

The per capita income for the County is $20,410. Of the total population, 19.9 percent of individuals and 16.6 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Local Population and Demographics

Buttonwillow

The community of Buttonwillow (a Census Designated Place) is located approximately 5 miles north of the Project Site. As of 2000, there were 1,266 (Male: 655 / Female: 611) people, 328 occupied housing units, and 277 families within the community of Buttonwillow.

Buttonwillow's racial makeup consists of the following:

TABLE 4.17-3: BUTTONWILLOW RACIAL MAKEUP	
White	34.3%
Black or African American	3.8%
Native American	1.7%
Asian	0.1%
Pacific Islander	0.0%
From other races	55.1%
From two or more races	5.1%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf*	

The median income breakdown for Buttonwillow is as follows:

TABLE 4.17-4: BUTTONWILLOW MEDIAN INCOME	
Household	$28,370
Family	$29,716
Full-time working Male	$19,514
Full-time working Female	$16,974
Source: U.S. Census Bureau 2000	

The per capita income for Buttonwillow is $9,424. Of the total population, 28.7 percent of individuals and 23.1 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Derby Acres

The community of Derby Acres (a Census Designated Place) is located approximately 6 miles southwest of the Project Site. As of 2000, there were 376 (Male: 188 / Female: 188) people, 125 occupied housing units, and 111 families within Derby Acres.

Derby Acres' racial makeup consists of the following:

TABLE 4.17-5: DERBY ACRES RACIAL MAKEUP	
White	93.1%
Black or African American	0.0%
Native American	1.1%
Asian	0.0%
Pacific Islander	0.5%
From other races	4.5%
From two or more races	0.8%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Derby Acres is as follows:

TABLE 4.17-6: DERBY ACRES MEDIAN INCOME	
Household	$44,688
Family	$50,179
Full-time working Male	$45,521
Full-time working Female	$22,917
Source: U.S. Census Bureau 2000	

The per capita income for Derby Acres is $19,925. Of the total population, 14.6 percent of individuals and 15.3 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Dustin Acres

The community of Dustin Acres (a Census Designated Place) is located approximately 5 miles southwest of the Project Site. As of 2000 there were 585 (Male: 303 / Female: 282) people, 199 occupied housing units, and 172 families within Dustin Acres.

Dustin Acres' racial makeup consists of the following:

TABLE 4.17-7: DUSTIN ACRES RACIAL MAKEUP	
White	85.1%
Black or African American	0.2%
Native American	3.4%
Asian	0.0%
Pacific Islander	0.0%
From other races	8.2%
From two or more races	3.1%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Dustin Acres is as follows:

TABLE 4.17-8: DUSTIN ACRES MEDIAN INCOME	
Household	$50,203
Family	$51,689
Full-time working Male	$51,149
Full-time working Female	$30,795
Source: U.S. Census Bureau 2000	

The per capita income for Dustin Acres is $23,929. Of the total population, 7.0 percent of individuals and 4.7 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Fellows

The community of Fellows (a Census Designated Place) is located approximately 5.5 miles southwest of the Project Site. As of 2000, there were 153 (Male: 77 / Female: 76) people, 56 occupied housing units, and 40 families within Fellows.

Fellows' racial makeup consists of the following:

TABLE 4.17-9: FELLOWS RACIAL MAKEUP	
White	88.9%
Black or African American	0.0%
Native American	2.0%
Asian	1.3%
Pacific Islander	0.7%
From other races	6.5%
From two or more races	0.7%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Fellows is as follows:

TABLE 4.17-10: FELLOWS MEDIAN INCOME	
Household	$30,417
Family	$30,000
Full-time working Male	$36,250
Full-time working Female	$20,781
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The per capita income for Fellows is $15,636. Of the total population, 17.4 percent of individuals and 17.5 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Ford City

The community of Ford City (a Census Designated Place) is located approximately 5 miles south of the Project Site. As of 2000, there were 3,512 (Male: 1,732 / Female: 1,780) people, 1,241 occupied housing units, and 905 families within Ford City.

Ford City's racial makeup consists of the following:

TABLE 4.17-11: FORD CITY RACIAL MAKEUP	
White	80.5%
Black or African American	0.6%
Native American	1.8%
Asian	1.3%
Pacific Islander	0.6%
From other races	11.6%
From two or more races	3.5%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Ford City is as follows:

TABLE 4.17-12: FORD CITY MEDIAN INCOME	
Household	$25,192
Family	$30,256
Full-time working Male	$34,474
Full-time working Female	$20,625
Source: U.S. Census Bureau 2000	

The per capita income for Ford City is $11,581. Of the total population, 31.3percent of individuals and 30.5 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

McKittrick

The community of McKittrick (a Census Designated Place) is located approximately 5 miles west of the Project Site. As of 2000, there were 160 (Male: 81 / Female: 79) people, 54 occupied housing units, and 34 families within McKittrick.

McKittrick's racial makeup consists of the following:

TABLE 4.17-13: MCKITTRICK RACIAL MAKEUP	
White	96.9%
Black or African American	0.0%
Native American	0.0%
Asian	0.0%
Pacific Islander	0.0%
From other races	0.0%
From two or more races	3.1%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for McKittrick is as follows:

TABLE 4.17-14: MCKITTRICK MEDIAN INCOME	
Household	$43,333
Family	$42,917
Full-time working Male	$30,625
Full-time working Female	$28,750
Source: U.S. Census Bureau 2000	

The per capita income for McKittrick is $14,174. Of the total population, 15.0 percent of individuals and 11.8 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

South Taft

The community of South Taft (a Census Designated Place) is located approximately 6.5 miles south of the Project Site. Because South Taft is located in excess of 6-miles from the Project Site, it has not been considered further within this analysis.

Taft Heights

The community of Taft Heights (a Census Designated Place) is located approximately 6.5 miles south of the Project Site. As of 2000, there were 1,865 (Male: 935 / Female: 930) people, 676 occupied housing units, and 465 families within Taft Heights.

Taft Heights' racial makeup consists of the following:

TABLE 4.17-15: TAFT HEIGHTS RACIAL MAKEUP	
White	88.2%
Black or African American	0.5%
Native American	1.4%
Asian	0.9%
Pacific Islander	1.0%
From other races	5.6%
From two or more races	2.3%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Taft Heights is as follows:

TABLE 4.17-16: TAFT HEIGHTS MEDIAN INCOME	
Household	$37,684
Family	$37,944
Full-time working Male	$36,098
Full-time working Female	$21,765
Source: U.S. Census Bureau 2000	

The per capita income for Taft Heights is $14,485. Of the total population, 18.0 percent of individuals and 17.2 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Tupman

The community of Tupman (a Census Designated Place) is located approximately 1.5 miles east of the Project Site. As of 2000, there were 277 (Male: 112 / Female: 115) people, 66 occupied housing units, and 48 families within Tupman.

Tupman's racial makeup consists of the following:

TABLE 4.17-17: TUPMAN RACIAL MAKEUP	
White	93.0%
Black or African American	0.4%
Native American	0.9%
Asian	0.0%
Pacific Islander	0.0%
From other races	2.6%
From two or more races	3.1%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source: http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf*	

The median income breakdown for Tupman is as follows:

TABLE 4.17-18: TUPMAN MEDIAN INCOME	
Household	$27,500
Family	$43,125
Full-time working Male	$38,125
Full-time working Female	$28,750
Source: U.S. Census Bureau 2000	

The per capita income for Tupman is $8,482. Of the total population, 20.1 percent of individuals and 12.5 percent of families are below the poverty line.

4.17 ENVIRONMENTAL JUSTICE

Valley Acres

The community of Valley Acres (a Census Designated Place) is located approximately 2 miles south of the Project Site. As of 2000, there were 512 (Male: 267 / Female: 245) people, 183 occupied housing units, and 197 families within Valley Acres.

Valley Acres' racial makeup consists of the following:

TABLE 4.17-19: VALLEY ACRES RACIAL MAKEUP	
White	89.6%
Black or African American	0.6%
Native American	1.8%
Asian	0.2%
Pacific Islander	0.6%
From other races	4.7%
From two or more races	2.3%
Source: U.S. Census Bureau 2000 *"From other race" was included in Census 2000 for respondents who were unable to identify with the five Office of Management and Budget race categories. Respondents who provided write-in entries such as Moroccan, South African, Belizean, or a Hispanic origin (for example, Mexican, Puerto-Rican, or Cuban) are included in the From other race category.* *Source:* http://www.census.gov/prod/2001pubs/c2kbr01-1.pdf	

The median income breakdown for Valley Acres is as follows:

TABLE 4.17-20: VALLEY ACRES MEDIAN INCOME	
Household	$41,477
Family	$48,958
Full-time working Male	$36,513
Full-time working Female	$45,357
Source: U.S. Census Bureau 2000	

The per capita income for Valley Acres is $18,013. Of the total population, 8.2 percent of individuals and 5.1 percent of families are below the poverty line.

Regional Employment

Primary components of the Kern County economy are farm products, petroleum, logistics/warehousing, and national defense and space activities, such as Edwards Air Force Base, China Lake Naval Weapons Center, the National Aeronautics and Space Administration (NASA)-Dryden Flight Research Center, and the East Kern (Mojave) Airport District. Edwards Air Force Base and China Lake Naval Weapons Center are two of Kern County's major employers, joined in that category by Kern County public schools and the Kern County government. Kern County is the largest oil-producing county in California, containing approximately 71 percent of California's oil reserves.

4.17 ENVIRONMENTAL JUSTICE

Kern County is also the third leading producer of agricultural products in the United States (Kern County final budget 2007-2008).

In September 2008, the Kern County civilian labor force of 369,500 represented 2.0 percent of the California civilian labor force. The Kern County civilian labor force increased by 2.8 percent, annually, between 2000 and 2007, and 1.3 percent, annually, between 1990 and 2000. From 2000 to 2007, the Kern County civilian labor force grew faster than the civilian labor force in California by 1.7 percentage points (Table 4.17-23, Kern County Labor force, Employment, and Industry).

TABLE 4.17-21: KERN COUNTY LABOR FORCE, EMPLOYMENT, AND INDUSTRY

Industry	1990	2000	2007
Civilian Labor Force	257,000	293,500	351,900
Employment	228,900	269,300	322,800
Civilian Unemployment Rate (%)	10.90	8.20	8.30
Percent of Employment, by Industry			
Farm	15	20	16
Natural Resources and Mining	6	3	3
Construction	6	5	7
Manufacturing	5	4	5
Trade, Transportation, and Utilities	17	15	16
Information	2	1	1
Financial Activities	3	3	3
Professional and Business Services	8	9	11
Education and Health Services	6	8	9
Leisure and Hospitality	7	7	8
Other Services	3	3	2
Government	22	21	21

Source: CEDD, 2008a

4.17.3 Regulatory Setting

Federal Regulation

Federal laws, guidelines and policies:

- EPA's 1998 Environmental Justice Guidance (provides details and guidance for implementing the federal Environmental Justice program);
- Executive Order #12898 of 1994 (established the federal Environmental Justice program); and
- US Constitution (equal protection) Title VI of the 1964 Civil Rights Act.

Executive Order 12898: An *Executive Order on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* was issued by President Clinton on February 11,

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1994. The executive order was designed to focus attention on environmental and human health conditions in areas of high minority populations and low-income communities, and promote non-discrimination in programs and projects substantially affecting human health and environment (Federal Register, 1994). Executive Order 12898 required the USEPA, all other federal agencies, as well as state Federal funded agencies to develop strategies to address the issue. Each agency was required to identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and/or low-income populations.

In 1997, the U.S. Environmental Protection Agency (USEPA) Office of Environmental Justice released the *Environmental Justice Implementation Plan* (USEPA, 1997), supplementing the USEPA environmental justice strategy and providing a framework for developing specific plans and guidance for implementing Executive Order 12898. Federal agencies received a framework for the assessment of environmental justice in the USEPA's *Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis*, in 1998 (USEPA, 1998). This approach emphasized the importance of selecting an analytical process appropriate to the unique circumstances of the potentially affected community.

State Regulations

California was one of the first states in the Nation to pass legislation to codify environmental justice in state statute. Environmental Justice is defined in statute as, "The fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies." (Government Code Section 65040.12).

California laws, guidelines and policies:

- Government Code Section 65040.12 (defines Environmental Justice and designates the Office of Planning and Research (OPR) as coordinator for state Environmental Justice program); and
- Government Code Section 65040.2 (requires the OPR to develop Environmental Justice guidelines for local General Plans).

California Energy Commission: The California Resources Agency developed an Environmental Justice Policy that applies to all of its Departments, Boards, Commissions, Conservancies and Special Programs. The California Energy Commission has been integrating environmental justice into its siting process since 1995, as part of its thorough CEQA analysis of applications for siting power plants and related facilities. The cornerstone of the Energy Commission approach is based on wide-reaching public outreach efforts by the Siting, Transmission & Environmental Protection Division, the Hearing Office, Media and Public Communications Office, in addition to the Public Adviser's Office, to notify, inform and involve community members, including non-English speaking people (CEC, 2010).

4.17 ENVIRONMENTAL JUSTICE

4.17.4 Impacts and Mitigation Measures

4.17.4.1 Methodology

In recent environmental justice analyses, the CEC has used consistent methodology under USEPA guidelines. Under current USEPA methodology and CEC practice, for potential environmental justice impacts to exist, an environmental justice population must be present within 6 miles of the Project Site and the Project must result in "high and adverse" environmental impacts that affect the environmental justice populations disproportionately.

Potential environmental justice populations are defined as areas where the minority or low income population percentage is meaningfully greater than the minority or low-income population percentage in the general population, according to CEC guidance. For the purposes of this analysis, "meaningfully greater" is defined as approximately 10 percentage points greater than the county-wide average. This threshold figure with respect to the Project Site would be any minority population greater than 46.8 percent, which would be 10 percentage points greater than the Kern County minority population of 36.8 percent, and a low-income population of 29.9 percent, which would be 10 percentage points greater than the Kern County low-income population of 19.9 percent. The above Kern County minority and low-income population data was derived from 3 year data between 2006-2008 Table 4.17-24 below lists the communities located within 6 miles of the proposed Project Site, percent racial minorities, percent of individuals living below the poverty level, and whether the community is considered an environmental justice population based on the above criteria.

TABLE 4.17-22: ENVIRONMENTAL JUSTICE COMMUNITIES

Geographic Area	% Racial Minority	% Individuals Living Below Poverty Level	Environmental Justice Community?
EJ Community Threshold (Kern County Average + 10%)	46.8	29.9	Threshold Value
Buttonwillow	65.8	28.7	YES
Derby Acres	11.9	14.6	NO
Dustin Acres	14.9	7.0	NO
Fellows	11.2	17.4	NO
Ford City	19.4	31.3	YES
McKittrick	3.1	15.0	NO
Taft Heights	11.7	18.0	NO
Tupman	7.0	20.1	NO
Valley Acres	10.2	8.2	NO

% Racial Minority: Total sum of Black or African American, Native American, Asian, Pacific Islander, From Other Races, and From Two or More Races.

4.17 ENVIRONMENTAL JUSTICE

Based on the above data, there are two environmental justice communities located in proximity to the Project Site; Buttonwillow and Ford City. Potential environmental justice impacts that could result to the communities of Buttonwillow and Ford City from Project implementation are analyzed below.

4.17.4.2 Significance Criteria

There are currently no established CEQA or NEPA thresholds for environmental justice issues. The Federal Executive Order on Environmental Justice and other sources were considered to derive a significance threshold for this analysis. A project would result in a significant environmental justice impact if it would:

- Cause a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area;
- Substantially increase project air emissions that disproportionately impact low-income or minority communities in proximity to the project site;
- Degrade the health and safety of low-income or minority communities disproportionately; or
- Fail to provide for or encourage effective participation of low-income or minority communities adjacent to, or in the affected vicinity of, the project area in the environmental review and decision-making process for this project.

4.17.4.3 Project Impacts

IMPACT EJ 1 Cause a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area

The following discussion includes an analysis of impacts that could result from Project implementation for the issue areas commonly evaluated for potential environmental justice impacts.

Aesthetics

The proposed Project will be constructed in phases over a 20 year period. This construction activity will temporarily introduce additional construction equipment at various locations within the Project Site. Given existing utilization of the Project vicinity primarily by oil and gas operations that commonly utilize heavy equipment, the short-term introduction of construction equipment at various locations would not contribute to a negative aesthetic impact to low-income or minority populations within the environmental justice communities.

The Project consists of utilizing CO2 enhanced oil recovery at an active oil field which will not substantially alter the visual character of the Project Site. Considering the distance away from the Project and topography of Elk Hills, it is not anticipated that any Project components will substantially alter or degrade the viewshed from Buttonwillow or Ford City. As discussed in Section 4.1, while the proposed EOR Processing Facility located in Section 27 has the potential to result in significant

impacts to aesthetics, it will not have a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area.

Air Quality

See Impact EJ 2 below.

Hazards and Hazardous Materials

See Impact EJ 3 below.

Hydrology and Water Quality

The proposed Project does not have the potential to result in significant water quality impacts during construction and operation (see Section 4.8). As water quality impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant water quality impacts to low-income or minority populations within environmental justice communities.

Noise

As discussed within Section 4.11, the proposed Project would generate short-term construction-related noise during facility installation. Operation of the Project would also generate equipment noise from the EOR Processing Facility located in Section 27S. However, the proposed Project will have less than significant noise impacts and will not have a disproportionately high and adverse impact on low-income or minority communities adjacent to or in the affected vicinity of the project area.

Population and Housing

The proposed Project is limited to utilizing CO2 EOR and the installation of supporting facilities at an active oil field. The proposed Project does not include a growth inducing element that would substantially increase population. As population and housing impacts resulting from the proposed Project will be less than significant (see Section 4.12), the proposed Project will have less than significant population and housing impacts to low-income or minority populations within environmental justice communities.

Public Services

The project is limited to CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. As discussed in Section 4.13, the proposed Project does not include an element that will substantially impact public services. As public services impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant public services impacts to low-income or minority populations within environmental justice communities.

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Recreation

The project is limited to CO2 enhanced oil recovery and the installation of supporting facilities at an active oil field. As discussed in Section 4.14, the proposed Project does not include an element that will substantially impact recreation resources. As recreation impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant recreation impacts to low-income or minority populations within environmental justice communities.

Transportation and Traffic

The proposed Project has the potential to result in significant transportation and traffic impacts during the construction phase of the Project. However, the significance of potential transportation and traffic impacts has been mitigated to a less than significant level (see Section 4.15). As transportation and traffic impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant transportation and traffic impacts to low-income or minority populations within environmental justice communities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT EJ 2 Substantially increase project air emissions that disproportionately impact low-income or minority communities in proximity to the project site

The proposed Project has the potential to result in significant air quality impacts. However, the significance of potential air quality impacts has been mitigated to a less than significant level (see Section 4.3). As air quality impacts resulting from the proposed Project will be less than significant, the proposed Project will have less than significant air quality impacts to low-income or minority populations within environmental justice communities.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

4.17 ENVIRONMENTAL JUSTICE

IMPACT EJ 3 Degrade the health and safety of low-income or minority communities disproportionately

Buttonwillow and Ford City are located less than 6 miles from the proposed Project Site. There are no project components that have the potential to result in significant health and safety impacts to low-income or minority populations within Buttonwillow and Ford City. No impact will occur.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

No impact.

IMPACT EJ 4 Fail to provide for or encourage effective participation of low-income or minority communities adjacent to, or in the affected vicinity of, the project area in the environmental review and decision-making process for this project

The Lead Agency retains the responsibility for coordinating public involvement and review of the Project under the CEQA. This process provides and encourages public participation, including environmental justice communities. However, the timing and location of public involvement opportunities such as public scoping meetings, workshops, and hearings can substantially influence attendance and possibly exclude involvement of low-income or minority populations. This is potentially a significant environmental justice impact. Although the Lead Agency will be responsible for coordinating public review under CEQA, mitigation measure EJ-1 below is recommended to encourage effective participation of environmental justice communities in the environmental review and decision-making process for the Project.

Mitigation Measures

Mitigation Measure EJ-1 Conduct at least two public scoping meetings at different times within 5 miles of each environmental justice community with the potential to be affected by the proposed Project (e.g., 6 miles); Buttonwillow and Ford City. A notice of each public scoping meeting must be posted in at least one local newspaper 3-7 days prior to each meeting. A notice of each pending meeting should also be posted at each meeting location at least 7 days in advance of each meeting

Level of Significance after Mitigation

Impacts would be less than significant.

4.17 ENVIRONMENTAL JUSTICE

4.17.5 Cumulative Impacts

As discussed above in Section 4.17.4, the proposed Project will result in less than significant adverse environmental justice impacts. Cumulative impacts of the proposed Project would be minimized through implementation of Mitigation Measure EJ-1. The proposed Project does not include any component with the potential to significantly contribute to a cumulative environmental justice impact. The proposed Project will therefore have a less than significant environmental justice cumulative impact.

Mitigation Measures

Mitigation Measure EJ-1detailed above is expected to reduce environmental justice impacts to a less than significant level, and thus ensure the proposed Project will not contribute to an overall cumulative impact.

Level of Significance after Mitigation

The proposed Project would have less than significant cumulative impacts.

4.18 GREENHOUSE GAS EMISSIONS

4.18 Greenhouse Gas Emissions

4.18.1 Introduction

This section considers the greenhouse gas impacts of the proposed Project.

4.18.2 Environmental Setting

Greenhouse gases, which are transparent to solar radiation, absorb infrared radiation, resulting in heat trapping. This phenomenon is known as the greenhouse effect. Among the prominent greenhouse gases contributing to the greenhouse effect are carbon dioxide (CO2), methane (CH4), ozone (O3), water vapor, nitrous oxide (N2O), and chlorofluorocarbons (CFCs).

Consumption of fossil fuels in the transportation sector was the single largest source of California's greenhouse gas emissions in 2004, accounting for 40.7 percent of total greenhouse gas emissions in the state (CEC, 2006a). This category was followed by the electric power sector (including both in- and out-of-state sources) (22.2 percent) and the industrial sector (20.5 percent) (CEC 2006a).

As compared to criteria air pollutants and toxic air contaminants, which can produce localized effects on air quality, emissions of greenhouse gases do not create localized impacts.

4.18.3 Regulatory Setting

This section describes local, State, and Federal Legislation and regulations that specifically address greenhouse gas emissions.

Local

San Joaquin Valley Air Pollution Control District

The SJVAPCD staff utilizes an approach intended to streamline the CEQA process to determine if project-specific greenhouse gas emissions could have a significant effect on the environment. The methodology relies on the use of performance based standards to determine significance of project specific greenhouse gas emission impacts. These are known as Best Performance Standards (BPS). Establishing BPS helps project proponents, lead agencies, and the public by proactively identifying effective, feasible greenhouse gas emission reduction measures. Emission reductions achieved through implementation of BPS are pre-quantified, thus negating the need for project specific quantification of greenhouse gas emissions (SJVAPCD 2009).

BPS' are defined as the most effective achieved-in-practice means of reducing or limiting greenhouse gas emissions from a specified greenhouse gas emissions source. For traditional stationary source projects, such as pollutant-emitting equipment requiring an air permit, BPS includes equipment type, equipment design, and operational and maintenance practices for the identified service, operation, or emission unit class and category. For development projects, such as new commercial or residential

development, BPS focuses on measures that improve energy efficiency and those that reduce vehicle miles travelled. SJVAPCD staff establishes BPS for specific classes and categories of stationary sources and development projects and maintains a listing of the established BPS ("BPS Guidance") on the Climate Change page of the SJVAPCD's webpage www.valleyair.org (SJVAPCD 2009). Projects implementing BPS in accordance with this Guidance will be judged as having a less than significant individual and cumulative impact on global climate change and would not require project specific quantification of greenhouse gas emissions.

The BPS Guidance employs a tiered approach to review a project's greenhouse gas emissions. Projects exempt from the requirements of CEQA, and projects complying with an approved greenhouse gas emission reduction plan or mitigation program (such as AB 32) will also be judged to have a less than significant individual or cumulative impact. Such plans or programs must be specified in law or adopted by the public agency with jurisdiction over the affected resources and have a certified final CEQA document. Projects not implementing BPS would require quantification of project specific greenhouse gas emissions. To be judged as having a less than significant individual and cumulative impact, such projects must have reduced or mitigated greenhouse gas emissions by 29 percent as measured against "business as usual" (BAU), consistent with greenhouse gas emission reduction targets established by CARB's AB 32 Scoping Plan. For all projects for which the lead agency has determined that an EIR is required, quantification of greenhouse gas emissions is recommended regardless of whether the project incorporates BPS (SJVAPCD 2009).

The Guidance also notes that "nothing…shall be construed as limiting a lead agency's authority to adopt a statement of overriding consideration for projects with significant greenhouse gas impacts" (SJVAPCD 2009).

Process for Evaluating Significance of Greenhouse Gas Emissions under the SJVAPCD Policy

Under the Guidance, greenhouse gas emissions are analyzed as follows:

- Projects determined to be exempt from the requirements of CEQA are characterized as having a less than significant individual and cumulative impact for greenhouse gas emissions and do not require further environmental review, including analysis of project specific greenhouse gas emissions. Projects exempt under CEQA are evaluated consistent with established rules and regulations governing project approval without consideration of BPS.
- Projects complying with an approved greenhouse gas emissions reduction plan or greenhouse gas mitigation program which avoids or substantially reduces greenhouse gas emissions within the geographic area in which the project is located will be judged to have a less than significant individual and cumulative impact for greenhouse gas emissions. Such plans or programs must be specified in law or approved by the lead agency with jurisdiction over the affected resource and supported by a CEQA compliant environmental

review document adopted by the lead agency.

- Projects implementing BPS are not required to quantify project specific greenhouse gas emissions. Consistent with CEQA Guideline, such projects will be judged to have a less than significant individual and cumulative impact for greenhouse gas emissions.
- Projects not implementing BPS, and not otherwise exempt from CEQA or deemed to have an insignificant impact are required to quantify project-specific greenhouse gas emissions and demonstrate that such emissions would be reduced or mitigated by at least 29 percent, compared to BAU (including greenhouse gas emission reductions achieved since the 2002-2004 baseline period) and to be determined to have a less than significant individual and cumulative greenhouse gas impact.
- Notwithstanding any of the above provisions, projects requiring preparation of an EIR for any other reason require quantification of project specific greenhouse gas emissions. Where such projects implement BPS or achieve at least 29 percent greenhouse gas emission reduction compared to BAU, they will be judged as having a less than significant individual and cumulative impact for greenhouse gas.

Application of BPS to Stationary Source Equipment

Greenhouse gas emissions can be directly emitted from stationary sources of air pollution requiring operating permits from the SJVAPD, or they may be emitted indirectly, as a result of electrical power consumption. In many cases, a land-use agency will act as the lead agency under CEQA for projects that will eventually require Permits to Operate from the SJVAPCD. The SJVAPCD recommends that the lead agency apply the SJVAPCD's policy for assessing significance of greenhouse gas emission impacts from stationary source projects, under CEQA.

For greenhouse gas emissions increases, the land-use agency should consult the Climate Change Action Plan (CCAP) to ascertain the appropriate BPS for the class and category of source of greenhouse gas emissions, and require the source to apply the BPS contained in the listing at the time the application for discretionary approval was deemed complete by the lead agency. If such BPS is proposed and required, or the project achieves a 29 percent reduction in greenhouse gas emissions relative to the BAU baseline, the greenhouse gas impacts from the stationary source equipment shall be judged as having a less than individually and cumulatively significant impact on global climate change for CEQA purpose.

State

Assembly Bill 32, the California Global Warming Solutions Act of 2006

In September 2006, the Global Warming Solutions Act of 2006 (AB 32) was signed into law by former Governor Arnold Schwarzenegger. AB 32 requires that statewide greenhouse gas emissions be reduced to 1990 levels by the year 2020, which results in a roughly 25 percent reduction under

4.18 GREENHOUSE GAS EMISSIONS

BAU estimates. The law requires this reduction to be accomplished through a variety of measures, including an enforceable statewide cap on greenhouse gas emissions that will be phased-in starting in 2012. AB 32 directs CARB to develop and implement regulations to reduce statewide greenhouse gas emissions from stationary sources.

The AB 32 Scoping Plan

CARB adopted the AB 32 Scoping Plan on December 12, 2008. The Scoping Plan provides the outline for future actions to reduce California's greenhouse gas emissions and establishes a schedule for CARB and other state agencies to adopt implementing regulations and other initiatives to reduce greenhouse gas emissions.

CARB has adopted a number of measures required by the Scoping Plan and the Scoping Plan calls for the remaining measures to be adopted by the start of 2011 and in effect on or before 2012. One of the most significant measures called for in the Scoping Plan is the statewide cap on emissions from the largest sources of greenhouse gas emissions. The cap-and-trade regulation was approved by CARB on December 16, 2010 following public review and comment. It calls for a phased program starting in 2012 that includes electricity producers, including electricity imports, and large industrial facilities (those with greater than 25,000 tonnes carbon dioxide per year). Starting in 2015, distributors of transportation fuels, natural gas, and other fuels will be included in the cap-and-trade program.

Facilities covered in the cap-and-trade program are not given a specific limit on their greenhouse gas emissions but must supply a sufficient number of allowances (each covering the equivalent of one tonne of carbon dioxide equivalent) to cover their annual emissions. Each year, the total number of allowances issued in the state drops, requiring covered facilities to find the most cost-effective and efficient approaches to reducing their emissions. Facilities without sufficient allowances to cover their annual emissions must acquire additional allowances or offsets. By the end of the program in 2020 there will be a reduction in greenhouse gas emissions sufficient to reach the same level of emissions as the state experienced in 1990, as required under AB 32.

On October 20, 2011, CARB submitted Final Rules for California's cap-and-trade program to the California Office of Administrative Law. With Office of Administrative Law's approval of the rules on December 13, 2011, Article 5: "California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms" was formally added to Subchapter 10 of Title 17 of the California Code of Regulations. The cap-and-trade final rules cover the following areas:

- Annual Cap and Allowance Budgets;
- Determining Reporting Obligations;
- Allowance Distribution;
- Market Operations;

- Market Oversight; and
- Offsets.

California Climate Action Registry

The California Climate Action Registry (CCAR) was created by the California legislature in 2000, as a non-profit public/private partnership that helps companies and organizations throughout the United States to track, publicly report and reduce their greenhouse gas emissions. The results are certified by independent third-parties to ensure compliance with CCAR protocols and standardization across participants and sectors. The CCAR has been widely recognized as a gold standard for public reporting of greenhouse gases.

Federal

Code of Federal Regulations (40 CFR Part 98)

In response to the FY2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), EPA issued the Mandatory Reporting of Greenhouse Gases Rule (74 FR 5620) which requires reporting of greenhouse gas data and other relevant information from large sources and suppliers in the United States. The purpose of the rule is to collect accurate and timely greenhouse gas data to inform future policy decisions. The Rule is codified in 40 CFR Part 98 and is referred to as the Greenhouse Gas Reporting Program (GHGRP).

Suppliers of certain products that would result in greenhouse gas emissions if released, combusted or oxidized; direct emitting source categories; and facilities that inject CO2 underground for geologic sequestration or any purpose other than geologic sequestration, are covered in the Rule. Specifically, facilities that emit 25,000 tonnes or more per year of greenhouse gases are required to submit annual reports to the U.S. EPA.

Subpart C of the 40 CFR 98 specifically addresses reporting requirements for stationary fuel combustion sources. The reporting requirements specify calculation methodologies based on unit heat input capacity and fuel type. Subpart NN addresses requirements for reporting greenhouse gas emissions from suppliers of natural gas and natural gas liquids that would result from complete combustion or oxidation of the products that are placed into commerce. Subpart UU addresses the underground injection of CO2 for the purposes of enhanced oil and gas recovery. Subpart W addresses requirements for leak detection, calculation and reporting of fugitive and process emissions from oil and natural gas systems.

Prevention of Significant Deterioration

In 2009, EPA issued an affirmative finding on the issue of whether greenhouse gas emissions contribute to air pollution that endangers public health or welfare. Shortly thereafter, it proposed to apply Prevention of Significant Deterioration ("PSD") requirements to facilities whose carbon dioxide

equivalent emissions exceed 25,000 tonnes per year. On May 13, 2010, EPA announced a final rule "tailoring" greenhouse gas emissions to PSD requirements and raised the emission threshold for rule applicability to 75,000 tonnes per year where a source was required to obtain a PSD permit for other pollutants and 100,000 tonnes per year for sources that would not otherwise be regulated. In 2011, EPA will consider whether the threshold should become carbon dioxide equivalent emissions of more than 50,000 tonnes per year.

4.18.4 Impacts and Mitigation Measures

4.18.4.1 Methodology

Greenhouse gas emissions associated with the proposed Project were estimated using CO2 emissions as a proxy for all greenhouse gas emissions. This is done by expressing the emissions of each greenhouse gas in terms of CO2 equivalents (CO2e), a well-accepted mathematical conversion based on the global warming potential of each gas. This is consistent with the current reporting requirements of the CARB.

The primary sources of the Project greenhouse gas emissions are anticipated to be vehicle emissions and construction equipment used during the construction phase and various stationary, mobile, and indirect sources during operation of the Project. Indirect sources refer to emissions of CO2e produced as a result of generating electrical power consumed by the Project.

Vehicle emissions were calculated using emissions factors for "Light Duty Autos" (LDA) and "Heavy-Duty Trucks" (HDT) obtained from CARB's EMFAC 2007 and are specific to each construction year and vehicles within the Kern County inventory. The Emissions factors associated with construction equipment were obtained from CARB's OFFROAD 2007 model. These emissions factors were then applied to the anticipated number of internal combustion engines, coupled with brake-horsepower, engine load factor, daily operating hours, and operational days per year. The greenhouse gas emissions from combustion equipment were calculated from the annual heat input rate to the equipment (MMBtu/Year, HHV) and the greenhouse gas emission factors (Kg/MMBtu) contained in Appendix-A of the California Air Resources Board (CARB) *"Regulations for the Mandatory Reporting of Greenhouse Gas Emissions"*. Fugitive greenhouse gas emissions (CO2 and methane) from leaking piping components were calculated from component counts and component leak factors. Leak rate factors (Lb/Day per component) were estimated using "Average Leak Rate Equations" (ALR) published by the EPA in the document titled *"Protocol for Equipment Leak Emission Estimate"*, EPA-453/R-95-017, 1995. Detailed emissions estimates and assumptions used in the calculations are included in Appendix A.

4.18.4.2 Threshold of Significance

CEQA Guidelines Appendix G and the Kern County CEQA Implementation Document states that a project has a significant impact on greenhouse gas emissions and climate change if it would:

4.18 GREENHOUSE GAS EMISSIONS

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or
- Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases.

Pursuant to SJVAPCD guidance, projects implementing BPS or achieving at least a 29% greenhouse gas emission reduction compared to BAU are judged as having a less than significant individual and cumulative greenhouse gas emissions impact.

4.18.4.3 Project Impacts

IMPACT GHG-1: Generates Greenhouse Gas Emissions, Either Directly or Indirectly, that may have a Significant Impact on the Environment

Tables 4.18-1 (Estimated Project Construction CO2e Emissions) and 4.18-2 (Estimated Project Operation CO2e Emissions) below present the estimated annual CO2e emissions that could result from Project implementation. Detailed calculations for all Project emission sources as well as assumptions used in the calculations are provided in Appendix A.

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TABLE 4.18-1 ESTIMATED PROJECT CONSTRUCTION CO2e EMISSIONS	
Year	**CO2e (tonnes)**
2014	1,838.46
2015	2,867.58
2016	2,461.04
2017	2,573.19
2018	2,150.89
2019	2,751.93
2020	1,413.83
2021	1,532.98
2022	1,105.61
2023	2,159.48
2024	1,625.36
2025	2,193.59
2026	1,379.83
2027	1,631.71
2028	1,821.30
2029	2,153.27
2030	1,302.29
2031	1,820.08
2032	903.43
2033	2,425.90
Project Construction Total:	**38,112**
Project Sequestration Total:	**44,000,000**
Net Reduction:	**43,961,888**

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TABLE 4.18-2 ESTIMATED PROJECT OPERATION CO2e EMISSIONS	
Source	**CO2e (tonnes)**
Stationary	46,281
Indirect (Electric Power)	180,177
Mobile Source	340
Annual Total	226,798
Project Operation Total (2016-2033):	**4,082,364**
Project Net Sequestration After Subtraction of Construction Emissions:	**43,961,888**
Net Reduction:	**39,879,524**

As shown above, construction and operation of the proposed EOR facilities could result in an estimated total of 38,112 and 4,082,364 tonnes of CO2e emissions respectively, for a combined total of approximately 4.12 million tonnes of CO2e emissions over a 20-year Project lifespan. The above estimates of CO2e emissions do not consider CO2e emissions from the HECA project. For purposes of this analysis, operational CO2e emissions for the entire Project were assumed to begin in 2016 and occur throughout the Project lifespan. Of the total estimated Project CO2e emissions, Table 4.18-2 shows that approximately 79 percent would be from indirect sources (e.g., consumption of electric power not generated as part of the Project).

The proposed Project involves the use of CO2 (produced by the gasification process at the proposed HECA facility). Through CO2 EOR it is estimated that the Project will ultimately sequester approximately 44 million tonnes of CO2e (over 2 million tones of CO2 each year) delivered by HECA. As a result, compared to the case in which CO2 generated through the HECA gasification process is vented to the atmosphere, over the life of the combined HECA and CO2 EOR projects, a net reduction of approximately 39.88 million tonnes of CO2e emissions will be achieved.

Based upon the foregoing, the Project will not result in emissions that trigger PSD permitting requirements or exceed applicable state or local significance thresholds. The Project will achieve more than a 29% reduction in greenhouse gas emissions from BAU and will have a less than significant impact on greenhouse gas emissions.

4.18 GREENHOUSE GAS EMISSIONS

Mitigation Measures

No mitigation measures are necessary.

Level of Significance after Mitigation

Impacts would be less than significant.

IMPACT GHG-2 Conflicts with any Applicable Plan, Policy or Regulation of an Agency Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases

SJVAPCD has adopted a Climate Change Action Plan and associated implementation guidance including requiring BPS for new projects in the air basin. There are no other plans, policies or regulations applicable to the Project. As mentioned in IMPACT GHG-1, under the SJVAPCD plan and guidance, the Project will result in a net reduction of approximately 39.88 million tonnes of CO2e. This reduction exceeds the 29% reduction from BAU set forth in the SJVAPCD guidance. In addition, the EHOF will be subject to the provisions of AB 32, including any applicable regulations from the Scoping Plan and the CARB cap-and-trade regulation that will require greenhouse gas emissions to be reduced beginning in 2012. Therefore the proposed Project will have a less than significant impact on green house gas emissions.

Mitigation Measures

No mitigation measures are necessary.

Level of Significance after Mitigation

Impacts would be less than significant.

4.18.5 Cumulative Impacts

The Project is estimated to generate approximately 4.12 million tonnes of CO2e emissions over a 20 year period, but will involve the sequestration of approximately 44 million tonnes of greenhouse gases in the form of CO2e. There will be a net reduction of approximately 39.88 million tonnes of CO2 from what would otherwise be emitted. This is considered a less than significant impact and therefore, the Project is not expected to result in cumulatively significant emissions of greenhouse gases or impacts to global climate change.

Mitigation Measures

No mitigation measures are required.

Level of Significance after Mitigation

Impacts would be less than significant.

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

5.0 Consequences of Project Implementation

5.0.1 Environmental Effects found to be Less Than Significant

Upon assessment and environmental review in this SEI, impacts in the following areas would be less than significant or could be reduced to less than significant levels with mitigation measures:

Aesthetics;

Agricultural resources;

Air quality;

Biological resources;

Cultural and paleontological resources;

Geology and soils;

Hazards and hazardous materials;

Hydrology and water quality;

Land use and planning;

Mineral resources;

Noise;

Population and housing;

Public services;

Recreation;

Transportation and traffic;

Utilities and service systems;

Environmental justice; and

Greenhouse gas emissions.

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

5.0.2 Significant Environmental Effects

Impacts in the following areas would be significant, even with the incorporation of feasible mitigation measures that attempt to reduce impacts to less than significant levels:

None.

5.1 Significant Cumulative Impacts

This SEI has considered the potential cumulative effects of the proposed Project. Impacts for the following have been found to be cumulatively considerable:

None.

5.2 Growth Inducement

This subsection has been prepared to address whether or not construction of the proposed Project is likely to foster additional growth, either directly or indirectly. This information can be an important factor in a decision to approve a project because such approval can, in turn, lead to additional projects that may have environmental consequences.

The fact that a project may result in additional growth does not imply that such growth is either detrimental or beneficial. For example, a project that furthers growth consistent with the adopted goals and policies of a County's General Plan would likely be considered beneficial. Conversely, a project that fosters growth that would conflict with such goals and policies would likely be considered detrimental.

The Kern County General Plan recognizes that certain forms of growth are beneficial, both economically and socially. Section 15126.2 [d] of the State CEQA Guidelines provides the following guidance on growth-inducing impacts: a project is identified as growth inducing if it "could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment."

In general, a project may foster spatial, economic, or population growth in a geographic area if it meets any one of the criteria identified below:

The project removes an impediment to growth (e.g., the establishment of an essential public service, or the provision of new access to an area)

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery and will not remove an impediment to growth, nor will it establish an essential public service or provide new access to an area that has the potential to induce growth. This is a less than significant impact.

The project results in the urbanization of land in a remote location (leapfrog development)

5.0 CONSEQUENCES OF PROJECT IMPLEMENTATION

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery and does not include urbanization of land. This is a less than significant impact.

The project establishes a precedent-setting action (e.g., a change in zoning or general plan amendment approval)

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery and does not include a component that requires a change in zoning or general plan amendment. This is a less than significant impact.

Economic expansion or growth occurs in an area in response to the project (e.g., changes in revenue base, employment expansion, etc.)

Project Evaluation. The Project is limited to utilizing CO2 for enhanced oil recovery at an active oil field. Although the Project will result in economic benefits, these benefits will not result in economic expansion or growth which has the potential to induce growth which could result in significant environmental impacts. This is a less than significant impact.

5.3 Precedent-Setting Action

Changes from a project that could be precedent-setting include (among others) a change in zoning, General Plan amendments, or approval of exceptions to regulations that could have implications for other properties or that could make it easier for other properties to develop.

The Project does not include a component that requires a change in zoning or General Plan amendment. The project will comply with all applicable rules and regulations and will not require approval or exceptions to regulations. The proposed Project is consistent with the goals and policies of the Kern County General Plan.

CO2 EOR and sequestration is a proven technology that can have both economic and environmental benefits. It has been demonstrated through study that the EHOF and specifically the Stevens Reservoirs, are extremely suitable for utilizing CO2 EOR and sequestering CO2. Implementation of the Project is not expected to result in a precedent setting action that would make it easier to develop other properties which could induce growth, conflict with established policies and plans, or lead to exceptions to regulations. As such, the Project will not result in a precedent setting action.

6.0 ALTERNATIVES TO THE PROJECT

6.0 Alternatives to the Project

6.1 Introduction

The California Environmental Quality Act (Public Resources Code, Section 21000 *et seq.*) (CEQA) and the State CEQA Guidelines (California Code of Regulations, Title 14, Section 15000 et seq.) require that an environmental impact report (EIR) "describe a range of reasonable alternatives to the proposed Project, or to the location of the proposed Project, which would feasibly attain most of the basic objectives of the proposed Project, but would avoid or substantially lessen any of the significant effects of the proposed Project, and evaluate the comparative merits of the alternatives" (CEQA Guidelines Section 15126.6(a)). If a project alternative would substantially lessen the significant environmental effects of a proposed Project, the decision maker should not approve the proposed Project unless it determines that specific technological, economic, social, or other considerations make the project alternatives infeasible (PRC Section 21002, CEQA Guidelines Section 15091(a)(3)). The EIR must also identify alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and should briefly explain the reasons underlying the lead agency's determination (CEQA Guidelines Section 15126.6(c)).

One of the alternatives analyzed must be the "No Project" alternative. The "No Project" analysis must discuss the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the Project were not approved and development continued to occur in accordance with existing plans and consistent with available infrastructure and community services (CEQA Guidelines Section 15126.6(e)(2)). As oil recovery operations would continue to occur within the EHOF but without utilizing CO2 from the HECA Project, the "No Project" alternative evaluates continuation of the existing oil recovery operations.

6.2 Alternatives Considered but Determined to be Infeasible

During the Pre-FEED stage of the Project, OEHI developed a range of alternatives that were considered, but were determined to be infeasible and therefore were not considered further in this alternatives evaluation. Each of these alternatives with a brief discussion on why they were eliminated from further consideration is presented below.

6.2.1 Reduced Project Scale

OEHI considered a reduced Project scale that would minimize CO2 EOR processing facilities (including satellite stations), injection and production wells, and pipeline linears. A reduced Project scale does have the potential to reduce potential environmental impacts. However, the proposed Project has been designed to utilize and mitigate for the total volume of CO2 generated by the HECA Project. Reducing the Project scale would not allow OEHI to utilize and mitigate for the total volume

of CO2 generated by the HECA Project. A reduced Project scale would not meet the critical Project objectives and has therefore not been considered further within this SEI.

6.2.2 Alternative Project Locations

Alternative Oil Field

Alternative oil field locations for CO2 EOR and sequestration were evaluated in HECA's Application for Certification with the CEC. HECA evaluated CO2 EOR and sequestration in oil fields in the well-studied Ventura Basin and southern end of the San Joaquin Basin due to their sequestration and EOR potential. The study evaluated capacity, containment, and other specific criteria generally deemed important by current industry and scientific standards in sequestration (depth, pressure, lithology, porosity & permeability, structural integrity, and storage capacity) and deemed necessary to satisfy HECA Project objectives. This study identified the EHOF and Ventura Oil Field as meeting these key factors. The EHOF was determined to be the preferred field due to its closer proximity to the HECA Project Site, shorter CO2 supply line length, results of previous CO2 pilot studies, and decreased construction time and requirements (URS, 2009). As implementation of the Project within the EHOF can reasonably be expected to result in less environmental impacts compared to Project implementation at another oil field, alternative oil field locations were not considered further within this SEI.

Alternative Reservoir within Elk Hills Oil Field

Alternative reservoirs within the EHOF for CO2 EOR and sequestration were evaluated in HECA's Application for Certification with the CEC. Characteristics of the Stevens reservoirs indicate they are ideal candidates for miscible-CO2 EOR. CO2 EOR in the targeted CO2 injection zones of the Stevens reservoirs has the potential to significantly increase oil reserves and extend the productive life of the EHOF. There is adequate capacity within the Stevens reservoirs to support the volume of CO2 that will be generated by the HECA Project (URS, 2009). Use of another reservoir within the EHOF will not meet the Project objectives and is not expected to reduce potential environmental impacts compared to the proposed Project. Considering the above, alternative reservoirs within the EHOF were not considered further within this SEI.

Alternative Project Layout within the Stevens Reservoirs

OEHI evaluated a range of Project component siting options within the Stevens reservoirs during the Pre-FEED stage of the Project. The proposed Project layout has been designed to reduce potential environmental impacts to the maximum extent possible. This includes the following measures incorporated into the Project design to minimize disturbances:

- Use of existing wells and well pads (approximately 80% of required Project wells are anticipated to use existing wells);
- Siting of facilities to reduce length of necessary supporting pipelines;

6.0 ALTERNATIVES TO THE PROJECT

- Pipelines installed in previously disturbed corridors to the extent feasible;
- Typical with current operations, pipelines with lower hazards installed above-ground (reduces surface disturbance); and
- Buried pipelines installed within multi-line right of ways when possible (reduces land disturbance).

Alternative site layouts within the Stevens reservoirs would likely result in increased disturbances and potential environmental impacts compared to the proposed layout. Considering the above, alternative Project layouts within the Stevens reservoirs were not considered further within this SEI.

6.3 Alternatives Analyzed within SEI

As discussed in Section 6.2, OEHI considered a range of Project alternatives during the Pre-FEED stage of the proposed Project. None of the alternatives considered were determined to be feasible or would not decrease potential significant environmental impacts and have therefore not been analyzed further within this SEI. As such, this alternatives evaluation focuses on an analysis of the potential environmental impacts of the "No Project" alternative.

6.4 Comparison of Proposed Project to No Project

Table 6-1 below provides a comparative summary of the potential environmental impacts that could result from the Proposed Project and the No Project alternative. A discussion to support the determination for each impact determination for the No Project alternative is provided in Section 6.5.

6.0 ALTERNATIVES TO THE PROJECT

TABLE 6-1: SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS OF PROJECT AND PROJECT ALTERNATIVES		
	Proposed Project (CO2 EOR and Sequestration)	**No-Project Alternative** (Continued Oil Field Production and Use)
Extent to Which Project Objectives Satisfied	**Total**	**None**
Aesthetics Impacts	Significant but Mitigable	Less than Significant
Agriculture Impacts	No Impact	No Impact
Air Quality Impacts	Significant but Mitigable	Significant but Mitigable
Biological Resources Impacts	Significant but Mitigable	Significant but Mitigable
Cultural and Paleontological Resources Impacts	Significant but Mitigable	Significant but Mitigable
Geology / Soils Impacts	Significant but Mitigable	Significant but Mitigable
Greenhouse Gases Impacts	Less than Significant	Significant but Mitigable
Hazards / Hazardous Materials Impacts	Less than Significant	Less than Significant
Hydrogeology and Water Quality Impacts	Less than Significant	Less than Significant
Land Use / Planning Impacts	Less than Significant	Less than Significant
Mineral Resources Impacts	Less than Significant	Less than Significant
Noise Impacts	Less than Significant	Less than Significant
Population and Housing Impacts	Less than Significant	Less than Significant
Public Services Impacts	Less than Significant	Less than Significant
Environmental Justice Impacts	Significant but Mitigable	Less than Significant
Recreation Impacts	Less than Significant	Less than Significant
Transportation / Traffic Impacts	Significant but Mitigable	Less than Significant
Utilities and Service Systems Impacts	Less than Significant	Less than Significant

6.5 No Project Alternative:

CEQA, through case law and statutory language, requires that a "No Project" alternative be evaluated. Under State CEQA Guidelines Section 15126.6(e)(2), "the No Project alternative shall discuss the existing conditions at the time the notice of preparation is published . . .as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" [14 CCR 15126.6(e)(2)].

The purpose of the No Project alternative is to allow comparison of the impacts of the proposed Project with the impacts of a continuation of baseline conditions. The No Project alternative assumes that existing oil recovery operations occur without the use of CO2 EOR for a 20 year period (the proposed lifespan of the CO2 EOR Project). Ongoing operations include installation of wells,

pipelines, access roads and other infrastructure within and outside the current area of operation. As discussed in section 3.2 Project Description Addendum, over the life of the proposed Project approximately 150 new wells would be needed for CO2 EOR. Under the No Project alternative over the same period of time, approximately 137 new wells would be required. The impacts of the No Project alternative were evaluated in the Supplemental Environmental Impact Statement/Program Environmental Impact Report (SEIS/PEIR) prepared for the sale of Naval Petroleum Reserve-1 (NPR-1)(Department of Energy [DOE], 1997).

6.5.1 Environmental Impact of the No Project Alternative

Aesthetics

NPR-1 (also referred to as the "Elk Hills"), was created by an Executive Order issued by President William Howard Taft in 1912. Development of Elk Hills began in 1973, with full production beginning in 1976. Considering that the No Project alternative is limited to oil recovery within an active oil field, visual impacts are anticipated to be less than significant.

Agriculture

The EHOF is primarily zoned for agricultural use (A and A-1). However the A and A-1 zoning designations allow for oil exploration and production. The EHOF does not contain any lands under Williamson Act Contract or other important farmland designations. The No Project alternative would not impact or impede agriculture production in the area. No impact to agricultural resources would result.

Air Quality

The continuation of existing oil recovery operations within the EHOF will result in both construction-related and operation-related emissions of criteria air pollutants which have the potential to result in significant air quality impacts. This is a potentially significant impact. However, it is expected that the significance of these emissions can be mitigated to a less than significant level through compliance with applicable San Joaquin Valley Air Pollution Control District (SJVAPCD) rules and regulations, emissions reduction requirements imposed by the SJVAPCD through permitting requirements for stationary sources, and utilization of emissions reduction credits to offset emissions.

Biological Resources

The EHOF contains important and some critical habitat for federally and State of California threatened and/or endangered species. Continuation of existing oil recovery operations has the potential to impact these special status species, especially as a result of new ground disturbances that are common to sustain production in a maturing oil field. This is a potentially significant impact. However, it is expected that the significance of these impacts can be mitigated to a less than significant level through implementation of OEHI's Habitat Conservation Plan (HCP) and associated mitigation measures.

6.0 ALTERNATIVES TO THE PROJECT

Cultural and Paleontological Resources

The EHOF contains important cultural and paleontological areas. Continuation of existing oil recovery operations has the potential to impact these special status areas. This is a potentially significant impact. However, it is expected that the significance of these impacts can be mitigated to a less than significant level by avoiding known cultural/paleontological resource areas to the maximum extent possible and incorporating best management practices (BMPs) for minimizing potential impacts to such resources.

Geology and Soils

Continuation of existing oil recovery operations within the EHOF will require the installation of new oil producing wells, pipelines, and other oil field support equipment that will cause ground disturbances. These disturbances have the potential to result in significant soil erosion-related impacts due to wind. However, it is anticipated that these impacts can be mitigated to a less than significant level by incorporating BMPs into the design, construction, and operation of oil recovery operations.

Greenhouse Gases

As discussed in Section 4.3 (Air Quality), as part of its CEQA review of new projects, the SJVAPCD evaluates the potential significance of a project's greenhouse gas emissions based on the implementation of Best Performance Standards (BPS) or whether the project's stationary source greenhouse gas emissions have been reduced by 29 percent from a business as usual baseline, consistent with projected emission reductions in the CARB AB32 Scoping Plan. Projects that implement either the applicable BPS or can otherwise demonstrate at least a 29 percent reduction in greenhouse gas emissions for stationary sources are determined to have a less than significant individual and cumulative greenhouse gas emissions impact. Although potentially significant, it is expected that this impact could be mitigated to a less than significant level.

Hazards and Hazardous Materials

Oil recovery operations within the EHOF involve the use of hazardous materials and the generation of hazardous waste. These materials are generally limited to use away from public areas and present a less than significant hazard to the public. Spills and releases of hazardous materials do however have the potential to significantly impact health and the environment. Adherence to OEHI's hazardous materials handling practices that comply with applicable regulations is expected to reduce the potential for releases to occur. Implementation of OEHI's spill response plan is expected to minimize and remediate impacts from potential releases of hazardous materials to a less than significant level.

6.0 ALTERNATIVES TO THE PROJECT

Hydrology and Water Quality

Potential water quality impacts from existing oil recovery operations are generally limited to polluted storm water runoff or the introduction of hazardous materials into waterways. The project area is located within an unnamed basin where several ephemeral washes flow across alluvial sediments and terminate at various points north of the OEHI operations. Per the Occidental of Elk Hills Construction General Permit Compliance Plan (Compliance Plan), this area has no common water conveyance connections that can be defined between various channels. The Compliance Plan finds that the ephemeral washes are non-jurisdictional according to the analysis method provided by the US Environmental Protection Agency and the US Army Corps of Engineers. Considering the above, potential impacts of the No Project alternative to hydrology and water quality are less than significant.

Land Use and Planning

The EHOF is primarily zoned for agricultural use that allows for oil exploration and production activities. The continuation of oil field recovery operations will not require any zoning change or conflict with any applicable plan. Therefore, the No Project alternative will have less than significant impacts on land use and planning.

Mineral Resources

As noted above in Land Use and Planning, the EHOF is primarily zoned for agricultural use that allows for oil exploration and production. There are no active mines or other known economically important mineral deposits near the EHOF. The No Project alternative would have a less than significant impact on mineral resources.

Noise

Oil recovery operations within the EHOF create noise from a variety of point sources. However, noises generated from standard oil field procedures are not located in close proximity and are buffered from sensitive receptors such as the town of Tupman. The No Project alternative is expected to have a less than significant noise impact.

Population and Housing

Continuation of existing oil recovery operations is not expected to result in substantial population growth, divide a community, or displace residents. Therefore, the No Project alternative is expected to have a less than significant population and housing impact.

Public Services

Continuation of existing oil recovery operations is not expected to result in a substantial increase in demand for public services that would exceed service capacities or require the construction of new

public service facilities which could cause significant impacts. Therefore, the No Project alternative is expected to have a less than significant impact on public services.

Environmental Justice

Existing oil field recovery operations do not disproportionately impact environmental justice communities. Continuation of these operations is not expected to modify the racial makeup or income level demographics in the neighboring areas or result in substantially higher magnitude environmental impacts than which occur under current baseline conditions. Therefore, the No Project alternative is expected to have a less than significant environmental justice impact.

Recreation

Continued oil recovery operations within the EHOF does not include the construction of recreational facilities nor is it expected to substantially increase demand for use of recreational facilities. Therefore, the No Project alternative is expected to have a less than significant recreation impact.

Transportation and Traffic

Continuation of existing oil recovery operations is not expected to result in a substantial increase in vehicle trips compared to those that occur under current baseline conditions. Therefore, the No Project alternative is expected to have a less than significant transportation and traffic impact.

Utilities and Service Systems

Continuation of existing oil recovery operations is not expected to result in a substantial increase in demand for utilities and service systems beyond typical use associated with current baseline conditions. An increase in demand that would require the construction of new utility service systems which could cause significant impacts is also not anticipated. Therefore, the No Project alternative is expected to have a less than significant impact on utilities and service systems.

Comparison to Project Objectives

Implementation of the No Project alternative will result in the continuation of existing oil recovery operations within the EHOF. As discussed in section 3.2 Project Description Addendum, over the life of the proposed Project approximately 150 new wells would be needed for CO2 EOR. Under the No Project alternative over the same period of time, approximately137 new wells would be required resulting in a similar, but slightly reduced area of disturbance. However, under either the proposed Project or the No Project alternative, impacts to biological, cultural, and paleontological resources would be mitigated to a less than significant level by compliance with the OEHI's HCP and BMPs. Ongoing operations are not subject to analysis pursuant to SJVAPCD CEQA guidance and so there would be no requirement to reduce greenhouse gas emissions by implementation of BPS or by 29 percent. Also, without the HECA Project, electricity would continue to be generated at power plants that are not required to capture their greenhouse gas emissions and there would be no demonstration

6.0 ALTERNATIVES TO THE PROJECT

of carbon capture and sequestration as a method of reducing greenhouse gas emissions. Accordingly, the No Project alternative would not result in the appreciable reduction in identified impacts compared to the Proposed Project.

The No Project alternative would not meet any of the Project objectives (Section 1.5) to enhance and maximize oil production of the Elk Hills Unit while providing a mechanism to mitigate CO2 emission impacts from the nearby HECA Project.

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APPENDICES

APPENDICES

APPENDICES

APPENDIX A
AIR EMISSIONS DATA

APPENDICES

OPERATIONAL PHASE CRITERIA POLLUTANT EMISSIONS

Total Operational Emissions from
The Occidental of Elk Hills, Inc. CO2 EOR Project

Annual Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Stationary Source Activities	14,399.57	45,265.98	63,958.45	5,805.67	5,753.07	2,107.99
Mobile Source Activities	234.55	67.01	1,954.77	42.61	42.61	4.38
Total Operational Emissions	14,634.12	45,332.99	65,913.22	5,848.28	5,795.68	2,112.37

Permitted Emissions of
Criteria Pollutants From Stationary Source Equipment

Criteria Pollutant Emissions From Combustion Equipment (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Injection Heater	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27
Mol-Sieve Heater	744.24	480.75	3,235.84	665.76	665.76	245.38
TEG Heater	1,594.81	240.38	6,471.68	332.88	332.88	122.69
NRU Heater	212.64	92.45	1,294.34	66.58	66.58	24.53
CTB - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
RCF - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
CTB - Emergency Flare	----------	---------	---------	---------	---------	---------
RCF - Emergency Flare	----------	---------	---------	---------	---------	---------
Total Combustion Emissions	7,040.06	3,676.49	30,427.92	5,060.80	5,060.80	1,864.91

Fugitive VOC Emissions From CO2 EOR Process Equipment

Emissions From Process Components	VOC Lb/Year	Calculated using EPA Average Leak Rate Equations
Central Tank Battery	1,966.11	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction
Reinjection Compression Facility	4,478.48	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction
Carbon Dioxide Recovery Plant	13,039.04	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction
Total Fugitive VOC Emissions	19,483.64	Fugitive VOC for a 500 ppmv leak, with 0.0010 Leak Fraction

VOC Emissions From Uncontrolled Fixed Roof Tanks

Emissions From Fixed Roof Tanks	VOC Lb/Year	Calculated using EPA AP42 Tanks 4.09d
CTB - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week
RCF - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week
CRP - Open Drain Sump Tank	64.60	1,500 Gallon, TVP < 1.5 psia, one turnover per week
Common Open Drain Sump Tank	193.34	3,100 Gallon, TVP < 1.5 psia, three turnovers per week
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week
Miscellaneous Organic Liquid Storage Tank	1,009.27	500 Bbl, TVP < 1.5 psia, one turnover per week
Total VOC Emissions from Tanks	3,414.95	Total Emission from Organic Liquid Storage Tanks

Operational Emissions of Criteria Pollutants From Stationary Source Activities Not Accounted For in Permitted Emissions, and Emissions From Mobile Sources

Annual Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Stationary Source Activities	5,816.05	18,290.40	31,646.18	684.24	684.24	239.48
Employee Travel To Plants	140.78	57.27	1,863.79	36.85	36.85	3.70
Max. Well Maintenance	1,543.45	400.50	1,884.35	60.62	8.02	3.593
Max. Travel to Well Sites	93.77	9.74	90.99	5.76	5.76	0.676
Total Emissions	7,594.06	18,757.92	35,485.30	787.48	734.88	247.46

1. Operational emissions not included in the "permitted emissions" include emission from emergency flaring due to power outages (7.47 hours per year). It also includes fugitive VOC emissions from production activities on new wells, and gas injection systems and gathering systems that are not otherwise subject to SJVAPCD permit requirements

2. Fugitive dust emissions are not included as operational emissions because travel on unpaved roads is not required and fugitive dust from travel on paved roads will not increase as a result of the project. Such travel already occurs and is required the operation of existing equipment. Windblown dust from the facility and satellite settings will be eliminated by paving or

3. Mobile source emissions were calculated using EMFAC2007 and include employee travel (25 full time employees) to and from the facility. The emissions were calculated using 50 one way trips per day with a travel distance of 30 miles per vehicle trip (i.e. 1500 VMT per day). The travel distance used in the calculations is the approximate distance from the Elk Hill Facility to Bakersfield, Ca.

4. Emissions from well maintenance activities were calculated from fuel use and emission factors from CARB OFFROAD2007. The reported emissions are the maximum annual emissions expected to occur in year 2034. The calculations are based on the assumption that each well will undergo maintenance annually.

5. Emission from mobile well workover rig and employee travel to and from the well sites was calculated using EMFAC2007. The emissions are estimated assuming 4 vehicle trips per well maintenance event. A trip length of 30 miles was used in The travel distance used in the calculations is the approximate distance from the Elk Hill Oilfield to Bakersfield, Ca. The reported emissions are the maximum annual emissions expected to occur in year 2034.

Permitted Emissions of
Criteria Pollutants From Stationary Source Equipment

Maximum Daily Emissions (Lb/Day)

Process Equipment	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
Injection Heater	12.23	7.84	53.19	10.94	10.94	4.03
Mol-Sieve Heater	2.04	1.32	8.87	1.82	1.82	0.67
TEG Heater	4.37	0.66	17.73	0.91	0.91	0.34
NRU Heater	0.58	0.25	3.55	0.18	0.18	0.07
CTB - Emergency Engine	22.92	0.57	11.05	1.03	1.03	0.05
RCF - Emergency Engine	22.92	0.57	11.05	1.03	1.03	0.05
CTB - Emergency Flare	4,662.00	4,315.50	25,345.00	548.00	548.00	191.80
RCF - Emergency Flare	4,662.00	4,319.20	25,366.74	548.47	548.47	191.96
Fugitive Emissions (VOC)	-------	53.38	-------	-------	-------	-------
Tank Emissions (VOC)	-------	9.36	-------	-------	-------	-------
Total Maximum Emissions	9,389.05	8,708.66	50,817.16	1,112.39	1,112.39	388.97

Annual Permitted Emissions (Lb/Year)

Process Equipment	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Injection Heater	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27
Mol-Sieve Heater	744.24	480.75	3,235.84	665.76	665.76	245.38
TEG Heater	1,594.81	240.38	6,471.68	332.88	332.88	122.69
NRU Heater	212.64	92.45	1,294.34	66.58	66.58	24.53
CTB - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
RCF - Emergency Engine	11.46	0.29	5.52	0.51	0.51	0.02
CTB - Emergency Flare	---------	---------	---------	---------	---------	---------
RCF - Emergency Flare	---------	---------	---------	---------	---------	---------
Fugitive Emissions (VOC)	---------	19,483.64	---------	---------	---------	---------
Tank Emissions (VOC)	---------	3,414.95	---------	---------	---------	---------
Total Maximum Emissions	7,040.06	26,575.07	30,427.92	5,060.80	5,060.80	1,864.91

Annual Emissions (Ton/Year)

Process Equipment	NOx Ton/Year	VOC Ton/Year	CO Ton/Year	PM10 Ton/Year	PM2.5 Ton/Year	SOx Ton/Year
Annual Emissions	3.52	13.29	15.21	2.53	2.53	0.93
Worst Case Offset	1.50	1.50	1.50	1.50	-------	1.50
ERC Required	5.28	19.93	22.82	3.80	-------	1.40
ERC Value $/Ton	65,000.00	35,000.00	15,000.00	40,000.00	-------	40,000.00
ERC Cost	343,203.05	697,595.66	342,314.14	151,824.11	-------	55,947.31

Total Cost	1,590,884.27

1. Flare emissions are calculated for purge gas and pilot gas only. Emergency use only equipment is exempt from offsets.
2. Fugitive VOC emissions have been estimated using EPA Average leak Rate Equations. All TOG is assumed to be VOC
3. The emissions from fixed roof tanks have been calculated using EPA AP42 Tanks 4.09d. All TOG is assumed to be VOC
4. It is assumed that the facility would include a two emergency use only diesel engine (Tier-3, 175 Bhp, 12 hour/year each).
5.. ERC are calculated using a worst case distance offset ratio. It is also assumed that PM emissions will be offset using SOx.

Emissions From a 60 MMBtu/Hr CO2 Injection Heater With Ultra Low NOx Burner

Process Emission Factors for Heater or Boiler
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

CO2 Injection Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
60.0000	Conc. (ppm 3% O2)	7	13	50	------	------	1.7
	Lb/MMBtu	0.0085	0.0054	0.0369	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	12.23	7.84	53.19	10.94	10.94	4.03

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	4,465.46	2,862.33	19,415.03	3,994.56	3,994.56	1,472.27

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions From a 10 MMBtu/Hr Mol-Sieve Heater With Ultra Low NOx Burner

Process Emission Factors for Heater or Boiler
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

Mol Sieve Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
10.0000	Conc. (ppm 3% O2)	7	13	50	------	------	1.7
	Lb/MMBtu	0.0085	0.0055	0.0369	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	2.04	1.32	8.87	1.82	1.82	0.67

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

Process Heater or Boiler	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	744.24	480.75	3,235.84	665.76	665.76	245.38

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions 5 MMBtu/Hr Glycol Reboiler With Low NOx Burner

Process Emission Factors for O2 Heater
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

TEG Reboiler MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
5.0000	Conc. (ppm 3% O2)	30	13	200	------	------	1.7
	Lb/MMBtu	0.0364	0.0055	0.1478	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	4.37	0.66	17.73	0.91	0.91	0.34

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	1,594.81	240.38	6,471.68	332.88	332.88	122.69

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

Emissions 2 MMBtu/Hr NRU Heater With Standard Burner

Process Emission Factors for O2 Heater
Natural Gas As Fuel (Total Sulfur Content 1 grain per 100 SDCF)

NRU Heater MMBtu/Hr Rating	Emission Factors	NOx	VOC	CO	PM10	PM2.5	SOx
1.0000	Conc. (ppm 3% O2)	20	25	200	------	------	1.7
	Lb/MMBtu	0.0243	0.0106	0.1478	0.0076	0.0076	0.0028

Maximum Daily Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
	24.00	0.58	0.25	3.55	0.18	0.18	0.07

Annual Emissions
(100% of Rated Heat Input, Full Time Operation)

O2 Heater	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
	8,760.00	212.64	92.45	1,294.34	66.58	66.58	24.53

Calculation Assumptions and Notes

Note:

1. Emissions from the process heater have been calculated using the listed process emission factors (Lb/MMBtu). The concentrations are calculated using EPA F-Factors (8710, 68F, Dry) corrected for temperature (60F) and excess oxygen (3% O2).
2. The concentration of VOC has been calculated from the EPA AP42 default value using a molecular weight of 16 (i.e. as methane).
3. The SOx concentration is equivalent to 1 grain of total sulfur / 100 SDCF of fuel (HHV 1020) or about 17 ppmv total S in the fuel gas.

EPA Certified Tier-3 Engine (175 Bhp)

Emission Factors for Emergency Use Only Engine
(Ultra Low Sulfur Diesel Fuel 15 ppmw S)

Emergency Use Only	Max Rating BHP	NOx g/Bhp*Hr	VOC g/Bhp*Hr	CO g/Bhp*Hr	PM10 g/Bhp*Hr	PM2.5 g/Bhp*Hr	SOx g/Bhp*Hr
CTB - Emergency Engine	175.00	2.4750	0.0620	1.1930	0.1110	0.1110	0.0050
RCF - Emergency Engine	175.00	2.4750	0.0620	1.1930	0.1110	0.1110	0.0050

Note: BSFC = 7065.26 Btu/Bhp*hr or 9.0 Gallons per hour of ultra low sulfur diesel fuel (Sulfur <= 15 ppmw);
Density = 7.079 Lb/Gal; HHV = 137,380 Btu/Gallon or 19,673 Btu/Lb

Diesel Fueled Engine (175 Bhp)
Emergency Use Only - Maximum Daily Emissions

Emergency Use Only	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
CTB - Emergency Engine	24	22.9167	0.5741	11.0463	1.0278	1.0278	0.0463
RCF - Emergency Engine	24	22.9167	0.5741	11.0463	1.0278	1.0278	0.0463

Diesel Fueled Engine (175 Bhp)
(Emergency Use Only - Allowable Annual Emissions - 12 Hour of Operation Each Engine)

Emergency Use Only	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
CTB - Emergency Engine	12	11.4583	0.2870	5.5231	0.5139	0.5139	0.0231
RCF - Emergency Engine	12	11.4583	0.2870	5.5231	0.5139	0.5139	0.0231

Emergency Use Only Flare - Tank Battery

Process Emission Factors
(For Pilot Gas, Purge Gas and Emergency Flare Event)

Emergency Use Flare 274 MMSCFD	Process Rate MMBtu/Hr	NOx Lb/MMBtu	VOC Lb/MMBtu	CO Lb/MMBtu	PM10 Lb/MMBtu	PM2.5 Lb/MMBtu	SOx Lb/MMBtu
Pilot Gas (4 x 50 Sdcfh)	0.20	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Purge Gas (2200 Sdcfh)	2.24	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Emergency (274 MMScfd)	2,854.17	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Total Heat or Average EF	2,856.61	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028

Maximum Daily Emissions
(Assumes Flaring at Rated Capacity During an Emergency Event)

Emergency Use Flare 274 MMSCFD	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
Pilot Gas	24.00	0.33	0.31	1.81	0.04	0.04	0.01
Purge Gas	24.00	3.66	3.39	19.93	0.43	0.43	0.15
Emergency Event	24.00	4,658.00	4,315.50	25,345.00	548.00	548.00	191.80
Max. Daily Emissions (With Emergency Event)		4,662.00	4,319.20	25,366.74	548.47	548.47	191.96

Annual Operational Emissions
From the Emergency Use Only Flare

Emergency Use Flare 250 MMSCFD	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Pilot Gas	8760.00	121.52	112.58	661.20	14.30	14.30	5.00
Purge Gas	8760.00	1,336.71	1,238.42	7,273.25	157.26	157.26	55.04
Emergency Event	7.47	1,449.80	1,343.20	7,888.63	170.57	170.57	59.70
Total Allowable Annual Emissions		2,908.03	2,694.20	15,823.09	342.12	342.12	119.74

Calculation Assumptions and Notes

Note:
1. The flare will be permitted for emergency use only. Daily emission estimates are equal to the total emissions that could occur on a day with an emergency event. Annual emissions are equal to the sum of the emissions from pilot gas and purge gas and 7.47 hours of reasonable foreseeable emergency use for power outages. Additional use is allowed but is not foreseeable and is therefore not quantified

Emergency Use Only Flare - CO2 Recompression Facility

Process Emission Factors
(For Pilot Gas, Purge Gas and Emergency Flare Event)

Emergency Use Flare 274 MMSCFD	Process Rate MMBtu/Hr	NOx Lb/MMBtu	VOC Lb/MMBtu	CO Lb/MMBtu	PM10 Lb/MMBtu	PM2.5 Lb/MMBtu	SOx Lb/MMBtu
Pilot Gas (4 x 50 Sdcfh)	0.20	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Purge Gas (2200 Sdcfh)	2.24	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Emergency (274 MMScfd)	2,854.17	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028
Total Heat or Average EF	2,856.61	0.0680	0.0630	0.3700	0.0080	0.0080	0.0028

Maximum Daily Emissions
(Assumes Flaring at Rated Capacity During an Emergency Event)

Emergency Use Flare 274 MMSCFD	Operating Hr/Day	NOx Lb/Day	VOC Lb/Day	CO Lb/Day	PM10 Lb/Day	PM2.5 Lb/MMBtu	SOx Lb/Day
Pilot Gas	24.00	0.33	0.31	1.81	0.04	0.04	0.01
Purge Gas	24.00	3.66	3.39	19.93	0.43	0.43	0.15
Emergency Event	24.00	4,658.00	4,315.50	25,345.00	548.00	548.00	191.80
Max. Daily Emissions (With Emergency Event)		4,662.00	4,319.20	25,366.74	548.47	548.47	191.96

Annual Operational Emissions
From the Emergency Use Only Flare

Emergency Use Flare 274 MMSCFD	Operating Hr/Year	NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	PM2.5 Lb/Year	SOx Lb/Year
Pilot Gas	8760.00	121.52	112.58	661.20	14.30	14.30	5.00
Purge Gas	8760.00	1,336.71	1,238.42	7,273.25	157.26	157.26	55.04
Emergency Event	7.47	1,449.80	1,343.20	7,888.63	170.57	170.57	59.70
Total Allowable Annual Emissions		2,908.03	2,694.20	15,823.09	342.12	342.12	119.74

Calculation Assumptions and Notes

Note:

1. The flare will be permitted for emergency use only. Daily emission estimates are equal to the total emissions that could occur on a day with an emergency event. Annual emissions are equal to the sum of the emissions from pilot gas and purge gas assuming full time operation (8760 hour per year).

Emissions From Organic Liquid Storage Tanks

Daily Emissions From Fixed Roof Tanks
(Breathing and Working Loss - Uncontrolled Tanks)

Breathing and Working Loss From Uncontrolled Tanks	Tank Emissions (Lb/Day)				Total CO2e Lb/Day
	Tank Vapor	VOC	CO2	CH4	
CTB - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.01	0.40
RCF - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.01	0.40
CRP - 1,500 Gallon Open Drain Tank	0.18	0.18	0.15	0.01	0.40
Shared 3,100 - Gallon Open Drain Tank	0.53	0.53	0.45	0.04	1.21
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	0.19	6.31
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	0.19	6.31
500 BBL Miscellaneous Organic Liquid Tank	2.77	2.77	2.37	0.19	6.31
Total Maximum Emissions	9.36	9.36	8.01	0.63	21.34

Annual Emissions From Fixed Roof Tanks
(Breathing and Working Loss - Uncontrolled Tanks)

Breathing and Working Loss From Uncontrolled Tanks	Tank Emissions (Lb/Year)				Total CO2e Lb/Year
	Tank Vapor	VOC	CO2	CH4	
CTB - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	4.38	147.37
RCF - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	4.38	147.37
CRP - 1,500 Gallon Open Drain Tank	64.60	64.60	55.31	4.38	147.37
Shared 3,100 - Gallon Open Drain Tank	193.34	193.34	165.53	13.12	441.06
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	68.49	2,302.43
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	68.49	2,302.43
500 BBL Miscellaneous Organic Liquid Tank	1,009.27	1,009.27	864.08	68.49	2,302.43
Total Maximum Emissions	3,414.95	3,414.95	2,923.69	231.75	7,790.47

Stream Composition Versus
CO2-EOR Project Gas Composition Versus Project Year

Stream Constituents	Molecular Formula	Weight	2015 Mol. Fraction	2017 Mol. Fraction	2019 Mol. Fraction	2025 Mol. Fraction
Water Vapor	H2O	18.02	0.040	0.0400	0.0400	0.0400
Nitrogen	N2	28.01	0.010	0.0210	0.0210	0.0150
Oxygen	O2	32.00	0.000	0.0000	0.0000	0.0000
Carbon Dioxide	CO2	44.01	0.433	0.8150	0.9100	0.9410
Hydrogen Sulfide	H2S	34.08	0.000	0.0000	0.0000	0.0000
Methane	C1	16.04	0.467	0.1200	0.0580	0.0290
Ethane	C2	30.07	0.032	0.0140	0.0060	0.0040
Propane	C3	44.10	0.024	0.0110	0.0040	0.0030
iso-Butane	i-C4	58.12	0.006	0.0030	0.0010	0.0010
Butane	n-C4	58.12	0.014	0.0070	0.0030	0.0020
iso-Pentane	i-C5	72.15	0.005	0.0030	0.0010	0.0010
Pentane	n-C5	72.15	0.006	0.0040	0.0020	0.0010
Hexanes	C6	86.18	0.000	0.0000	0.0000	0.0000
Heptanes+	C7+	100.20	0.000	0.0000	0.0000	0.0000
Molecular Weight of Gas Stream			31.52	41.09	43.09	43.59

GHG By Year CO2e (Tonne/Year)	8.67	2.88	2.14	1.82

Tank - Calculation Assumptions and Notes

Notes:

1. Tank emissions were calculated using EPA AP42 Tanks 4.09d. For permitting purposes all of the emissions predicted by Tanks 4.09d are assumed to be VOC.

2. The emissions of GHG were calculate by speciating the mass of the tank vapors using the average MW, average mole fraction for methane and the average mole fraction for CO2 for the period 2015 through 2025

Criteria Pollutant (Exhaust)
Emissions From Well Maintenance Activities

Exhaust Emissions From
Diesel Engines Used in Mobile 425 Hp Workover Rig

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	3073.291	579.866	74.803	328.784	24.354	0.661
2018		22	3720.816	665.495	87.173	377.043	27.711	0.808
2019		22	3720.816	622.262	82.921	354.363	25.727	0.808
2020	8	22	3720.816	581.156	79.377	333.810	23.884	0.808
2021		30	5073.840	739.331	103.410	429.102	30.250	1.102
2022	9	30	5073.840	688.109	98.577	406.874	28.027	1.102
2023	27	39	6595.992	832.980	122.371	503.808	33.671	1.432
2024		66	11162.448	1309.727	197.947	814.327	52.729	2.424
2025	20	66	11162.448	1218.301	189.655	780.308	48.690	2.424
2026		86	14545.008	1473.894	236.876	983.520	58.734	3.158
2027		86	14545.008	1365.846	227.456	950.274	54.024	3.158
2028		86	14545.008	1263.338	218.591	919.799	49.869	3.158
2029	20	86	14545.008	1169.142	210.556	894.864	45.990	3.158
2030		106	17927.568	1331.762	250.303	1072.239	52.246	3.893
2031	21	106	17927.568	1229.319	242.108	1048.336	48.490	3.893
2032		127	21479.256	1362.399	280.662	1227.386	53.596	4.664
2033	23	127	21479.256	1260.116	272.480	1202.838	49.505	4.664
2034	0	150	25335.180	1370.513	312.709	1394.641	54.048	5.501
Average	------	------	11349.114	1003.345	173.051	738.017	40.081	2.464

Exhaust Emissions From
Diesel Engines Used in Mobile 375 Hp Workover Rig

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	1397.650	155.118	20.435	64.059	5.559	0.303
2018		22	1705.004	169.530	23.812	76.353	6.134	0.370
2019		22	1705.004	150.765	22.647	75.059	5.494	0.370
2020	8	22	1705.004	133.294	21.482	74.412	4.872	0.370
2021		30	2325.006	159.706	27.794	100.588	5.841	0.505
2022	9	30	2325.006	141.177	26.294	99.706	5.100	0.505
2023	27	39	3022.508	161.736	32.347	128.471	5.724	0.656
2024		66	5115.013	238.765	51.830	215.471	8.231	1.110
2025	20	66	5115.013	205.765	49.112	215.471	6.911	1.110
2026		86	6665.017	231.442	60.706	280.765	7.512	1.447
2027		86	6665.017	200.836	58.430	280.765	6.602	1.447
2028		86	6665.017	175.036	56.406	280.765	6.020	1.447
2029	20	86	6665.017	152.524	54.382	280.765	5.489	1.447
2030		106	8215.021	168.353	65.783	346.060	6.235	1.783
2031	21	106	8215.021	153.389	64.535	346.060	5.736	1.783
2032		127	9842.525	169.209	76.200	414.619	6.350	2.137
2033	23	127	9842.525	156.883	75.080	414.619	5.939	2.137
2034	0	150	11625.030	172.942	87.794	489.707	6.574	2.524
Average	------	------	5200.811	162.972	46.056	220.196	5.806	1.129

Total Exhaust Emissions From Diesel Engines
Used in Mobile 425 Hp Workover Rig and 375 Hp Workover Pump

Project Year	Number Of Well Drilled	Wells Undergoing Maintenance	Annual Fuel Use Gal/Year	Annual Emission From Well Maintenance (Mobile Workover Rig)				
				NOx Lb/Year	VOC Lb/Year	CO Lb/Year	PM10 Lb/Year	SOx Lb/Year
2016	18	0	0.000	0.000	0.000	0.000	0.000	0.000
2017	4	18	4470.941	734.984	95.238	392.843	29.913	0.964
2018		22	5425.820	835.024	110.985	453.396	33.845	1.178
2019		22	5425.820	773.027	105.568	429.422	31.220	1.178
2020	8	22	5425.820	714.450	100.860	408.222	28.756	1.178
2021		30	7398.846	899.037	131.204	529.690	36.091	1.606
2022	9	30	7398.846	829.286	124.872	506.580	33.127	1.606
2023	27	39	9618.500	994.715	154.718	632.279	39.395	2.088
2024		66	16277.461	1548.493	249.777	1029.798	60.960	3.534
2025	20	66	16277.461	1424.067	238.767	995.779	55.600	3.534
2026		86	21210.025	1705.336	297.582	1264.285	66.246	4.605
2027		86	21210.025	1566.681	285.886	1231.039	60.626	4.605
2028		86	21210.025	1438.374	274.997	1200.564	55.889	4.605
2029	20	86	21210.025	1321.666	264.939	1175.630	51.479	4.605
2030		106	26142.589	1500.116	316.086	1418.299	58.481	5.676
2031	21	106	26142.589	1382.708	306.643	1394.396	54.226	5.676
2032		127	31321.781	1531.608	356.862	1642.005	59.946	6.801
2033	23	127	31321.781	1416.999	347.559	1617.457	55.444	6.801
2034	0	150	36960.210	1543.454	400.503	1884.348	60.622	8.025
Average	------	------	16549.925	1166.317	219.108	958.212	45.888	3.593

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Total Fugitive Emissions (Occidental of Elk Hills CO2 Enhanced Oil Recovery Project)

Type of Component	Component Service	Total Component Counts	Weighted Average Leak (ppmv)	Weighted Average Leak Fraction	Weighted Average Leak Rate lb/day*component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	14,191	1,820	0.0010	7.895E-04	11.204	173.383
	Light Crude Oil	7,205	1,369	0.0010	4.241E-03	30.558	229.791
	Heavy Crude Oil	248	500	0.0010	8.854E-05	0.022	0.028
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	59	500	0.0010	7.920E-03	0.469	3.526
	Heavy Crude Oil	12	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	1,251	1,625	0.0010	5.360E-03	6.706	103.778
	Light Crude Oil	1,638	1,489	0.0010	6.126E-03	10.032	75.435
	Heavy Crude Oil	44	500	0.0010	1.167E-03	0.052	0.066
Connectors	Gas/Light Liquid	44,531	1,613	0.0010	1.439E-03	64.100	991.939
	Light Crude Oil	33,772	1,421	0.0010	1.426E-04	4.817	36.225
	Heavy Crude Oil	406	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	13,249	1,495	0.0010	2.941E-03	38.971	603.070
	Light Crude Oil	11,422	1,501	0.0010	2.661E-03	30.393	228.551
	Heavy Crude Oil	299	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	0	0.0000	0.000E+00	0.000	0.000
	Light Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
Total Fugitive VOC Emissions From Associated Components						208.044	2611.691
Weight percentage of VOC in the total organic compounds in gas ?						---------	---------
Weight percentage of VOC in the total organic compounds in oil ?						---------	---------

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Reinjection Compression Facility (RCF)

Type of Component	Component Service	Component Counts For RCF	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	319	500	0.0010	5.505E-04	0.176	2.719
	Light Crude Oil	384	500	0.0010	3.612E-03	1.387	10.429
	Heavy Crude Oil	12	500	0.0010	4.805E-04	0.006	0.007
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	7.920E-03	0.000	0.000
	Heavy Crude Oil	2	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	43	500	0.0010	3.854E-03	0.167	2.577
	Light Crude Oil	61	500	0.0010	4.594E-03	0.281	2.114
	Heavy Crude Oil	1	500	0.0010	1.167E-03	0.001	0.002
Connectors	Gas/Light Liquid	1,496	500	0.0010	1.251E-03	1.873	28.977
	Light Crude Oil	3,850	500	0.0010	1.251E-03	4.817	36.225
	Heavy Crude Oil	7	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,050	500	0.0010	2.328E-03	2.445	37.835
	Light Crude Oil	558	500	0.0010	2.003E-03	1.118	8.406
	Heavy Crude Oil	26	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						12.270	129.290
Weight percentage of VOC in the total organic compounds in gas ?						100.0	---------
Weight percentage of VOC in the total organic compounds in oil ?						100.0	---------

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Carbon Dioxide Recovery Plant (CRP)

Type of Component	Component Service	Component Counts For CRP	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	1,289	500	0.0010	5.505E-04	0.709	10.979
	Light Crude Oil	1,961	500	0.0010	3.612E-03	7.081	53.251
	Heavy Crude Oil	236	500	0.0010	6.864E-05	0.016	0.021
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	43	500	0.0010	7.920E-03	0.342	2.573
	Heavy Crude Oil	10	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	247	500	0.0010	3.854E-03	0.953	14.745
	Light Crude Oil	416	500	0.0010	4.594E-03	1.913	14.384
	Heavy Crude Oil	43	500	0.0010	1.167E-03	0.050	0.064
Connectors	Gas/Light Liquid	9,662	500	0.0010	1.251E-03	12.091	187.110
	Light Crude Oil	8,204	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	398	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	3,310	500	0.0010	2.328E-03	7.706	119.255
	Light Crude Oil	2,426	500	0.0010	2.003E-03	4.861	36.551
	Heavy Crude Oil	272	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						35.723	438.931
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Central Tank Battery (CTB)

Type of Component	Component Service	Component Counts For CTB	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	98	500	0.0010	5.505E-04	0.054	0.835
	Light Crude Oil	688	500	0.0010	3.612E-03	2.485	18.685
	Heavy Crude Oil	0	500	0.0010	6.864E-05	0.000	0.000
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	16	500	0.0010	7.920E-03	0.127	0.953
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	22	500	0.0010	3.854E-03	0.085	1.312
	Light Crude Oil	80	500	0.0010	4.594E-03	0.367	2.763
	Heavy Crude Oil	0	500	0.0010	1.167E-03	0.000	0.000
Connectors	Gas/Light Liquid	324	500	0.0010	1.251E-03	0.405	6.274
	Light Crude Oil	982	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	100	500	0.0010	2.328E-03	0.233	3.603
	Light Crude Oil	814	500	0.0010	2.003E-03	1.631	12.262
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						5.387	46.688
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From Production Satellite Settings

Type of Component	Component Service	Component Counts Per Setting	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	572	2,000	0.0010	4.699E-03	2.688	20.213
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	208	2,000	0.0010	5.861E-03	1.219	18.865
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	2,106	2,000	0.0010	1.505E-03	3.169	49.042
	Light Crude Oil	936	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	286	2,000	0.0010	3.252E-03	0.930	14.395
	Light Crude Oil	1,144	2,000	0.0010	2.988E-03	3.419	25.709
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						11.425	128.223
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From Crude Oil and Natural Gas Production Wells

Type of Component	Component Service	Component Counts Per Well	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	10,260	2,000	0.0010	8.222E-04	8.436	130.543
	Light Crude Oil	3,600	2,000	0.0010	4.699E-03	16.917	127.214
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	360	2,000	0.0010	5.861E-03	2.110	32.650
	Light Crude Oil	1,080	2,000	0.0010	6.917E-03	7.470	56.174
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	25,380	2,000	0.0010	1.505E-03	38.192	591.016
	Light Crude Oil	19,800	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	7,020	2,000	0.0010	3.252E-03	22.832	353.330
	Light Crude Oil	6,480	2,000	0.0010	2.988E-03	19.365	145.624
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						126.043	1602.449
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From CO2 Injection Wells

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	2,225	2,000	0.0010	8.222E-04	1.829	28.307
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	371	2,000	0.0010	5.861E-03	2.173	33.630
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	5,562	2,000	0.0010	1.505E-03	8.370	129.520
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,483	2,000	0.0010	3.252E-03	4.824	74.652
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						17.196	266.110
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Gathering System for Crude oil and Natural Gas Production

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000

Weight percentage of VOC in the total organic compounds in gas?	100.0	
Weight percentage of VOC in the total organic compounds in oil?	100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

CO2 Intake and CO2 Distribution System for Injection

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000

Weight percentage of VOC in the total organic compounds in gas?	100.0	
Weight percentage of VOC in the total organic compounds in oil?	100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Reserved

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid		2,000	0.0200	2.399E-03	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.994E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.785E-03	0.000	0.000
Pump Seals	Gas/Light Liquid		2,000	0.0200	6.706E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	9.662E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Others	Gas/Light Liquid		2,000	0.0200	7.207E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.413E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid		2,000	0.0200	2.157E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid		2,000	0.0200	6.244E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	5.816E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid		2,000	0.0200	4.792E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	3.805E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	2.144E-02	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 10,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.098 x LKFRAC) + 2.5E-5]*2.2*24	1.320E-03
	Light Crude Oil	0.0000	ALR = [(0.087 x LKFRAC) + 1.9E-5]*2.2*24	1.003E-03
	Heavy Crude Oil	0.0000	ALR = (8.4 E-6)*2.2*24	4.435E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.074 x LKFRAC) + 3.5E-4]*2.2*24	1.848E-02
	Light Crude Oil	0.0000	ALR = [(0.100 x LKFRAC) + 5.1E-4]*2.2*24	2.693E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.089 x LKFRAC) + 1.2E-4]*2.2*24	6.336E-03
	Light Crude Oil	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-4]*2.2*24	7.392E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.848E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.026 x LKFRAC) + 1.0E-5]*2.2*24	5.280E-04
	Light Crude Oil	0.0000	ALR = [(0.026 x LKFRAC) + 9.7E-6]*2.2*24	5.122E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.082 x LKFRAC) + 5.7E-6]*2.2*24	3.010E-04
	Light Crude Oil	0.0000	ALR = [(0.073 x LKFRAC) + 2.4E-6]*2.2*24	1.267E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.055 x LKFRAC) + 1.5E-5]*2.2*24	7.920E-04
	Light Crude Oil	0.0000	ALR = [(0.044 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Heavy Crude Oil	0.0000	ALR = [(0.030 x LKFRAC) + 7.2E-6]*2.2*24	3.802E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 2,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Light Crude Oil	0.0000	ALR = [(0.075 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Heavy Crude Oil	0.0000	ALR = [(0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.082 x LKFRAC) + 1.9E-4]*2.2*24	1.003E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.066 x LKFRAC) + 4.5E-5]*2.2*24	2.376E-03
	Light Crude Oil	0.0000	ALR = [(0.067 x LKFRAC) + 6.4E-5]*2.2*24	3.379E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.690E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.020 x LKFRAC) + 8.5E-6]*2.2*24	4.488E-04
	Light Crude Oil	0.0000	ALR = [(0.022 x LKFRAC) + 8.6E-6]*2.2*24	4.541E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.059 x LKFRAC) + 2.6E-6]*2.2*24	1.373E-04
	Light Crude Oil	0.0000	ALR = [(0.055 x LKFRAC) + 1.6E-6]*2.2*24	8.448E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.045 x LKFRAC) + 7.5E-6]*2.2*24	3.960E-04
	Light Crude Oil	0.0000	ALR = [(0.036 x LKFRAC) + 6.7E-6]*2.2*24	3.538E-04
	Heavy Crude Oil	0.0000	ALR = [(0.020 x LKFRAC) + 6.0E-6]*2.2*24	3.168E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 1,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.076 x LKFRAC) + 1.1E-5]*2.2*24	5.808E-04
	Light Crude Oil	0.0000	ALR = [(0.069 x LKFRAC) + 1.2E-5]*2.2*24	6.336E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6)*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.079 x LKFRAC) + 1.5E-4]*2.2*24	7.920E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.061 x LKFRAC) + 3.1E-5]*2.2*24	1.637E-03
	Light Crude Oil	0.0000	ALR = [(0.058 x LKFRAC) + 4.4E-5]*2.2*24	2.323E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.018 x LKFRAC) + 8.0E-6]*2.2*24	4.224E-04
	Light Crude Oil	0.0000	ALR = [(0.021 x LKFRAC) +8.3E-6]*2.2*24	4.382E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.051 x LKFRAC) + 1.8E-6]*2.2*24	9.504E-05
	Light Crude Oil	0.0000	ALR = [(0.046 x LKFRAC) + 1.2E-6]*2.2*24	6.336E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.039 x LKFRAC) + 5.0E-6]*2.2*24	2.640E-04
	Light Crude Oil	0.0000	ALR = [(0.032 x LKFRAC) + 4.7E-6]*2.2*24	2.482E-04
	Heavy Crude Oil	0.0000	ALR = [(0.015 x LKFRAC) + 4.9E-6]*2.2*24	2.587E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 500 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.070 x LKFRAC) + 9.1E-6]*2.2*24	4.805E-04
	Light Crude Oil	0.0000	ALR = [(0.059 x LKFRAC) + 9.4E-6]*2.2*24	4.963E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6)*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.027 x LKFRAC) + 1.1E-4]*2.2*24	5.808E-03
	Light Crude Oil	0.0000	ALR = [(0.071 x LKFRAC) + 7.9E-5]*2.2*24	4.171E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.055 x LKFRAC) + 1.8E-5]*2.2*24	9.504E-04
	Light Crude Oil	0.0000	ALR = [(0.053 x LKFRAC) + 3.4E-5]*2.2*24	1.795E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.016 x LKFRAC) + 7.7E-6]*2.2*24	4.066E-04
	Light Crude Oil	0.0000	ALR = [(0.016 x LKFRAC) +7.7E-6]*2.2*24	4.066E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.043 x LKFRAC) + 1.1E-6]*2.2*24	5.808E-05
	Light Crude Oil	0.0000	ALR = [(0.037 x LKFRAC) + 9.4E-7]*2.2*24	4.963E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.037 x LKFRAC) + 4.1E-6]*2.2*24	2.165E-04
	Light Crude Oil	0.0000	ALR = [(0.030 x LKFRAC) + 3.8E-6]*2.2*24	2.006E-04
	Heavy Crude Oil	0.0000	ALR = [(0.012 x LKFRAC) + 4.3E-6]*2.2*24	2.270E-04

APPENDICES

OPERATIONAL PHASE HAP/TAC EMISSIONS

CAPCOA Risk Prioritization for The
CO2 Enhanced Oil Recovery (EOR) Project - Operational Activities

(Prioritized using the CAPCOAA Dispersion Adjustment Procedure, DPM included as BAP)

Daily and Annual HAP/TAC Emissions						OEHHA Risk Matrix			CAPCOA Risk Score		
Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	Max Daily TAC Lb/Day	Annual TAC Lb/Year	Unit Risk ug/M3	Acute REL	Chronic REL	Cancer Score	Acute Score	Chronic Score
1,3 Butadiene	106-99-0	Y	Y	6.903781E-04	2.572065E-01	2.70E-06	4.70E+02	1.40E+02	2.3334E-06	9.1806E-08	3.1459E-08
2-Methylchloroanthrene	56-49-5	Y	Y	3.218824E-06	1.174871E-03						
2-Methylnaphthalene	91-57-6	Y	Y	4.291765E-05	1.566494E-02						
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	2.861176E-05	1.044329E-02						
Acenaphthene	83-32-9	Y	Y	1.940235E-06	7.696858E-04						
Acenaphthylene	208-96-8	Y	Y	2.092235E-06	5.697830E-02						
Acetaldehyde	75-07-0	Y	Y	5.785374E+00	5.403354E+00	2.7000E-06	4.7000E+02	1.4000E+02	4.9019E-05	1.5387E-03	1.3218E-06
Acrolein	107-02-8	Y	Y	1.359313E+00	6.319376E+00		2.5000E+00	3.5000E-01		6.7966E-02	6.1833E-04
Anthracene	120-12-7	Y	Y	4.291765E-06	1.578123E-03						
Benzene	71-43-2	Y	Y	2.150870E+01	6.237296E+01	2.9000E-05	1.3000E+03	6.0000E+01	6.0776E-03	2.0681E-03	3.5601E-05
Benzo(a)anthracene	56-55-6	Y	Y	2.771765E-06	1.039964E-03	1.1000E-04			3.8437E-07		
Benzo(a)pyrene (BAP) + Diesel DPM	50-32-8	Y	Y	2.613967E+00	8.583248E+01	1.1000E-03			3.1724E-01		
Benzo(b)fluoranthene	205-99-2	Y	Y	1.940235E-06	7.113563E-04	1.1000E-04			2.6292E-07		
Benzo(g,h,i)perylene	191-24-2	Y	Y	1.403765E-06	5.147262E-04						
Benzo(k)fluoranthene	207-08-9	Y	Y	1.940235E-06	7.100381E-04	1.1000E-04			2.6243E-07		
Butane	106-07-8	N	N	0.000000E+00	0.000000E+00						
Chlorobenzene	108-90-7	Y	Y	0.000000E+00	4.781150E-06	4.6000E-06		1.00E+03	7.3897E-11		1.6374E-13
Chrysene	218-01-9	Y	Y	2.619765E-06	9.800999E-04	1.1000E-05			3.6224E-08		
Dibenzo(a,h)anthracene	53-70-3	Y	Y	1.403765E-06	5.161061E-04	1.2000E-03			2.0809E-06		
Dibenzochlorine	25321-22-6	Y	Y	2.145882E-03	7.832471E-01						
Ethane	74-84-00	N	N	0.000000E+00	0.000000E+00						
Ethylbenzene	100-41-4	Y	Y	1.941329E+02	1.269673E+02			2.0000E+03			2.1741E-06
Fluoranthene	206-44-0	Y	Y	3.934118E-06	1.482621E-03						
Fluorene	86-73-7	Y	Y	4.649412E-06	2.008292E-03						
Formaldehyde	50-00-0	Y	Y	1.572212E+02	1.245711E+02	6.0000E-06	5.5000E+01	9.0000E+00	2.5114E-03	3.5732E-01	4.7401E-04
Hydrogen Chloride	7647-01-0	Y	Y	0.000000E+00	0.000000E+00		2.1000E+03	9.0000E+00		0.0000E+00	0.0000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	3.040000E-01	1.109600E+02						
Hexane	110-54-3	Y	Y	6.416765E+00	9.216108E+02						
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	1.940235E-06	7.100911E-04	1.1000E-04			2.6245E-07		
Naphthalene	91-20-3	Y	Y	1.479370E+00	1.157072E+00	3.4000E-05		9.0000E+00	1.3218E-04		4.4029E-06
Pentane	109-66-0	N	N	0.000000E+00	0.000000E+00						
Phenanthrene	85-01-8	Y	Y	2.592941E-05	1.052744E-02						
Propane	74-98-6	N	N	0.000000E+00	0.000000E+00						
Propylene	115-07-1	N	Y	1.945877E+02	4.888962E+02						
Pyrene	129-00-0	Y	Y	6.258824E-06	2.345106E-03						
Toluene	108-88-3	Y	Y	7.857979E+00	2.714703E+01		3.7000E+04	3.0000E+02		2.6547E-05	3.0990E-06
Total xylene	1330-20-7	Y	Y	3.920156E+00	1.034878E+01		2.2000E+04	7.0000E+02		2.2274E-05	5.0630E-07
Total PAH(W/Napthalene)	1150/1151	Y	Y	1.882763E+00	1.447833E+00	1.10E-03			5.3512E-03		
Total PAH(W/O Napthalene)	1150/1151	Y	Y	5.416931E-02	1.797377E-01						

CAPCOA Risk Prioritization for The
CO2 Enhanced Oil Recovery (EOR) Project - Operational Activities

(Prioritized using the CAPCOAA Dispersion Adjustment Procedure, DPM included as BAP)

Daily and Annual HAP/TAC Emissions						OEHHA Risk Matrix			CAPCOA Risk Score		
Chemical Substance	Chemical CAS No	Status (Y/N) HAP	Status (Y/N) TAC	Max Daily TAC Lb/Day	Annual TAC Lb/Year	Unit Risk ug/M3	Acute REL	Chronic REL	Cancer Score	Acute Score	Chronic Score
Arsenic	7440-38-2	Y	Y	2.724339E-02	1.472634E-01	3.3000E-03	2.0000E-01	1.5000E-02	1.6329E-03	1.7027E-02	3.3622E-04
Barium	7440-39-3	N	Y	5.993545E-01	3.238901E+00						
Beryllium	7440-41-7	Y	Y	1.634603E-03	8.876325E-03	2.4000E-03		7.0000E-03	7.1579E-05		4.3426E-05
Cadmium	7440-43-9	Y	Y	1.498386E-01	8.097518E-01	4.2000E-03		2.0000E-02	1.1427E-02		1.3866E-03
Chromium, VI	18540-29-9	Y	Y	0.000000E+00	1.717867E-05	1.5000E-01		2.0000E-01	8.6580E-06		2.9416E-09
Chromium, total as Cr VI	7440-47-3	Y	Y	1.907037E-01	1.030703E+00						
Cobalt	744048-4	Y	Y	1.144222E-02	6.183357E-02						
Copper	7440-50-8	N	Y	1.157844E-01	6.258127E-01		1.0000E+02			1.4473E-04	
Lead	7439-92-1	Y	Y	0.000000E+00	8.589335E-05	1.2500E-05			3.6075E-09		
Manganese	7439-96-5	Y	Y	5.176244E-02	2.797974E-01			9.0000E-02			1.0647E-04
Mercury	7439-97-6	Y	Y	3.541640E-02	1.914565E-01		6.0000E-01	3.0000E-02		7.3784E-03	2.1856E-04
Molybdenum	7439-98-7	N	Y	1.498386E-01	8.097253E-01						
Nickel	7440-02-0	Y	Y	2.860556E-01	1.545894E+00	2.6000E-04	6.0000E+00	5.0000E-02	1.3505E-03	5.9595E-03	1.0588E-03
Selenium	7782-49-2	Y	Y	3.269207E-03	1.773598E-02			2.0000E+01			3.0370E-08
Vanadium	7440-62-2	N	Y	3.132990E-01	1.693062E+00		3.0000E+01			1.3054E-03	
Zinc	7440-66-6	N	Y	3.950291E+00	2.134762E+01						
Risk Prioritization Score for CO2 EOR Operational Emissions						-------	-------	-------	3.4585E-01	4.6076E-01	4.2895E-03

Note:

1. Risk is prioritized using the CAPCO "dispersion adjustment procedure". The stack height used for selecting the dispersion adjustment factors was 0.060 (stack < 20m)

2. The gas plant is located in an existing oilfield. The nearest public (or sensitive) receptors are located more than one mile away. Consequently, the receptor adjustment factor used in the analysis was set equal to 0.002 (1500m < receptor < 2,000 m).

HAP/TAC Emissions from
The CO2 Enhanced Oil Recovery (EOR) Project

Total HAP/TAC Emissions from Operational Activities

Chemical Substance	Chemical CAS No	Status (Y/N)		POM	Maximum Daily Emissions		Annual Emissions	
		HAP	TAC	Y/N	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N	2.362395E-02	2.362395E-02	2.914463E+00	2.914463E+00
2-Methylchloroanthrene	56-49-5	Y	Y	Y	3.218824E-06	3.218824E-06	1.174871E-03	1.174871E-03
2-Methylnaphthalene	91-57-6	Y	Y	Y	4.291765E-05	4.291765E-05	1.566494E-02	1.566494E-02
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y	2.861176E-05	2.861176E-05	1.044329E-02	1.044329E-02
Acenaphthene	83-32-9	Y	Y	Y	9.061768E-05	9.061768E-05	4.846312E-03	4.846312E-03
Acenaphthylene	208-96-8	Y	Y	Y	8.105859E-02	8.105859E-02	3.783259E+00	3.783259E+00
Acetaldehyde	75-07-0	Y	Y	N	5.845942E+00	5.845942E+00	1.242125E+01	1.242125E+01
Acrolein	107-02-8	Y	Y	N	1.363004E+00	1.363004E+00	6.747030E+00	6.747030E+00
Anthracene	120-12-7	Y	Y	Y	2.105898E-05	2.105898E-05	2.348935E-03	2.348935E-03
Benzene	71-43-2	Y	Y	N	2.152842E+01	2.152842E+01	6.465725E+01	6.465725E+01
Benzo(a)anthracene	56-55-6	Y	Y	Y	4.353405E-05	4.353405E-05	2.913863E-03	2.913863E-03
Benzo(a)pyrene	50-32-8	Y	Y	Y	3.667506E-05	3.667506E-05	2.158306E-03	2.158306E-03
Benzo(b)fluoranthene	205-99-2	Y	Y	Y	6.511720E-06	6.511720E-06	9.215138E-04	9.215138E-04
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y	4.795213E-06	4.795213E-06	6.706358E-04	6.706358E-04
Benzo(k)fluoranthene	207-08-9	Y	Y	Y	4.610908E-06	4.610908E-06	8.328126E-04	8.328126E-04
Butane	106-07-8	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y	N	2.101145E-05	2.101145E-05	2.439326E-03	2.439326E-03
Chrysene	218-01-9	Y	Y	Y	3.706088E-05	3.706088E-05	2.563406E-03	2.563406E-03
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y	6.784929E-06	6.784929E-06	7.634857E-04	7.634857E-04
Dibenzochlorine	25321-22-6	Y	Y	N	2.145882E-03	2.145882E-03	7.832471E-01	7.832471E-01
Ethane	74-84-00	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	N	1.941341E+02	1.941341E+02	1.270997E+02	1.270997E+02
Fluoranthene	206-44-0	Y	Y	Y	7.122519E-05	7.122519E-05	4.576085E-03	4.576085E-03
Fluorene	86-73-7	Y	Y	Y	4.534543E-04	4.534543E-04	2.264048E-02	2.264048E-02
Formaldehyde	50-00-0	Y	Y	N	1.573480E+02	1.573480E+02	1.392583E+02	1.392583E+02
Hydrogen Chloride	7647-01-0	Y	Y	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N	0.000000E+00	3.040000E-01	0.000000E+00	1.109600E+02
Hexane	110-54-3	Y	Y	N	6.419588E+00	6.419588E+00	9.219379E+02	9.219379E+02
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y	4.687332E-06	4.687332E-06	8.363789E-04	8.363789E-04
Naphthalene	91-20-3	Y	Y	Y	1.480683E+00	1.480683E+00	1.217449E+00	1.217449E+00
Pentane	109-66-0	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y	Y	1.558973E-03	1.558973E-03	8.100357E-02	8.100357E-02

HAP/TAC Emissions from
The CO2 Enhanced Oil Recovery (EOR) Project

Total HAP/TAC Emissions from Operational Activities

Chemical Substance	Chemical CAS No	Status (Y/N)		POM	Maximum Daily Emissions		Annual Emissions	
		HAP	TAC	Y/N	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Propane	74-98-6	N	N	N	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	N	0.000000E+00	1.946309E+02	0.000000E+00	4.939023E+02
Pyrene	129-00-0	Y	Y	Y	9.368936E-05	9.368936E-05	6.364410E-03	6.364410E-03
Toluene	108-88-3	Y	Y	N	7.870756E+00	7.870756E+00	2.862748E+01	2.862748E+01
Total xylene	1330-20-7	Y	Y	N	3.924734E+00	3.924734E+00	1.087928E+01	1.087928E+01
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	1.885933E+00	1.885933E+00	1.593559E+00	1.593559E+00
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	5.585525E-02	5.585525E-02	2.572432E-01	2.572432E-01
Arsenic	7440-38-2	Y	Y	N	2.742183E-02	2.742183E-02	1.679387E-01	1.679387E-01
Barium	7440-39-3	N	Y	N	0.000000E+00	5.993545E-01	0.000000E+00	3.238901E+00
Beryllium	7440-41-7	Y	Y	N	1.823391E-03	1.823391E-03	3.075071E-02	3.075071E-02
Cadmium	7440-43-9	Y	Y	N	1.499552E-01	1.499552E-01	8.232544E-01	8.232544E-01
Chromium VI	18540-29-9	Y	Y	N	7.549412E-05	7.549412E-05	8.764497E-03	8.764497E-03
Chromium, total	7440-47-3	Y	Y	N	1.913341E-01	1.913341E-01	1.103739E+00	1.103739E+00
Cobalt	744048-4	Y	Y	N	1.144222E-02	1.144222E-02	6.183357E-02	6.183357E-02
Copper	7440-50-8	N	Y	N	0.000000E+00	1.162936E-01	0.000000E+00	6.848077E-01
Lead	7439-92-1	Y	Y	N	3.774706E-04	3.774706E-04	4.382248E-02	4.382248E-02
Manganese	7439-96-5	Y	Y	N	5.208812E-02	5.208812E-02	3.175328E-01	3.175328E-01
Mercury	7439-97-6	Y	Y	N	3.571020E-02	3.571020E-02	2.254975E-01	2.254975E-01
Molybdenum	7439-98-7	N	Y	N	0.000000E+00	1.498386E-01	0.000000E+00	8.097253E-01
Nickel	7440-02-0	Y	Y	N	2.862982E-01	2.862982E-01	1.574006E+00	1.574006E+00
Selenium	7782-49-2	Y	Y	N	3.573505E-03	3.573505E-03	5.299426E-02	5.299426E-02
Vanadium	7440-62-2	N	Y	N	0.000000E+00	3.132990E-01	0.000000E+00	1.693062E+00
Zinc	7440-66-6	N	Y	N	0.000000E+00	3.951669E+00	0.000000E+00	2.150728E+01

Total EPA HAP and CARB TAC	400.761025	600.826375	1,321.985433	1,954.781552
Total EPA Polycyclic Organic Material (POM)	2.235697	N/A	1.625722	N/A

Maximum Daily Emissions of a Single EPA HAP (Ethyl Benzene)	194.134073	194.630895	---------	---------
Maximum Annual Emissions of a Single HAP (Hexane)	---------	---------	921.937948	921.937948

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From CO2 Injection Heater (60 MMBtu/HR)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	1,440.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	525,600.00 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	2.541176E-06	2.541176E-06	0.000928	0.000928
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	3.388235E-05	3.388235E-05	0.012367	0.012367
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	2.258824E-05	2.258824E-05	0.008245	0.008245
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.531765E-06	1.531765E-06	0.000559	0.000559
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09	5.294118E-10	1.147059E-09	1.651765E-06	1.651765E-06	0.000603	0.000603
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06		1.568627E-06	2.303922E-06	3.317647E-03	3.317647E-03	1.210941	1.210941
Acrolein	107-02-8	Y	Y	N	2.647059E-06		1.372549E-05	8.186275E-06	1.178824E-02	1.178824E-02	4.302706	4.302706
Anthracene	120-12-7	Y	Y	Y		2.352941E-09	2.352941E-09	2.352941E-09	3.388235E-06	3.388235E-06	0.001237	0.001237
Benzene	71-43-2	Y	Y	N	5.686275E-06	2.058824E-06	1.568627E-06	3.104575E-06	4.470588E-03	4.470588E-03	1.631765	1.631765
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09	1.274510E-09	1.519608E-09	2.188235E-06	2.188235E-06	0.000799	0.000799
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.108235E-06	1.108235E-06	0.000405	0.000405
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.531765E-06	1.531765E-06	0.000559	0.000559
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.108235E-06	1.108235E-06	0.000405	0.000405
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.531765E-06	1.531765E-06	0.000559	0.000559
Butane	106-07-8	N	N	N		2.058824E-03		2.058824E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y		1.764706E-09	1.107843E-09	1.436275E-09	2.068235E-06	2.068235E-06	0.000755	0.000755
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.108235E-06	1.108235E-06	0.000405	0.000405
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06		1.176471E-06	1.694118E-03	1.694118E-03	0.618353	0.618353
Ethane	74-84-00	N	N	N		3.039216E-03		3.039216E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06		1.176471E-05	9.264706E-06	1.334118E-02	1.334118E-02	4.869529	4.869529
Fluoranthene	206-44-0	Y	Y	Y		2.941176E-09	1.372549E-09	2.156863E-09	3.105882E-06	3.105882E-06	0.001134	0.001134
Fluorene	86-73-7	Y	Y	Y		2.745098E-09	2.352941E-09	2.549020E-09	3.670588E-06	3.670588E-06	0.001340	0.001340
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05	7.352941E-05	3.235294E-05	3.931373E-05	5.661176E-02	5.661176E-02	20.663294	20.663294
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N		1.666667E-04		1.666667E-04	0.000000E+00	2.400000E-01	0.000000	87.600000
Hexane	110-54-3	Y	Y	N	4.509804E-06	1.764706E-03		8.846078E-04	1.273835E+00	1.273835E+00	464.949882	464.949882
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.531765E-06	1.531765E-06	0.000559	0.000559
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07	5.980392E-07	1.833333E-07	3.584967E-07	5.162353E-04	5.162353E-04	0.188426	0.188426
Pentane	109-66-0	N	N	N		2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08	1.176471E-08	1.421569E-08	2.047059E-05	2.047059E-05	0.007472	0.007472
Propane	74-98-6	N	N	N		1.568627E-03		1.568627E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N	5.196078E-04		5.882353E-04	5.539216E-04	0.000000E+00	7.976471E-01	0.000000	291.141176
Pyrene	129-00-0	Y	Y	Y		4.901961E-09	1.960784E-09	3.431373E-09	4.941176E-06	4.941176E-06	0.001804	0.001804
Toluene	108-88-3	Y	Y	N	2.598039E-05	3.333333E-06	1.960784E-05	1.630719E-05	2.348235E-02	2.348235E-02	8.571059	8.571059
Total xylene	1330-20-7	Y	Y	N	1.931373E-05		2.058824E-07	9.759804E-06	1.405412E-02	1.405412E-02	5.129753	5.129753
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	6.543137E-07	2.058824E-07	4.174510E-07	6.011294E-04	6.011294E-04	0.219412	0.219412
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	5.627451E-08	2.058824E-07	2.181046E-07	3.140706E-04	3.140706E-04	0.114636	0.114636

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From CO2 Injection Heater (60 MMBtu/HR)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	1,440.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	525,600.00 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	2.823529E-04	2.823529E-04	0.103059	0.103059
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	6.211765E-03	0.000000	2.267294
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	1.694118E-05	1.694118E-05	0.006184	0.006184
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	1.552941E-03	1.552941E-03	0.566824	0.566824
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	1.976471E-03	1.976471E-03	0.721412	0.721412
Cobalt	744048-4	Y	Y	N		8.235294E-08		8.235294E-08	1.185882E-04	1.185882E-04	0.043285	0.043285
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	1.200000E-03	0.000000	0.438000
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	5.364706E-04	5.364706E-04	0.195812	0.195812
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	3.670588E-04	3.670588E-04	0.133976	0.133976
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	1.552941E-03	0.000000	0.566824
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	2.964706E-03	2.964706E-03	1.082118	1.082118
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	3.388235E-05	3.388235E-05	0.012367	0.012367
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	3.247059E-03	0.000000	1.185176
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	4.094118E-02	0.000000	14.943529
Total EPA HAP and CARB TAC (Lb/Year)									1.411071	2.501871	515.040875	913.182875
Total EPA Polycyclic Organic Material (POM)									0.000626	N/A	0.228557	N/A

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From Mole Sieve Heater (10 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	240.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	87,600.00 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	4.235294E-07	4.235294E-07	0.000155	0.000155
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	5.647059E-06	5.647059E-06	0.002061	0.002061
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	3.764706E-06	3.764706E-06	0.001374	0.001374
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-07	2.552941E-07	0.000093	0.000093
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09	5.294118E-10	1.147059E-09	2.752941E-07	2.752941E-07	0.000100	0.000100
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06		1.568627E-06	2.303922E-06	5.529412E-04	5.529412E-04	0.201824	0.201824
Acrolein	107-02-8	Y	Y	N	2.647059E-06		1.372549E-05	8.186275E-06	1.964706E-03	1.964706E-03	0.717118	0.717118
Anthracene	120-12-7	Y	Y	Y		2.352941E-09	2.352941E-09	2.352941E-09	5.647059E-07	5.647059E-07	0.000206	0.000206
Benzene	71-43-2	Y	Y	N	5.686275E-06	2.058824E-06	1.568627E-06	3.104575E-06	7.450980E-04	7.450980E-04	0.271961	0.271961
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09	1.274510E-09	1.519608E-09	3.647059E-07	3.647059E-07	0.000133	0.000133
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-07	1.847059E-07	0.000067	0.000067
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-07	2.552941E-07	0.000093	0.000093
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-07	1.847059E-07	0.000067	0.000067
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-07	2.552941E-07	0.000093	0.000093
Butane	106-07-8	N	N	N		2.058824E-03		2.058824E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y		1.764706E-09	1.107843E-09	1.436275E-09	3.447059E-07	3.447059E-07	0.000126	0.000126
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-07	1.847059E-07	0.000067	0.000067
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06		1.176471E-06	2.823529E-04	2.823529E-04	0.103059	0.103059
Ethane	74-84-00	N	N	N		3.039216E-03		3.039216E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06		1.176471E-05	9.264706E-06	2.223529E-03	2.223529E-03	0.811588	0.811588
Fluoranthene	206-44-0	Y	Y	Y		2.941176E-09	1.372549E-09	2.156863E-09	5.176471E-07	5.176471E-07	0.000189	0.000189
Fluorene	86-73-7	Y	Y	Y		2.745098E-09	2.352941E-09	2.549020E-09	6.117647E-07	6.117647E-07	0.000223	0.000223
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05	7.352941E-05	3.235294E-05	3.931373E-05	9.435294E-03	9.435294E-03	3.443882	3.443882
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N		1.666667E-04		1.666667E-04	0.000000E+00	4.000000E-02	0.000000	14.600000
Hexane	110-54-3	Y	Y	N	4.509804E-06	1.764706E-03		8.846078E-04	2.123059E-01	2.123059E-01	77.491647	77.491647
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-07	2.552941E-07	0.000093	0.000093
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07	5.980392E-07	1.833333E-07	3.584967E-07	8.603922E-05	8.603922E-05	0.031404	0.031404
Pentane	109-66-0	N	N	N		2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08	1.176471E-08	1.421569E-08	3.411765E-06	3.411765E-06	0.001245	0.001245
Propane	74-98-6	N	N	N		1.568627E-03		1.568627E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N	5.196078E-04		5.882353E-04	5.539216E-04	0.000000E+00	1.329412E-01	0.000000	48.523529
Pyrene	129-00-0	Y	Y	Y		4.901961E-09	1.960784E-09	3.431373E-09	8.235294E-07	8.235294E-07	0.000301	0.000301
Toluene	108-88-3	Y	Y	N	2.598039E-05	3.333333E-06	1.960784E-05	1.630719E-05	3.913725E-03	3.913725E-03	1.428510	1.428510
Total xylene	1330-20-7	Y	Y	N	1.931373E-05		2.058824E-07	9.759804E-06	2.342353E-03	2.342353E-03	0.854959	0.854959
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	6.543137E-07	2.058824E-07	4.174510E-07	1.001882E-04	1.001882E-04	0.036569	0.036569
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	5.627451E-08	2.058824E-07	2.181046E-07	5.234510E-05	5.234510E-05	0.019106	0.019106

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From Mole Sieve Heater (10 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	240.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	87,600.00 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	4.705882E-05	4.705882E-05	0.017176	0.017176
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	1.035294E-03	0.000000	0.377882
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	2.823529E-06	2.823529E-06	0.001031	0.001031
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	2.588235E-04	2.588235E-04	0.094471	0.094471
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	3.294118E-04	3.294118E-04	0.120235	0.120235
Cobalt	744048-4	Y	Y	N		8.235294E-08		8.235294E-08	1.976471E-05	1.976471E-05	0.007214	0.007214
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	2.000000E-04	0.000000	0.073000
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	8.941176E-05	8.941176E-05	0.032635	0.032635
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	6.117647E-05	6.117647E-05	0.022329	0.022329
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	2.588235E-04	0.000000	0.094471
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	4.941176E-04	4.941176E-04	0.180353	0.180353
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	5.647059E-06	5.647059E-06	0.002061	0.002061
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	5.411765E-04	0.000000	0.197529
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	6.823529E-03	0.000000	2.490588
Total EPA HAP and CARB TAC (Lb/Year)									0.235178	0.416978	85.840146	152.197146
Total EPA Polycyclic Organic Material (POM)									0.000104	N/A	0.038093	N/A

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (5 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	120.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	43,800.00 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	2.117647E-07	2.117647E-07	0.000077	0.000077
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	2.823529E-06	2.823529E-06	0.001031	0.001031
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	1.882353E-06	1.882353E-06	0.000687	0.000687
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	1.276471E-07	0.000047	0.000047
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09	5.294118E-10	1.147059E-09	1.376471E-07	1.376471E-07	0.000050	0.000050
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06		1.568627E-06	2.303922E-06	2.764706E-04	2.764706E-04	0.100912	0.100912
Acrolein	107-02-8	Y	Y	N	2.647059E-06		1.372549E-05	8.186275E-06	9.823529E-04	9.823529E-04	0.358559	0.358559
Anthracene	120-12-7	Y	Y	Y		2.352941E-09	2.352941E-09	2.352941E-09	2.823529E-07	2.823529E-07	0.000103	0.000103
Benzene	71-43-2	Y	Y	N	5.686275E-06	2.058824E-06	1.568627E-06	3.104575E-06	3.725490E-04	3.725490E-04	0.135980	0.135980
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09	1.274510E-09	1.519608E-09	1.823529E-07	1.823529E-07	0.000067	0.000067
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	9.235294E-08	9.235294E-08	0.000034	0.000034
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	1.276471E-07	0.000047	0.000047
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	9.235294E-08	9.235294E-08	0.000034	0.000034
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	1.276471E-07	0.000047	0.000047
Butane	106-07-8	N	N	N		2.058824E-03		2.058824E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y		1.764706E-09	1.107843E-09	1.436275E-09	1.723529E-07	1.723529E-07	0.000063	0.000063
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	9.235294E-08	9.235294E-08	0.000034	0.000034
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06		1.176471E-06	1.411765E-04	1.411765E-04	0.051529	0.051529
Ethane	74-84-00	N	N	N		3.039216E-03		3.039216E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06		1.176471E-05	9.264706E-06	1.111765E-03	1.111765E-03	0.405794	0.405794
Fluoranthene	206-44-0	Y	Y	Y		2.941176E-09	1.372549E-09	2.156863E-09	2.588235E-07	2.588235E-07	0.000094	0.000094
Fluorene	86-73-7	Y	Y	Y		2.745098E-09	2.352941E-09	2.549020E-09	3.058824E-07	3.058824E-07	0.000112	0.000112
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05	7.352941E-05	3.235294E-05	3.931373E-05	4.717647E-03	4.717647E-03	1.721941	1.721941
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N		1.666667E-04		1.666667E-04	0.000000E+00	2.000000E-02	0.000000	7.300000
Hexane	110-54-3	Y	Y	N	4.509804E-06	1.764706E-03		8.846078E-04	1.061529E-01	1.061529E-01	38.745824	38.745824
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	1.276471E-07	1.276471E-07	0.000047	0.000047
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07	5.980392E-07	1.833333E-07	3.584967E-07	4.301961E-05	4.301961E-05	0.015702	0.015702
Pentane	109-66-0	N	N	N		2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08	1.176471E-08	1.421569E-08	1.705882E-06	1.705882E-06	0.000623	0.000623
Propane	74-98-6	N	N	N		1.568627E-03		1.568627E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N	5.196078E-04		5.882353E-04	5.539216E-04	0.000000E+00	6.647059E-02	0.000000	24.261765
Pyrene	129-00-0	Y	Y	Y		4.901961E-09	1.960784E-09	3.431373E-09	4.117647E-07	4.117647E-07	0.000150	0.000150
Toluene	108-88-3	Y	Y	N	2.598039E-05	3.333333E-06	1.960784E-05	1.630719E-05	1.956863E-03	1.956863E-03	0.714255	0.714255
Total xylene	1330-20-7	Y	Y	N	1.931373E-05		2.058824E-07	9.759804E-06	1.171176E-03	1.171176E-03	0.427479	0.427479
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	6.543137E-07	2.058824E-07	4.174510E-07	5.009412E-05	5.009412E-05	0.018284	0.018284
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	5.627451E-08	2.058824E-07	2.181046E-07	2.617255E-05	2.617255E-05	0.009553	0.009553

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (5 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	120.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	43,800.00 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	2.352941E-05	2.352941E-05	0.008588	0.008588
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	5.176471E-04	0.000000	0.188941
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	1.411765E-06	1.411765E-06	0.000515	0.000515
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	1.294118E-04	1.294118E-04	0.047235	0.047235
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	1.647059E-04	1.647059E-04	0.060118	0.060118
Cobalt	744048-4	Y	Y	N		8.235294E-08		8.235294E-08	9.882353E-06	9.882353E-06	0.003607	0.003607
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	1.000000E-04	0.000000	0.036500
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	4.470588E-05	4.470588E-05	0.016318	0.016318
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	3.058824E-05	3.058824E-05	0.011165	0.011165
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	1.294118E-04	0.000000	0.047235
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	2.470588E-04	2.470588E-04	0.090176	0.090176
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	2.823529E-06	2.823529E-06	0.001031	0.001031
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	2.705882E-04	0.000000	0.098765
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	3.411765E-03	0.000000	1.245294
Total EPA HAP and CARB TAC (Lb/Year)									0.117589	0.208489	42.920073	76.098573
Total EPA Polycyclic Organic Material (POM)									0.000052	N/A	0.019046	N/A

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (1 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	24.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	8,760.00 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y		1.764706E-09		1.764706E-09	4.235294E-08	4.235294E-08	0.000015	0.000015
2-Methylnaphthalene	91-57-6	Y	Y	Y		2.352941E-08		2.352941E-08	5.647059E-07	5.647059E-07	0.000206	0.000206
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y		1.568627E-08		1.568627E-08	3.764706E-07	3.764706E-07	0.000137	0.000137
Acenaphthene	83-32-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Acenaphthylene	208-96-8	Y	Y	Y		1.764706E-09	5.294118E-10	1.147059E-09	2.752941E-08	2.752941E-08	0.000010	0.000010
Acetaldehyde	75-07-0	Y	Y	N	3.039216E-06		1.568627E-06	2.303922E-06	5.529412E-05	5.529412E-05	0.020182	0.020182
Acrolein	107-02-8	Y	Y	N	2.647059E-06		1.372549E-05	8.186275E-06	1.964706E-04	1.964706E-04	0.071712	0.071712
Anthracene	120-12-7	Y	Y	Y		2.352941E-09	2.352941E-09	2.352941E-09	5.647059E-08	5.647059E-08	0.000021	0.000021
Benzene	71-43-2	Y	Y	N	5.686275E-06	2.058824E-06	1.568627E-06	3.104575E-06	7.450980E-05	7.450980E-05	0.027196	0.027196
Benzo(a)anthracene	56-55-6	Y	Y	Y		1.764706E-09	1.274510E-09	1.519608E-09	3.647059E-08	3.647059E-08	0.000013	0.000013
Benzo(a)pyrene	50-32-8	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Butane	106-07-8	N	N	N		2.058824E-03		2.058824E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y		1.764706E-09	1.107843E-09	1.436275E-09	3.447059E-08	3.447059E-08	0.000013	0.000013
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		1.176471E-09	3.627451E-10	7.696078E-10	1.847059E-08	1.847059E-08	0.000007	0.000007
Dibenzochlorine	25321-22-6	Y	Y	N		1.176471E-06		1.176471E-06	2.823529E-05	2.823529E-05	0.010306	0.010306
Ethane	74-84-00	N	N	N		3.039216E-03		3.039216E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	6.764706E-06		1.176471E-05	9.264706E-06	2.223529E-04	2.223529E-04	0.081159	0.081159
Fluoranthene	206-44-0	Y	Y	Y		2.941176E-09	1.372549E-09	2.156863E-09	5.176471E-08	5.176471E-08	0.000019	0.000019
Fluorene	86-73-7	Y	Y	Y		2.745098E-09	2.352941E-09	2.549020E-09	6.117647E-08	6.117647E-08	0.000022	0.000022
Formaldehyde	50-00-0	Y	Y	N	1.205882E-05	7.352941E-05	3.235294E-05	3.931373E-05	9.435294E-04	9.435294E-04	0.344388	0.344388
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N		1.666667E-04		1.666667E-04	0.000000E+00	4.000000E-03	0.000000	1.460000
Hexane	110-54-3	Y	Y	N	4.509804E-06	1.764706E-03		8.846078E-04	2.123059E-02	2.123059E-02	7.749165	7.749165
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		1.764706E-09	3.627451E-10	1.063725E-09	2.552941E-08	2.552941E-08	0.000009	0.000009
Naphthalene	91-20-3	Y	Y	Y	2.941176E-07	5.980392E-07	1.833333E-07	3.584967E-07	8.603922E-06	8.603922E-06	0.003140	0.003140
Pentane	109-66-0	N	N	N		2.549020E-03		2.549020E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		1.666667E-08	1.176471E-08	1.421569E-08	3.411765E-07	3.411765E-07	0.000125	0.000125
Propane	74-98-6	N	N	N		1.568627E-03		1.568627E-03	0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N	5.196078E-04		5.882353E-04	5.539216E-04	0.000000E+00	1.329412E-02	0.000000	4.852353
Pyrene	129-00-0	Y	Y	Y		4.901961E-09	1.960784E-09	3.431373E-09	8.235294E-08	8.235294E-08	0.000030	0.000030
Toluene	108-88-3	Y	Y	N	2.598039E-05	3.333333E-06	1.960784E-05	1.630719E-05	3.913725E-04	3.913725E-04	0.142851	0.142851
Total xylene	1330-20-7	Y	Y	N	1.931373E-05		2.058824E-07	9.759804E-06	2.342353E-04	2.342353E-04	0.085496	0.085496
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	6.543137E-07	2.058824E-07	4.174510E-07	1.001882E-05	1.001882E-05	0.003657	0.003657
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.921569E-07	5.627451E-08	2.058824E-07	2.181046E-07	5.234510E-06	5.234510E-06	0.001911	0.001911

HAP/TAC Emissions from Natural Gas Fired Heaters

Increase In HAP/TAC Emission From TEG Heater (1 MMBtu/Hr)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	24.00 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	8,760.00 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.960784E-07		1.960784E-07	4.705882E-06	4.705882E-06	0.001718	0.001718
Barium	7440-39-3	N	Y	N		4.313725E-06		4.313725E-06	0.000000E+00	1.035294E-04	0.000000	0.037788
Beryllium	7440-41-7	Y	Y	N		1.176471E-08		1.176471E-08	2.823529E-07	2.823529E-07	0.000103	0.000103
Cadmium	7440-43-9	Y	Y	N		1.078431E-06		1.078431E-06	2.588235E-05	2.588235E-05	0.009447	0.009447
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N		1.372549E-06		1.372549E-06	3.294118E-05	3.294118E-05	0.012024	0.012024
Cobalt	744048-4	Y	Y	N		8.235294E-08		8.235294E-08	1.976471E-06	1.976471E-06	0.000721	0.000721
Copper	7440-50-8	N	Y	N		8.333333E-07		8.333333E-07	0.000000E+00	2.000000E-05	0.000000	0.007300
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N		3.725490E-07		3.725490E-07	8.941176E-06	8.941176E-06	0.003264	0.003264
Mercury	7439-97-6	Y	Y	N		2.549020E-07		2.549020E-07	6.117647E-06	6.117647E-06	0.002233	0.002233
Molybdenum	7439-98-7	N	Y	N		1.078431E-06		1.078431E-06	0.000000E+00	2.588235E-05	0.000000	0.009447
Nickel	7440-02-0	Y	Y	N		2.058824E-06		2.058824E-06	4.941176E-05	4.941176E-05	0.018035	0.018035
Selenium	7782-49-2	Y	Y	N		2.352941E-08		2.352941E-08	5.647059E-07	5.647059E-07	0.000206	0.000206
Vanadium	7440-62-2	N	Y	N		2.254902E-06		2.254902E-06	0.000000E+00	5.411765E-05	0.000000	0.019753
Zinc	7440-66-6	N	Y	N		2.843137E-05		2.843137E-05	0.000000E+00	6.823529E-04	0.000000	0.249059
Total EPA HAP and CARB TAC (Lb/Year)									0.023518	0.041698	8.584015	15.219715
Total EPA Polycyclic Organic Material (POM)									0.000010	N/A	0.003809	N/A

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Engine (2 @ 175 Hp Each)

									Adjusted Lb/Day		Adjusted Lb/Year	
Chemical	Chemical	Status (Y/N)		POM	Non-Adjusted Emission Factors (Lb per 1000 Gallon)				M Gallons/Year =	0.432000	M Gallons/Year =	0.432000
Substance	CAS No	HAP	TAC	Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N	2.1740E-01	5.3880E-03	4.3210E-01	2.1830E-01	0.005219	0.005219	0.005219	0.005219
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y		1.9568E-04	2.3640E-03	1.2798E-03	0.000061	0.000061	0.000061	0.000061
Acenaphthylene	208-96-8	Y	Y	Y		6.9727E-04	2.3390E+00	1.1698E+00	0.056215	0.056215	0.056215	0.056215
Acetaldehyde	75-07-0	Y	Y	N	7.8330E-01	1.0528E-01	8.4100E-01	5.7653E-01	0.013782	0.013782	0.013782	0.013782
Acrolein	107-02-8	Y	Y	N	3.3900E-02	1.2747E-02	5.8750E-02	3.5132E-02	0.000840	0.000840	0.000840	0.000840
Anthracene	120-12-7	Y	Y	Y		2.5769E-04	2.2630E-04	2.4199E-04	0.000012	0.000012	0.000012	0.000012
Benzene	71-43-2	Y	Y	N	1.8630E-01	1.2857E-01	2.4810E-01	1.8766E-01	0.004486	0.004486	0.004486	0.004486
Benzo(a)anthracene	56-55-6	Y	Y	Y		2.3150E-04	9.4510E-04	5.8830E-04	0.000028	0.000028	0.000028	0.000028
Benzo(a)pyrene	50-32-8	Y	Y	Y		2.5906E-05	9.9220E-04	5.0905E-04	0.000024	0.000024	0.000024	0.000024
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.3656E-05	1.1830E-04	6.5978E-05	0.000003	0.000003	0.000003	0.000003
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		6.7384E-05	3.0510E-05	4.8947E-05	0.000002	0.000002	0.000002	0.000002
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		2.1359E-05	5.5730E-05	3.8545E-05	0.000002	0.000002	0.000002	0.000002
Butane	106-07-8	N	N	N					0.000000	0.000000	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N	2.0000E-04			2.0000E-04	0.000005	0.000005	0.000005	0.000005
Chrysene	218-01-9	Y	Y	Y		4.8643E-05	9.4550E-04	4.9707E-04	0.000024	0.000024	0.000024	0.000024
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		8.0337E-05	7.4990E-05	7.7664E-05	0.000004	0.000004	0.000004	0.000004
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000	0.000000	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	1.0900E-02		1.0850E-02	1.0875E-02	0.000260	0.000260	0.000260	0.000260
Fluoranthene	206-44-0	Y	Y	Y		1.0487E-03	8.9370E-04	9.7118E-04	0.000047	0.000047	0.000047	0.000047
Fluorene	86-73-7	Y	Y	Y		4.0238E-03	8.9310E-03	6.4774E-03	0.000311	0.000311	0.000311	0.000311
Formaldehyde	50-00-0	Y	Y	N	1.7261E+00	1.6260E-01	1.7310E+00	1.2066E+00	0.028844	0.028844	0.028844	0.028844
Hydrogen Chloride (HCl)	7647-01-0	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000	0.000000	0.000000	0.000000
Hexane	110-54-3	Y	Y	N	2.6900E-02		2.6850E-02	2.6875E-02	0.000642	0.000642	0.000642	0.000642
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		5.1675E-05	2.7620E-05	3.9648E-05	0.000002	0.000002	0.000002	0.000002
Naphthalene	91-20-3	Y	Y	Y	1.9700E-02	1.1685E-02	2.5480E-02	1.8955E-02	0.000911	0.000911	0.000911	0.000911
Pentane	109-66-0	N	N	N					0.000000	0.000000	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		4.0513E-03	4.0200E-02	2.2126E-02	0.001063	0.001063	0.001063	0.001063
Propane	74-98-6	N	N	N					0.000000	0.000000	0.000000	0.000000
Propylene	115-07-1	N	Y	N	4.6700E-01	3.5552E-01		4.1126E-01	0.000000	0.009832	0.000000	0.009832
Pyrene	129-00-0	Y	Y	Y		6.5868E-04	1.8650E-03	1.2618E-03	0.000061	0.000061	0.000061	0.000061
Toluene	108-88-3	Y	Y	N	1.5040E-01	5.6360E-02	1.5810E-01	1.2162E-01	0.002907	0.002907	0.002907	0.002907
Total xylene	1330-20-7	Y	Y	N	4.2400E-02	3.9273E-02	4.9070E-02	4.3581E-02	0.001042	0.001042	0.001042	0.001042
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.002198	0.002198	0.002198	0.002198
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y		1.1465E-02	3.7200E-02	2.4332E-02	0.001169	0.001169	0.001169	0.001169

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Engine (2 @ 175 Hp Each)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon) VCAPCD	EPA	SJVAPCD	Average	Adjusted Lb/Day M Gallons/Year = 0.432000 HAP Lb/Day	TAC Lb/Day	Adjusted Lb/Year M Gallons/Year = 0.432000 HAP Lb/Year	TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N	1.6000E-03		1.7970E-03	1.6985E-03	0.000041	0.000041	0.000041	0.000041
Barium	7440-39-3	N	Y	N					0.000000	0.000000	0.000000	0.000000
Beryllium	7440-41-7	Y	Y	N			1.7970E-03	1.7970E-03	0.000043	0.000043	0.000043	0.000043
Cadmium	7440-43-9	Y	Y	N	1.5000E-03		7.1850E-04	1.1093E-03	0.000027	0.000027	0.000027	0.000027
Chromium VI	18540-29-9	Y	Y	N			7.1860E-04	7.1860E-04	0.000017	0.000017	0.000017	0.000017
Chromium, total	7440-47-3	Y	Y	N	6.0000E-03			6.0000E-03	0.000143	0.000143	0.000143	0.000143
Cobalt	744048-4	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Copper	7440-50-8	N	Y	N	4.1000E-03		5.5930E-03	4.8465E-03	0.000000	0.000116	0.000000	0.000116
Lead	7439-92-1	Y	Y	N			3.5930E-03	3.5930E-03	0.000086	0.000086	0.000086	0.000086
Manganese	7439-96-5	Y	Y	N	3.1000E-03			3.1000E-03	0.000074	0.000074	0.000074	0.000074
Mercury	7439-97-6	Y	Y	N	2.0000E-03		3.5930E-03	2.7965E-03	0.000067	0.000067	0.000067	0.000067
Molybdenum	7439-98-7	N	Y	N					0.000000	0.000000	0.000000	0.000000
Nickel	7440-02-0	Y	Y	N	3.9000E-03		7.1880E-04	2.3094E-03	0.000055	0.000055	0.000055	0.000055
Selenium	7782-49-2	Y	Y	N	2.2000E-03		3.5930E-03	2.8965E-03	0.000069	0.000069	0.000069	0.000069
Vanadium	7440-62-2	N	Y	N					0.000000	0.000000	0.000000	0.000000
Zinc	7440-66-6	N	Y	N	2.2400E-02		3.8330E-03	1.3117E-02	0.000000	0.000314	0.000000	0.000314
Total EPA HAP and CARB TAC (Lb/Year)									0.117419	0.127680	0.117419	0.127680
Total EPA Polycyclic Organic Material (POM)									0.528348	N/A	0.528348	N/A

Diesel Particulate Matter	CAS No	HAP	TAC	Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.002198	0.002198	0.002198	0.002198
Calculated PM as DPM	Tier-3	Y	Y	Y				4.7580E+00	2.055456	2.055456	2.055456	2.055456

Corrections Factors for Tier-3 Engine versus Tier-0 Engine

Adjustment Factors for PM AND Organics			
Adjustment Facctor Category	AP42 g/Bhp	Engine g/Bhp	Adjust Factor
VOC	1.1204	0.062	0.05534
PM	0.9979	0.111	0.11123
VOC adjustment factor is applined to non PM (gaseous HAP/TAC)			
PM adjustment factor is applied to POM (HAPS with BP <100 C)			
PM adjustment factor is applied to metals			

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Emergency Use of Flare

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	68,558.64 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	42,538.08 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acetaldehyde	75-07-0	Y	Y	N	4.2157E-05			4.21569E-05	2.890217E+00	2.890217E+00	1.793272E+00	1.793272E+00
Acrolein	107-02-8	Y	Y	N	9.8039E-06			9.80392E-06	6.721435E-01	6.721435E-01	4.170400E-01	4.170400E-01
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzene	71-43-2	Y	Y	N	0.00015588			0.000155882	1.068708E+01	1.068708E+01	6.630935E+00	6.630935E+00
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	N	0.00141569			0.001415686	9.705753E+01	9.705753E+01	6.022057E+01	6.022057E+01
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Formaldehyde	50-00-0	Y	Y	N	0.00114608			0.001146078	7.857358E+01	7.857358E+01	4.875197E+01	4.875197E+01
Hydrogen Chloride (HCL)	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hexane	110-54-3	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Naphthalene	91-20-3	Y	Y	Y	1.0784E-05			1.07843E-05	7.393579E-01	7.393579E-01	4.587440E-01	4.587440E-01
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	N	0.00141176			0.001411765	0.000000E+00	9.678867E+01	0.000000E+00	6.005376E+01
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Toluene	108-88-3	Y	Y	N	5.6863E-05			5.68627E-05	3.898432E+00	3.898432E+00	2.418832E+00	2.418832E+00
Total xylene	1330-20-7	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	1.3725E-05			1.37255E-05	9.410009E-01	9.410009E-01	5.838560E-01	5.838560E-01
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.9216E-07			3.92157E-07	2.688574E-02	2.688574E-02	1.668160E-02	1.668160E-02

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Emergency Use of Flare

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	68,558.64 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	42,538.08 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.9608E-07		1.96078E-07	1.344287E-02	1.344287E-02	8.340799E-03	8.340799E-03
Barium	7440-39-3	N	Y	N		4.3137E-06		4.31373E-06	0.000000E+00	2.957432E-01	0.000000E+00	1.834976E-01
Beryllium	7440-41-7	Y	Y	N		1.1765E-08		1.17647E-08	8.065722E-04	8.065722E-04	5.004480E-04	5.004480E-04
Cadmium	7440-43-9	Y	Y	N		1.0784E-06		1.07843E-06	7.393579E-02	7.393579E-02	4.587440E-02	4.587440E-02
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chromium, total	7440-47-3	Y	Y	N		1.3725E-06		1.37255E-06	9.410009E-02	9.410009E-02	5.838560E-02	5.838560E-02
Cobalt	744048-4	Y	Y	N		8.2353E-08		8.23529E-08	5.646006E-03	5.646006E-03	3.503136E-03	3.503136E-03
Copper	7440-50-8	N	Y	N		8.3333E-07		8.33333E-07	0.000000E+00	5.713220E-02	0.000000E+00	3.544840E-02
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Manganese	7439-96-5	Y	Y	N		3.7255E-07		3.72549E-07	2.554145E-02	2.554145E-02	1.584752E-02	1.584752E-02
Mercury	7439-97-6	Y	Y	N		2.5490E-07		2.54902E-07	1.747573E-02	1.747573E-02	1.084304E-02	1.084304E-02
Molybdenum	7439-98-7	N	Y	N		1.0784E-06		1.07843E-06	0.000000E+00	7.393579E-02	0.000000E+00	4.587440E-02
Nickel	7440-02-0	Y	Y	N		2.0588E-06		2.05882E-06	1.411501E-01	1.411501E-01	8.757839E-02	8.757839E-02
Selenium	7782-49-2	Y	Y	N		2.3529E-08		2.35294E-08	1.613144E-03	1.613144E-03	1.000896E-03	1.000896E-03
Vanadium	7440-62-2	N	Y	N		2.2549E-06		2.2549E-06	0.000000E+00	1.545930E-01	0.000000E+00	9.591919E-02
Zinc	7440-66-6	N	Y	N		2.8431E-05		2.84314E-05	0.000000E+00	1.949216E+00	0.000000E+00	1.209416E+00
Total EPA HAP and CARB TAC (Lb/Year)									1.987905E+02	2.981098E+02	1.233421E+02	1.849660E+02
Total EPA Polycyclic Organic Material (POM)									1.707245E+00	N/A	1.059282E+00	N/A

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	68,558.64 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	42,538.08 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Acetaldehyde	75-07-0	Y	Y	N	4.2157E-05			4.21569E-05	2.890217E+00	2.890217E+00	1.793272E+00	1.793272E+00
Acrolein	107-02-8	Y	Y	N	9.8039E-06			9.80392E-06	6.721435E-01	6.721435E-01	4.170400E-01	4.170400E-01
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzene	71-43-2	Y	Y	N	0.00015588			0.000155882	1.068708E+01	1.068708E+01	6.630935E+00	6.630935E+00
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Ethylbenzene	100-41-4	Y	Y	N	0.00141569			0.001415686	9.705753E+01	9.705753E+01	6.022057E+01	6.022057E+01
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Formaldehyde	50-00-0	Y	Y	N	0.00114608			0.001146078	7.857358E+01	7.857358E+01	4.875197E+01	4.875197E+01
Hydrogen Chloride (HCL)	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Hexane	110-54-3	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Naphthalene	91-20-3	Y	Y	Y	1.0784E-05			1.07843E-05	7.393579E-01	7.393579E-01	4.587440E-01	4.587440E-01
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Propylene	115-07-1	N	Y	N	0.00141176			0.001411765	0.000000E+00	9.678867E+01	0.000000E+00	6.005376E+01
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Toluene	108-88-3	Y	Y	N	5.6863E-05			5.68627E-05	3.898432E+00	3.898432E+00	2.418832E+00	2.418832E+00
Total xylene	1330-20-7	Y	Y	N	2.8431E-05			2.84314E-05	1.949216E+00	1.949216E+00	1.209416E+00	1.209416E+00
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	1.3725E-05			1.37255E-05	9.410009E-01	9.410009E-01	5.838560E-01	5.838560E-01
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y	3.9216E-07			3.92157E-07	2.688574E-02	2.688574E-02	1.668160E-02	1.668160E-02

HAP/TAC Emissions from Emergency Use Flare

Increase In HAP/TAC Emission From Flare (2856.61 MMBtu/Hr Duing and Emergency Event)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Emission Factors (Lb/MMBtu) VCAPCD	EPA	SJVAPCD	Average	MMBtu/Day = HAP Lb/Day	68,558.64 TAC Lb/Day	MMBtu/Year = HAP Lb/Year	42,538.08 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N		1.9608E-07		1.96078E-07	1.344287E-02	1.344287E-02	8.340799E-03	8.340799E-03
Barium	7440-39-3	N	Y	N		4.3137E-06		4.31373E-06	0.000000E+00	2.957432E-01	0.000000E+00	1.834976E-01
Beryllium	7440-41-7	Y	Y	N		1.1765E-08		1.17647E-08	8.065722E-04	8.065722E-04	5.004480E-04	5.004480E-04
Cadmium	7440-43-9	Y	Y	N		1.0784E-06		1.07843E-06	7.393579E-02	7.393579E-02	4.587440E-02	4.587440E-02
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Chromium, total	7440-47-3	Y	Y	N		1.3725E-06		1.37255E-06	9.410009E-02	9.410009E-02	5.838560E-02	5.838560E-02
Cobalt	744048-4	Y	Y	N		8.2353E-08		8.23529E-08	5.646006E-03	5.646006E-03	3.503136E-03	3.503136E-03
Copper	7440-50-8	N	Y	N		8.3333E-07		8.33333E-07	0.000000E+00	5.713220E-02	0.000000E+00	3.544840E-02
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
Manganese	7439-96-5	Y	Y	N		3.7255E-07		3.72549E-07	2.554145E-02	2.554145E-02	1.584752E-02	1.584752E-02
Mercury	7439-97-6	Y	Y	N		2.5490E-07		2.54902E-07	1.747573E-02	1.747573E-02	1.084304E-02	1.084304E-02
Molybdenum	7439-98-7	N	Y	N		1.0784E-06		1.07843E-06	0.000000E+00	7.393579E-02	0.000000E+00	4.587440E-02
Nickel	7440-02-0	Y	Y	N		2.0588E-06		2.05882E-06	1.411501E-01	1.411501E-01	8.757839E-02	8.757839E-02
Selenium	7782-49-2	Y	Y	N		2.3529E-08		2.35294E-08	1.613144E-03	1.613144E-03	1.000896E-03	1.000896E-03
Vanadium	7440-62-2	N	Y	N		2.2549E-06		2.2549E-06	0.000000E+00	1.545930E-01	0.000000E+00	9.591919E-02
Zinc	7440-66-6	N	Y	N		2.8431E-05		2.84314E-05	0.000000E+00	1.949216E+00	0.000000E+00	1.209416E+00
Total EPA HAP and CARB TAC (Lb/Year)									1.987905E+02	2.981098E+02	1.233421E+02	1.849660E+02
Total EPA Polycyclic Organic Material (POM)									1.707245E+00	N/A	1.059282E+00	N/A

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Workover Equipment

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon) VCAPCD	EPA	SJVAPCD	Average	Adjusted Lb/Day M Gallons/Year = 0.246401 HAP Lb/Day	TAC Lb/Day	Adjusted Lb/Year M Gallons/Year = 36.960210 HAP Lb/Year	TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N	2.1740E-01	5.3880E-03	4.3210E-01	2.1830E-01	0.017715	0.017715	2.657256	2.657256
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000	0.000000	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y		1.9568E-04	2.3640E-03	1.2798E-03	0.000027	0.000027	0.004077	0.004077
Acenaphthylene	208-96-8	Y	Y	Y		6.9727E-04	2.3390E+00	1.1698E+00	0.024842	0.024842	3.726280	3.726280
Acetaldehyde	75-07-0	Y	Y	N	7.8330E-01	1.0528E-01	8.4100E-01	5.7653E-01	0.046786	0.046786	7.017895	7.017895
Acrolein	107-02-8	Y	Y	N	3.3900E-02	1.2747E-02	5.8750E-02	3.5132E-02	0.002851	0.002851	0.427654	0.427654
Anthracene	120-12-7	Y	Y	Y		2.5769E-04	2.2630E-04	2.4199E-04	0.000005	0.000005	0.000771	0.000771
Benzene	71-43-2	Y	Y	N	1.8630E-01	1.2857E-01	2.4810E-01	1.8766E-01	0.015229	0.015229	2.284282	2.284282
Benzo(a)anthracene	56-55-6	Y	Y	Y		2.3150E-04	9.4510E-04	5.8830E-04	0.000012	0.000012	0.001874	0.001874
Benzo(a)pyrene	50-32-8	Y	Y	Y		2.5906E-05	9.9220E-04	5.0905E-04	0.000011	0.000011	0.001621	0.001621
Benzo(b)fluoranthene	205-99-2	Y	Y	Y		1.3656E-05	1.1830E-04	6.5978E-05	0.000001	0.000001	0.000210	0.000210
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y		6.7384E-05	3.0510E-05	4.8947E-05	0.000001	0.000001	0.000156	0.000156
Benzo(k)fluoranthene	207-08-9	Y	Y	Y		2.1359E-05	5.5730E-05	3.8545E-05	0.000001	0.000001	0.000123	0.000123
Butane	106-07-8	N	N	N					0.000000	0.000000	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N	2.0000E-04			2.0000E-04	0.000016	0.000016	0.002435	0.002435
Chrysene	218-01-9	Y	Y	Y		4.8643E-05	9.4550E-04	4.9707E-04	0.000011	0.000011	0.001583	0.001583
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y		8.0337E-05	7.4990E-05	7.7664E-05	0.000002	0.000002	0.000247	0.000247
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000	0.000000	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N	1.0900E-02		1.0850E-02	1.0875E-02	0.000883	0.000883	0.132378	0.132378
Fluoranthene	206-44-0	Y	Y	Y		1.0487E-03	8.9370E-04	9.7118E-04	0.000021	0.000021	0.003093	0.003093
Fluorene	86-73-7	Y	Y	Y		4.0238E-03	8.9310E-03	6.4774E-03	0.000138	0.000138	0.020632	0.020632
Formaldehyde	50-00-0	Y	Y	N	1.7261E+00	1.6260E-01	1.7310E+00	1.2066E+00	0.097915	0.097915	14.687217	14.687217
Hydrogen Chloride (HCl)	7647-01-0	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000	0.000000	0.000000	0.000000
Hexane	110-54-3	Y	Y	N	2.6900E-02		2.6850E-02	2.6875E-02	0.002181	0.002181	0.327142	0.327142
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y		5.1675E-05	2.7620E-05	3.9648E-05	0.000001	0.000001	0.000126	0.000126
Naphthalene	91-20-3	Y	Y	Y	1.9700E-02	1.1685E-02	2.5480E-02	1.8955E-02	0.000403	0.000403	0.060377	0.060377
Pentane	109-66-0	N	N	N					0.000000	0.000000	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y		4.0513E-03	4.0200E-02	2.2126E-02	0.000470	0.000470	0.070476	0.070476
Propane	74-98-6	N	N	N					0.000000	0.000000	0.000000	0.000000
Propylene	115-07-1	N	Y	N	4.6700E-01	3.5552E-01		4.1126E-01	0.000000	0.033375	0.000000	5.006178
Pyrene	129-00-0	Y	Y	Y		6.5868E-04	1.8650E-03	1.2618E-03	0.000027	0.000027	0.004019	0.004019
Toluene	108-88-3	Y	Y	N	1.5040E-01	5.6360E-02	1.5810E-01	1.2162E-01	0.009870	0.009870	1.480447	1.480447
Total xylene	1330-20-7	Y	Y	N	4.2400E-02	3.9273E-02	4.9070E-02	4.3581E-02	0.003537	0.003537	0.530499	0.530499
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.000972	0.000972	0.145726	0.145726
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y		1.1465E-02	3.7200E-02	2.4332E-02	0.000517	0.000517	0.077505	0.077505

HAP/TAC Emissions from Emergency Use IC Engine
Increase In HAP/TAC Emission From Workover Equipment

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Non-Adjusted Emission Factors (Lb per 1000 Gallon) VCAPCD	EPA	SJVAPCD	Average	Adjusted Lb/Day M Gallons/Year = 0.246401 HAP Lb/Day	TAC Lb/Day	Adjusted Lb/Year M Gallons/Year = 36.960210 HAP Lb/Year	TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N	1.6000E-03		1.7970E-03	1.6985E-03	0.000138	0.000138	0.020675	0.020675
Barium	7440-39-3	N	Y	N					0.000000	0.000000	0.000000	0.000000
Beryllium	7440-41-7	Y	Y	N			1.7970E-03	1.7970E-03	0.000146	0.000146	0.021874	0.021874
Cadmium	7440-43-9	Y	Y	N	1.5000E-03		7.1850E-04	1.1093E-03	0.000090	0.000090	0.013503	0.013503
Chromium VI	18540-29-9	Y	Y	N			7.1860E-04	7.1860E-04	0.000058	0.000058	0.008747	0.008747
Chromium, total	7440-47-3	Y	Y	N	6.0000E-03			6.0000E-03	0.000487	0.000487	0.073036	0.073036
Cobalt	744048-4	Y	Y	N					0.000000	0.000000	0.000000	0.000000
Copper	7440-50-8	N	Y	N	4.1000E-03		5.5930E-03	4.8465E-03	0.000000	0.000393	0.000000	0.058995
Lead	7439-92-1	Y	Y	N			3.5930E-03	3.5930E-03	0.000292	0.000292	0.043737	0.043737
Manganese	7439-96-5	Y	Y	N	3.1000E-03			3.1000E-03	0.000252	0.000252	0.037735	0.037735
Mercury	7439-97-6	Y	Y	N	2.0000E-03		3.5930E-03	2.7965E-03	0.000227	0.000227	0.034041	0.034041
Molybdenum	7439-98-7	N	Y	N					0.000000	0.000000	0.000000	0.000000
Nickel	7440-02-0	Y	Y	N	3.9000E-03		7.1880E-04	2.3094E-03	0.000187	0.000187	0.028112	0.028112
Selenium	7782-49-2	Y	Y	N	2.2000E-03		3.5930E-03	2.8965E-03	0.000235	0.000235	0.035258	0.035258
Vanadium	7440-62-2	N	Y	N					0.000000	0.000000	0.000000	0.000000
Zinc	7440-66-6	N	Y	N	2.2400E-02		3.8330E-03	1.3117E-02	0.000000	0.001064	0.000000	0.159664
Total EPA HAP and CARB TAC (Lb/Year)									0.225064	0.259896	33.759592	38.984429
Total EPA Polycyclic Organic Material (POM)									0.301356	N/A	45.203330	N/A

Diesel Particulate Matter	CAS No	HAP	TAC	Y/N	VCAPCD	EPA	SJVAPCD	Average	HAP Lb/Day	TAC Lb/Day	HAP Lb/Year	TAC Lb/Year
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y	5.5900E-02	2.3150E-02	5.8200E-02	4.5750E-02	0.000972	0.000972	0.145726	0.145726
Calculated PM as DPM	OffRoad2007	Y	Y	Y				2.2667E+00	0.558510	0.558510	83.776490	83.776490

Corrections Factors for Workover Engine and Pump

Adjustment Factors for PM AND Organics			
Adjustment Facctor Category	AP42 g/Bhp	Engine g/Bhp	Adjust Factor
VOC	1.1204	0.369	0.32935
PM	0.9979	0.086	0.08618
VOC adjustment factor is applined to non PM (gaseous HAP/TAC)			
PM adjustment factor is applied to POM (HAPS with BP <100 C)			
PM adjustment factor is applied to metals			

Engine factors were obtained from Offroad 2007, SJVAPCD
Mobile workover rigs / workover pumps, 250<Hp<500

HAP/TAC Emissions from Fugitive Hydrocarbon Emissions

Increase In HAP/TAC Emissions From Fugitive Emissions

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Wt Fraction of Constituent VCAPCD	EPA	SJVAPCD	Average	TOG Lb/Day = HAP Lb/Day	98.03 TAC Lb/Day	TOG Lb/Year = HAP Lb/Year	35,780.59 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acetaldehyde	75-07-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Acrolein	107-02-8	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzene	71-43-2	Y	Y	N		1.230000E-03		1.230000E-03	1.205757E-01	1.205757E-01	44.010122	44.010122
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N		1.000000E-05		1.000000E-05	9.802900E-04	9.802900E-04	0.357806	0.357806
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Formaldehyde	50-00-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hexane	110-54-3	Y	Y	N		9.230000E-03		9.230000E-03	9.048077E-01	9.048077E-01	330.254814	330.254814
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Naphthalene	91-20-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Toluene	108-88-3	Y	Y	N		3.200000E-04		3.200000E-04	3.136928E-02	3.136928E-02	11.449788	11.449788
Total xylene	1330-20-7	Y	Y	N		4.000000E-05		4.000000E-05	3.921160E-03	3.921160E-03	1.431223	1.431223
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000

HAP/TAC Emissions from Fugitive Hydrocarbon Emissions

Increase In HAP/TAC Emissions From Fugitive Emissions

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	Status (Y/N) TAC	POM Y/N	Wt Fraction of Constituent VCAPCD	EPA	SJVAPCD	Average	TOG Lb/Day = HAP Lb/Day	98.03 TAC Lb/Day	TOG Lb/Year = HAP Lb/Year	35,780.59 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Barium	7440-39-3	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Beryllium	7440-41-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Cadmium	7440-43-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Cobalt	744048-4	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Copper	7440-50-8	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Mercury	7439-97-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Molybdenum	7439-98-7	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Nickel	7440-02-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Selenium	7782-49-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Vanadium	7440-62-2	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Zinc	7440-66-6	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total EPA HAP and CARB TAC (Lb/Year)									1.061654	1.061654	387.503753	387.503753
Total EPA Polycyclic Organic Material (POM)									0.000000	N/A	0.000000	N/A

HAP/TAC Emissions from Vehicles

Increase In HAP/TAC Emissions (Employee Commute and Travel)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	TAC	POM Y/N	Wt Fraction of Constituent VCAPCD	EPA	SJVAPCD	Average	TOG Lb/Day = HAP Lb/Day	0.16 TAC Lb/Day	TOG Lb/Year = HAP Lb/Year	57.27 TAC Lb/Year
1,3 Butadiene	106-99-0	Y	Y	N		4.400000E-03		4.400000E-03	6.903781E-04	6.903781E-04	0.251988	0.251988
2-Methylchloroanthrene	56-49-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
2-Methylnaphthalene	91-57-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
7,12-Dimethylbenz(a)anthracene	57-96-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthene	83-32-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acenaphthylene	208-96-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Acetaldehyde	75-07-0	Y	Y	N		4.700000E-03		4.700000E-03	7.374493E-04	7.374493E-04	0.269169	0.269169
Acrolein	107-02-8	Y	Y	N		6.000000E-04		6.000000E-04	9.414247E-05	9.414247E-05	0.034362	0.034362
Anthracene	120-12-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzene	71-43-2	Y	Y	N		5.290000E-02		5.290000E-02	8.300227E-03	8.300227E-03	3.029583	3.029583
Benzo(a)anthracene	56-55-6	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(a)pyrene	50-32-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(b)fluoranthene	205-99-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(g,h,i)perylene	191-24-2	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Benzo(k)fluoranthene	207-08-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Butane	106-07-8	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chlorobenzene	108-90-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chrysene	218-01-9	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzo(a,h)anthracene	53-70-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Dibenzochlorine	25321-22-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethane	74-84-00	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Ethylbenzene	100-41-4	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluoranthene	206-44-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Fluorene	86-73-7	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Formaldehyde	50-00-0	Y	Y	N		1.510000E-02		1.510000E-02	2.369252E-03	2.369252E-03	0.864777	0.864777
Hydrogen Chloride	7647-01-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hydrogen Sulfide (H2S)	77-83-06-4	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Hexane	110-54-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Indeno(1,2,3,c,d)pyrene	193-39-5	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Naphthalene	91-20-3	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Pentane	109-66-0	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Phenanthrene	85-01-8	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Propane	74-98-6	N	N	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Propylene	115-07-1	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Pyrene	129-00-0	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Toluene	108-88-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total xylene	1330-20-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/Napthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000
Total PAH(W/O Napthalene)	1150/1151	Y	Y	Y					0.000000E+00	0.000000E+00	0.000000	0.000000

HAP/TAC Emissions from Vehicles

Increase In HAP/TAC Emissions (Employee Commute and Travel)

Chemical Substance	Chemical CAS No	Status (Y/N) HAP	Status (Y/N) TAC	POM Y/N	Wt Fraction of Constituent VCAPCD	EPA	SJVAPCD	Average	TOG Lb/Day = HAP Lb/Day	0.16 TAC Lb/Day	TOG Lb/Year = HAP Lb/Year	57.27 TAC Lb/Year
Arsenic	7440-38-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Barium	7440-39-3	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Beryllium	7440-41-7	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Cadmium	7440-43-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium VI	18540-29-9	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Chromium, total	7440-47-3	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Cobalt	744048-4	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Copper	7440-50-8	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Lead	7439-92-1	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Manganese	7439-96-5	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Mercury	7439-97-6	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Molybdenum	7439-98-7	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Nickel	7440-02-0	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Selenium	7782-49-2	Y	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Vanadium	7440-62-2	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Zinc	7440-66-6	N	Y	N					0.000000E+00	0.000000E+00	0.000000	0.000000
Total EPA HAP and CARB TAC (Lb/Year)									0.012191	0.012191	4.449879	4.449879
Total EPA Polycyclic Organic Material (POM)									0.000000	N/A	0.000000	N/A

APPENDICES

OPERATIONAL PHASE GREENHOUSE GAS EMISSIONS

Greenhouse Gas Emissions From
OEHI Enhance Oil Recovery Project (CO2 Flood)

Maximum GHG Emissions Summary for Operating Activities

Equipment Description and Process Information	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
Stationary Source	46,120.77	137.26	23.29	46,281.33
Indirect (Electric Power)	---------	---------	---------	180,176.63
Mobile Source	551.12	0.50	2.50	340.21
Total GHG Emissions	46,671.90	137.76	25.79	226,798.17

Gas Plant Greenhouse Gas Emissions
From Natural Gas Fueled Combustion Equipment

Equipment Description and Process Information	Carbon Dioxide CO2 Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
CO2 Injection Heater	27,788.47	9.93	16.29	27,814.70
Regeneration Gas Heater	4,631.41	1.66	2.72	4,635.78
TEG Reboiler	2,315.71	0.83	1.36	2,317.89
Amine Unit	463.14	0.17	0.27	463.58
Fire Pump Engines (2 x 175 Hp)	2.23	0.00	0.00	2.23
CTB - Flare (Pilot + Purge)	1,133.77	0.41	0.66	1,134.84
RCP - Flare (Pilot + Purge)	1,133.77	0.41	0.66	1,134.84
Reasonably Foreseeable GHG Emissions From Emergency Use Only Equipment				
CTB - Flare (Emergency Use)	4,443.70	0.40	0.66	4,444.77
RCF - Flare (Emergency Use)	4,131.07	0.40	0.66	4,132.13
Total GHG Emissions	46,043.27	14.20	23.29	46,080.76

GHG Emissions From Plant Maintenance, Injection and Production Operations

Greenhouse Gas Emissions Production Operations	Average Greenhouse Gas Emissions (Tonne/Year)			
	Carbon Dioxide CO2 Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year	Total CO2e Tonne/Year
Fugitive GHG Emissions	34.88	58.06	----------	92.95
Maintenance GHG	40.47	61.62	----------	102.09
Pressure Relief GHG	0.83	1.17	----------	2.00
Miscellaneous Small Tanks	1.33	2.21	----------	3.53
Total GHG Emissions	77.50	123.06	0.00	200.57
GHG Emissions By Project Year	2015	2017	2019	2025
	389.67	157.61	128.04	112.82

Indirect GHG Emissions From Power Consumption

GHG Emissions from Project Power Consumption (Tonne/Year)				
Horsepower Require For the Project X PG&E CPUC Factor 0.524 CO2e Lb/KWh	Electrical Hp/Hr	MWh/Year	GHG (Kg/MWh)	GHG CO2e
	116,000.00	758,055.36	237.68	180,176.63
	Note: The GHG factor is for the PGE Grid within the San Joaquin Valley			

GHG Emissions From Mobile Source Activity (Employee Commute)

GHG Emissions from Employee Commute (Tonne/Year)				
25 Full Time Employees 60 Miles Round Trip 1500 VMT per Day	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
	165.07	0.17	1.53	166.77

Average GHG Emissions From Well Maintenance Activities (Year 2016 - 2034)

GHG Emissions from Travel to and From Drilling Site (Tonne/Year)				
Greenhouse Gas Emissions From Well	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
Workover Equipment	164.84	0.14	0.42	165.40
Vehicle Travel to Well Sites	8.02	0.00	0.01	8.03
Total GHG Emissions	172.86	0.14	0.43	173.44

Maximum GHG Emissions From Well Maintenance Activities (Year 2034)

GHG Emissions from Travel to and From Drilling Site (Tonne/Year)				
Greenhouse Gas Emissions From Well	Carbon Dioxide CO2	Methane CH4 as CO2e	Nitrous Oxide N2O as CO2e	Total CO2e Tonne/Year
Workover Equipment	368.12	0.32	0.94	165.40
Vehicle Travel to Well Sites	17.93	0.00	0.03	8.03
Total GHG Emissions	386.05	0.32	0.97	173.44

Greenhouse Gas Emissions From
Natural Gas Combustion in Gas Processing Equipment

Greenhouse Gas (GHG) Emission
Factors for Natural Gas Fueled Combustion Equipment

GHG Emission Factors for Natural Gas Fueled, Stationary Combustion Equipment	CO2 Kg/MMBtu	CH4 Kg/MMBtu	N2O Kg/MMBtu	CO2e Weighted Ave Kg/MMbtu
	52.870000	0.000900	0.000100	1.000925

Gas Plant Greenhouse Gas Emissions
From Natural Gas Fueled Combustion Equipment

Equipment Description and Process Information	Annual Heat Input (MMBtu/Yr)/1000	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year
CO2 Injection Heater	525.600	27,788.47	9.93	16.29
Regeneration Gas Heater	87.600	4,631.41	1.66	2.72
TEG Reboiler	43.800	2,315.71	0.83	1.36
Amine Unit	8.760	463.14	0.17	0.27
Fire Pump Engine (175 Hp) X2	0.031	2.23	0.00	0.00
CTB - Flare (Pilot + Purge)	21.444	1,133.77	0.41	0.66
RCP - Flare (Pilot + Purge)	21.444	1,133.77	0.41	0.66
Reasonably Foreseeable GHG Emissions From Emergency Use Only Equipment				
CTB - Flare (Emergency Use)	21.32	4,443.70	0.40	0.66
RCF - Flare (Emergency Use)	21.32	4,131.07	0.40	0.66
Total GHG Emissions	-------	46,043.27	14.20	23.29
Total GHG Emission From All Natural Gas Combustion Equipment (CO2e Tonne/Year)				46,080.76

Calculation Assumptions and Notes

Note:

1. GHG Emission factors are from the CARB "Regulations for the Mandatory Reporting of Greenhouse Emissions", Appendix-A. The CO2 factor is for gas having a HHV of 1000 to 1025 Btu/sdcf.

2. The facility will include two 175 Hp diesel fueled IC engine that will be used to power a fire water pump. The engine will be permitted for 10 hours/year of non-emergency use per year (for engine maintenance). Emissions from the emergency use of the engine are not included because they are not reasonably foreseeable.

3. Total emissions include for non-emergency use of flare include the flare pilot and purge gas. Emergency use of flare includes 10 hours per year for foreseeable power outages plus other emergency events which are not quantified because they are nor reasonable foreseeable.

4. Flare emissions are calculated assuming each flare is used for a total of 7.47 hours per year. The time allocated to emergency flaring was obtained from the Pacific Gas & Electricity (PG&E) reliability report, submitted to the California Public Utility Commissions. It is assumed that flaring would be required during an electrical power outage. Other emergency flaring events could occur but are not included in the emission calculation because the events are not reasonably foreseeable. The total heat input to each flare is estimated to be 2,854 MMBtu/Hr during an emergency event.

Greenhouse Gas Emissions
From the Carbon Dioxide (CO2) Injection Wells

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Maintenance (Venting & Purge)	0.000	0.000	0.000	0.000
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	0.000	0.000	0.000	0.000

Notes:

1. Greenhouse gas emissions were calculated using a gas composition expected to be representative of the CO2 composition during the period 2015 through 2025.

2. In the early stages of the project (circa 2015) the injection gas is expected to have a composition typical of the produced gas and the HECA gas blend.

3. The gas volume estimated for maintenance venting is for oil well workover. The gas volume used in the calculation was estimated to be 2554 Scf/well workover assuming that each well undergoes maintenance annually.

4. The well workover gas volume factor is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996

Stream	Molecular		2015 Gas	2015 HECA	2025 LP CO2	2025 HP CO2
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.0000	0.0000	0.0000
Nitrogen	N2	28.010000	0.010	0.0150	0.0150	0.0160
Oxygen	O2	32.000000	0.000	0.0000	0.0000	0.0000
Carbon Dioxide	CO2	44.010000	0.433	0.9450	0.9450	0.9500
Hydrogen Sulfide	H2S	34.080000	0.000	0.0000	0.0000	0.0000
Methane	C1	16.040000	0.467	0.0290	0.0290	0.0260
Ethane	C2	30.070000	0.032	0.0040	0.0040	0.0030
Propane	C3	44.100000	0.024	0.0030	0.0030	0.0020
iso-Butane	i-C4	58.120000	0.006	0.0010	0.0010	0.0010
Butane	n-C4	58.120000	0.014	0.0020	0.0020	0.0020
iso-Pentane	i-C5	72.150000	0.005	0.0010	0.0010	0.0010
Pentane	n-C5	72.150000	0.006	0.0010	0.0010	0.0010
Hexanes	C6	86.180000	0.000	0.0000	0.0000	0.0000
Heptanes+	C7+	100.200000	0.000	0.0000	0.0000	0.0000

GHG By Year CO2e (Tonne/Year)	0.00	0.00	0.00	0.00

Non-Permitted VOC (Ton/Year)	0.00	0.00	0.00	0.00

Greenhouse Gas Emissions
From Crude Oil and Natural Gas Production Wells

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	584.894	23.831	1.889	63.499
Maintenance (Venting & Purge)	14.400	0.587	0.047	1.563
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	599.294	24.417	1.935	65.062

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025

2. The gas volume estimated for maintenance venting is for oil well workover. The gas volume used in the calculation was estimated to be 96 Scf/well workover assuming that each well undergoes maintenance annually.

3. The well workover gas volume factor is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	126.29	54.63	42.67	36.65

VOC Emissions By Year (Ton/Year)	2.38	1.24	0.49	0.36

Greenhouse Gas Emissions From
Combustion Emissions From Well Maintenance Activities

Greenhouse Gas (GHG) Emission
Factors for Diesel Fuel Combustion in Equipment Used for Well Maintenance

CARB Recommended GHG Emission Factors for Diesel Fuel Combustion in IC Engines	CO2 Kg/Gallon	CH4 Kg/Gallon	N2O Kg/Gallon	Total CO2e Kg/Gallon
	9.960000	0.000412	0.000082	9.994208

Greenhouse Gas (GHG) Emissions From
Diesel Fuel Combustion in Equipment Used for Well Maintenance

Project Year	Number Of Wells Drilled	Wells Undergoing Maintenance	Annual Fuel Use MGal/Year	Carbon Dioxide CO2e Tonne/Year	Methane CH4 as CO2e Tonne/Year	Nitrous Oxide N2O as CO2e Tonne/Year
2016	18	0	0.00	0.00	0.00E+00	0.00E+00
2017	4	18	4,470.94	44.53	3.87E-02	1.14E-01
2018		22	5,425.82	54.04	4.70E-02	1.39E-01
2019		22	5,425.82	54.04	4.70E-02	1.39E-01
2020	8	22	5,425.82	54.04	4.70E-02	1.39E-01
2021		30	7,398.85	73.69	6.40E-02	1.89E-01
2022	9	30	7,398.85	73.69	6.40E-02	1.89E-01
2023	27	39	9,618.50	95.80	8.32E-02	2.46E-01
2024		66	16,277.46	162.12	1.41E-01	4.16E-01
2025	20	66	16,277.46	162.12	1.41E-01	4.16E-01
2026		86	21,210.03	211.25	1.84E-01	5.42E-01
2027		86	21,210.03	211.25	1.84E-01	5.42E-01
2028		86	21,210.03	211.25	1.84E-01	5.42E-01
2029	20	86	21,210.03	211.25	1.84E-01	5.42E-01
2030		106	26,142.59	260.38	2.26E-01	6.68E-01
2031	21	106	26,142.59	260.38	2.26E-01	6.68E-01
2032		127	31,321.78	311.96	2.71E-01	8.00E-01
2033	23	127	31,321.78	311.96	2.71E-01	8.00E-01
2034	0	150	36,960.21	368.12	3.20E-01	9.44E-01
Average Greenhouse Emissions (Tonne/Year)				164.84	1.43E-01	4.23E-01
Average GHG Emission From Well Maintenance (CO2e Tonne/Year)					----------	165.40

Calculation Assumptions and Notes

Note:

1. GHG Emission factors are from the CARB "Regulations for the Mandatory Reporting of Greenhouse Emissions", Appendix-A. The CO_2 emissions were calculated using the CARB emission factor for California low sulfur diesel fuel (Table-7). The emissions of CH_4 and N_2O were calculated using the stationary source emission factors (Table-6) for diesel fuel combustion. The factors were converted from g/MMBtu to Kg/gallon using the higher heating value of diesel (137,380 Btu/Gallon).

2. The engine fuel use was determined using California Air Resources Board (CARB) OFFROAD2007 model. for mobile workover rigs and workover pumps. Well maintenance will require the use of a single mobile workover rig with a 425 Hp rating. The mobile rig will operate 12 hours per day. Well maintenance will also require the use of a workover pump. The workover pump will operate 6 hours per day.

3. Well workover maintenance is expected to take one day per well to complete. Per EPA guidance, it is assumed that 41% of the wells will undergo maintenance on an annual basis.

Greenhouse Gas Emissions From
Crude oil and Natural Gas Production "Satellite" Settings

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	46.801	1.907	0.151	5.081
Maintenance (Venting & Purge)	51.129	2.083	0.165	5.551
Pressure Relief (PRV)	0.884	0.036	0.003	0.000
Total GHG Emissions	98.814	4.026	0.319	10.632

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025

2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks. One turnaround per year is assumed.

3. Each satellite facility will includes a 100 Bbl emergency use only tank that will prevent liquid carryover during a pressure relief event. GHG emissions from emergency use of the tanks are included in the PRV emission estimate.

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	20.82	9.01	7.04	6.04

VOC Emissions By Year (Ton/Year)	0.39	0.20	0.08	0.06

Greenhouse Gas Emissions
From The Central Tank Battery (CTB)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	17.041	0.694	0.055	1.850
Maintenance (Venting & Purge)	374.396	15.254	1.209	40.646
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	391.437	15.948	1.264	42.496

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025

2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks. One turnaround per year is assumed.

3. Compressor blowdown and startup gas is routed to a vapor recovery system and is not vented to the atmosphere.

4. All tanks are served by a vapor recovery system and the pressure relief valves on vessels are routed to the intake compressor of the gas processing plants. During an emergency the gas from the tanks and vessels will be routed to an emergency use only flare. The GHG emissions from flaring CTB gas are accounted for in the GHG emission estimate for the RCF flare .

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	82.49	35.68	27.87	23.94

VOC Emissions By Year (Ton/Year)	1.49	0.77	0.31	0.22

Greenhouse Gas Emissions From
The Reinjection Compression Facility (RCF)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	47.191	1.923	0.152	5.123
Maintenance (Venting & Purge)	18.666	0.761	0.060	2.026
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	65.857	2.683	0.213	7.150

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025

2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks x 2. One turnaround per year is assumed.

3. Compressor blowdown and startup gas is routed to a closed process system and is not vented to the atmosphere.

4. Process equipment is not vented to the atmosphere. All process vent emissions (i.e. the TEG) are captured and returned to the process system or routed to the facility vapor recovery unit. During an emergency gas from the RCF will be routed to an emergency use only flare. The GHG emissions from flaring are accounted for in the GHG emission estimate for the CTB flare .

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	13.88	6.00	4.69	4.03

VOC Emissions By Year (Ton/Year)	0.07	0.04	0.02	0.01

Greenhouse Gas Emissions From
The Carbon Dioxide Recovery Plant (RCP)

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	160.210	6.527	0.517	17.393
Maintenance (Venting & Purge)	48.372	1.971	0.156	5.252
Pressure Relief (PRV)	0.000	0.000	0.000	0.000
Total GHG Emissions	208.582	8.498	0.674	22.645

Notes:

1. Greenhouse gas emissions were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery systems for the period 2015 through 2025

2. The gas volume estimated for maintenance venting assume that all process vessels and tanks are depressurized to atmospheric pressure via a vapor recovery system prior to opening. The total estimated gas volume is equal to the total volume of the vessels and tanks x 2. One turnaround per year is assumed.

3. Compressor blowdown and startup gas is routed to a vapor recovery system and is not vented to the atmosphere.

4. All tanks are served by a vapor recovery system and the pressure relief valves on vessels are routed to the intake compressor of the gas processing plants. During an emergency the gas from the tanks and vessels will be routed to the CRP flare. The GHG emissions from gas flaring are accounted for in the GHG emission estimate for the CRP combustion flare.

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	43.96	19.01	14.85	12.76

VOC Emissions By Year (Ton/Year)	0.19	0.10	0.04	0.03

Greenhouse Gas Emissions From
The Crude Oil and Natural Gas Gathering System

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Gathering System Blowdown	111.240	4.532	0.359	12.077
Pipeline PRV (One PRV per Mile)	6.120	0.249	0.020	0.664
Total GHG Emissions	117.360	4.782	0.379	12.741

Notes:

1. Greenhouse gas emissions for the new wells were calculated using the average composition of the gas from the crude oil production satellite setting and vapor recovery system for 2015 through 2025.

2. For the most part, the gas gathering system is constructed using welded connections and fugitive GHG emissions from leaking components are expected to be negligible.

4. The gas gathering system blowdown factor (309 Scf/mile) is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996.

5. The length of pipeline included in the calculation was estimated to be 180 miles (150 wells x 1.2 miles per well). The line length per well was calculated from the total length of the new pipeline (550 miles) required for the 309 new CO2 injectors and 150 new production wells.

Stream	Molecular		2015	2017	2019	2025
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.040	0.040	0.040
Nitrogen	N2	28.010000	0.010	0.021	0.021	0.015
Oxygen	O2	32.000000	0.000	0.000	0.000	0.000
Carbon Dioxide	CO2	44.010000	0.433	0.815	0.910	0.941
Hydrogen Sulfide	H2S	34.080000	0.000	0.000	0.000	0.000
Methane	C1	16.040000	0.467	0.120	0.058	0.029
Ethane	C2	30.070000	0.032	0.014	0.006	0.004
Propane	C3	44.100000	0.024	0.011	0.004	0.003
iso-Butane	i-C4	58.120000	0.006	0.003	0.001	0.001
Butane	n-C4	58.120000	0.014	0.007	0.003	0.002
iso-Pentane	i-C5	72.150000	0.005	0.003	0.001	0.001
Pentane	n-C5	72.150000	0.006	0.004	0.002	0.001
Hexanes	C6	86.180000	0.000	0.000	0.000	0.000
Heptanes+	C7+	100.200000	0.000	0.000	0.000	0.000

GHG By Year CO2e (Tonne/Year)	24.73	10.70	8.36	7.18

VOC Emissions By Year (Ton/Year)	0.47	0.24	0.10	0.07

Greenhouse Gas Emissions From
The CO2 Intake and CO2 Gas Distribution System

	Average Greenhouse Gas Emissions (Tonne/Year)			
	Gas Mcf/Year	CO2	Methane	CO2e
Fugitive GHG Emissions	0.000	0.000	0.000	0.000
Pipeline Gas Blowdown (6615 Scfy/Mile)	355.119	15.281	0.938	34.971
Pipeline PRV (One PRV per Mile)	12.607	0.543	0.033	1.242
Total GHG Emissions	367.726	15.824	0.971	36.212

Notes:

1. Greenhouse gas emissions were calculated using a gas composition expected to be representative of the CO2 composition during the period 2015 through 2025 (listed below)..

2. In the early stages of the project (circa 2015) the injection gas is expected to have a composition typical of the produced gas and the HECA gas blend.

3. The gas volume for the CO2 injection system blowdown is calculated from the total length of the injection system piping which is equal to 309 injection wells x 1.20 miles/well. The gas volume for the HECA pipeline (12" x 4 miles or 16,587.6) is included in the volume estimate. It is assumed that the entire pipeline system (including the HECA line) would be blowndown annually (highly unlikely). The CO2 injection system and the HECA line would be depressurized to about 300 psig before to venting to the atmosphere pressure. The gas volume has been adjusted accordingly.

4. The gas distribution system blowdown factor (309 Scf/mile) is from the report entitled "Methane Emissions from the Natural Gas Industry, Volume 7: Blow and Purge Activities, Final Report, Shires, T.M. GRI-94/0257.24 and EPA-600/R96-0809, Gas Research Institute and the US Environmental Protection Agency, June 1996.

Stream	Molecular		2015 Gas	2015 HECA	2025 LP CO2	2025 HP CO2
Constituents	Formula	Weight	Mol. Fraction	Mol. Fraction	Mol. Fraction	Mol. Fraction
Water Vapor	H2O	18.020000	0.040	0.0000	0.0000	0.0000
Nitrogen	N2	28.010000	0.010	0.0150	0.0150	0.0160
Oxygen	O2	32.000000	0.000	0.0000	0.0000	0.0000
Carbon Dioxide	CO2	44.010000	0.433	0.9450	0.9450	0.9500
Hydrogen Sulfide	H2S	34.080000	0.000	0.0000	0.0000	0.0000
Methane	C1	16.040000	0.467	0.0290	0.0290	0.0260
Ethane	C2	30.070000	0.032	0.0040	0.0040	0.0030
Propane	C3	44.100000	0.024	0.0030	0.0030	0.0020
iso-Butane	i-C4	58.120000	0.006	0.0010	0.0010	0.0010
Butane	n-C4	58.120000	0.014	0.0020	0.0020	0.0020
iso-Pentane	i-C5	72.150000	0.005	0.0010	0.0010	0.0010
Pentane	n-C5	72.150000	0.006	0.0010	0.0010	0.0010
Hexanes	C6	86.180000	0.000	0.0000	0.0000	0.0000
Heptanes+	C7+	100.200000	0.000	0.0000	0.0000	0.0000

GHG By Year CO2e (Tonne/Year)	77.49	22.57	22.57	22.22

VOC Emissions By Year (Ton/Year)	1.46	0.22	0.22	0.20

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Total Fugitive Emissions (Occidental of Elk Hills CO2 Enhanced Oil Recovery Project)

Type of Component	Component Service	Total Component Counts	Weighted Average Leak (ppmv)	Weighted Average Leak Fraction	Weighted Average Leak Rate lb/day*component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	11,966	1,786	0.0010	7.835E-04	9.375	145.076
	Light Crude Oil	7,205	1,369	0.0010	4.241E-03	30.558	229.791
	Heavy Crude Oil	248	500	0.0010	8.854E-05	0.022	0.028
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	59	500	0.0010	7.920E-03	0.469	3.526
	Heavy Crude Oil	12	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	880	1,468	0.0010	5.149E-03	4.533	70.149
	Light Crude Oil	1,638	1,489	0.0010	6.126E-03	10.032	75.435
	Heavy Crude Oil	44	500	0.0010	1.167E-03	0.052	0.066
Connectors	Gas/Light Liquid	38,969	1,558	0.0010	1.430E-03	55.730	862.419
	Light Crude Oil	33,772	1,421	0.0010	1.426E-04	4.817	36.225
	Heavy Crude Oil	406	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	11,766	1,431	0.0010	2.902E-03	34.147	528.418
	Light Crude Oil	11,422	1,501	0.0010	2.661E-03	30.393	228.551
	Heavy Crude Oil	299	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	0	0.0000	0.000E+00	0.000	0.000
	Light Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	0	0.0000	0.000E+00	0.000	0.000
Total Fugitive VOC Emissions From Associated Components						190.848	2345.581
Weight percentage of VOC in the total organic compounds in gas ?						---------	---------
Weight percentage of VOC in the total organic compounds in oil ?						---------	---------

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Reinjection Compression Facility (RCF)

Type of Component	Component Service	Component Counts For RCF	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	319	500	0.0010	5.505E-04	0.176	2.719
	Light Crude Oil	384	500	0.0010	3.612E-03	1.387	10.429
	Heavy Crude Oil	12	500	0.0010	4.805E-04	0.006	0.007
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	7.920E-03	0.000	0.000
	Heavy Crude Oil	2	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	43	500	0.0010	3.854E-03	0.167	2.577
	Light Crude Oil	61	500	0.0010	4.594E-03	0.281	2.114
	Heavy Crude Oil	1	500	0.0010	1.167E-03	0.001	0.002
Connectors	Gas/Light Liquid	1,496	500	0.0010	1.251E-03	1.873	28.977
	Light Crude Oil	3,850	500	0.0010	1.251E-03	4.817	36.225
	Heavy Crude Oil	7	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	1,050	500	0.0010	2.328E-03	2.445	37.835
	Light Crude Oil	558	500	0.0010	2.003E-03	1.118	8.406
	Heavy Crude Oil	26	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						12.270	129.290
Weight percentage of VOC in the total organic compounds in gas ?						100.0	---------
Weight percentage of VOC in the total organic compounds in oil ?						100.0	---------

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Carbon Dioxide Recovery Plant (CRP)

Type of Component	Component Service	Component Counts For CRP	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	1,289	500	0.0010	5.505E-04	0.709	10.979
	Light Crude Oil	1,961	500	0.0010	3.612E-03	7.081	53.251
	Heavy Crude Oil	236	500	0.0010	6.864E-05	0.016	0.021
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	43	500	0.0010	7.920E-03	0.342	2.573
	Heavy Crude Oil	10	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	247	500	0.0010	3.854E-03	0.953	14.745
	Light Crude Oil	416	500	0.0010	4.594E-03	1.913	14.384
	Heavy Crude Oil	43	500	0.0010	1.167E-03	0.050	0.064
Connectors	Gas/Light Liquid	9,662	500	0.0010	1.251E-03	12.091	187.110
	Light Crude Oil	8,204	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	398	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	3,310	500	0.0010	2.328E-03	7.706	119.255
	Light Crude Oil	2,426	500	0.0010	2.003E-03	4.861	36.551
	Heavy Crude Oil	272	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						35.723	438.931
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From The Central Tank Battery (CTB)

Type of Component	Component Service	Component Counts For CTB	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	98	500	0.0010	5.505E-04	0.054	0.835
	Light Crude Oil	688	500	0.0010	3.612E-03	2.485	18.685
	Heavy Crude Oil	0	500	0.0010	6.864E-05	0.000	0.000
Pump Seals	Gas/Light Liquid	0	500	0.0010	7.234E-03	0.000	0.000
	Light Crude Oil	16	500	0.0010	7.920E-03	0.127	0.953
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	22	500	0.0010	3.854E-03	0.085	1.312
	Light Crude Oil	80	500	0.0010	4.594E-03	0.367	2.763
	Heavy Crude Oil	0	500	0.0010	1.167E-03	0.000	0.000
Connectors	Gas/Light Liquid	324	500	0.0010	1.251E-03	0.405	6.274
	Light Crude Oil	982	500	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	100	500	0.0010	2.328E-03	0.233	3.603
	Light Crude Oil	814	500	0.0010	2.003E-03	1.631	12.262
	Heavy Crude Oil	0	500	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	500	0.0010	2.170E-03	0.000	0.000
	Light Crude Oil	0	500	0.0010	1.785E-03	0.000	0.000
	Heavy Crude Oil	0	500	0.0010	8.606E-04	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						5.387	46.688
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From Production Satellite Settings

Type of Component	Component Service	Component Counts Per Setting	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	572	2,000	0.0010	4.699E-03	2.688	20.213
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	208	2,000	0.0010	5.861E-03	1.219	18.865
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	2,106	2,000	0.0010	1.505E-03	3.169	49.042
	Light Crude Oil	936	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	286	2,000	0.0010	3.252E-03	0.930	14.395
	Light Crude Oil	1,144	2,000	0.0010	2.988E-03	3.419	25.709
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						11.425	128.223
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From Crude Oil and Natural Gas Production Wells

Type of Component	Component Service	Component Counts Per Well	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	10,260	2,000	0.0010	8.222E-04	8.436	130.543
	Light Crude Oil	3,600	2,000	0.0010	4.699E-03	16.917	127.214
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	720	2,000	0.0010	1.489E-02	10.721	165.899
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	360	2,000	0.0010	5.861E-03	2.110	32.650
	Light Crude Oil	1,080	2,000	0.0010	6.917E-03	7.470	56.174
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	25,380	2,000	0.0010	1.505E-03	38.192	591.016
	Light Crude Oil	19,800	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	7,020	2,000	0.0010	3.252E-03	22.832	353.330
	Light Crude Oil	6,480	2,000	0.0010	2.988E-03	19.365	145.624
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						126.043	1602.449
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Fugitive Emissions From CO2 Injection Wells

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Gathering System for Crude oil and Natural Gas Production

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000

Weight percentage of VOC in the total organic compounds in gas?	100.0	
Weight percentage of VOC in the total organic compounds in oil?	100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

CO2 Intake and CO2 Distribution System for Injection

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid	0	2,000	0.0010	8.222E-04	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	4.699E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	4.805E-04	0.000	0.000
Pump Seals	Gas/Light Liquid	0	2,000	0.0010	1.489E-02	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.436E-02	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Others	Gas/Light Liquid	0	2,000	0.0010	5.861E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	6.917E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid	0	2,000	0.0010	1.505E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid	0	2,000	0.0010	3.252E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	2.988E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid	0	2,000	0.0010	2.772E-03	0.000	0.000
	Light Crude Oil	0	2,000	0.0010	1.936E-03	0.000	0.000
	Heavy Crude Oil	0	2,000	0.0010	1.373E-03	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000
Weight percentage of VOC in the total organic compounds in gas?						100.0	
Weight percentage of VOC in the total organic compounds in oil?						100.0	

Fugitive VOC Emissions From Components
Calculated From Component Counts and EPA ALR Emission Factors

Reserved

Type of Component	Component Service	Component Counts	Leak Threshold (ppmv)	Leak Fraction	EPA 1995 ALR TOG Factor lb/day*Component	Fugitive VOC Emissions (lb/day)	VOC Equivalent Gas Volume (SCF/Day)
Valves	Gas/Light Liquid		2,000	0.0200	2.399E-03	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.994E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.785E-03	0.000	0.000
Pump Seals	Gas/Light Liquid		2,000	0.0200	6.706E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	9.662E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Others	Gas/Light Liquid		2,000	0.0200	7.207E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	7.413E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	1.690E-03	0.000	0.000
Connectors	Gas/Light Liquid		2,000	0.0200	2.157E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Flanges	Gas/Light Liquid		2,000	0.0200	6.244E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	5.816E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	0.000E+00	0.000	0.000
Open-ended Lines	Gas/Light Liquid		2,000	0.0200	4.792E-02	0.000	0.000
	Light Crude Oil		2,000	0.0200	3.805E-02	0.000	0.000
	Heavy Crude Oil		2,000	0.0200	2.144E-02	0.000	0.000
Total Fugitive VOC Emissions From Associated Components (lb/day)						0.000	0.000

Weight percentage of VOC in the total organic compounds in gas?	100.0	
Weight percentage of VOC in the total organic compounds in oil?	100.0	

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 10,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.098 x LKFRAC) + 2.5E-5]*2.2*24	1.320E-03
	Light Crude Oil	0.0000	ALR = [(0.087 x LKFRAC) + 1.9E-5]*2.2*24	1.003E-03
	Heavy Crude Oil	0.0000	ALR = (8.4 E-6)*2.2*24	4.435E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.074 x LKFRAC) + 3.5E-4]*2.2*24	1.848E-02
	Light Crude Oil	0.0000	ALR = [(0.100 x LKFRAC) + 5.1E-4]*2.2*24	2.693E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.089 x LKFRAC) + 1.2E-4]*2.2*24	6.336E-03
	Light Crude Oil	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-4]*2.2*24	7.392E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.848E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.026 x LKFRAC) + 1.0E-5]*2.2*24	5.280E-04
	Light Crude Oil	0.0000	ALR = [(0.026 x LKFRAC) + 9.7E-6]*2.2*24	5.122E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.082 x LKFRAC) + 5.7E-6]*2.2*24	3.010E-04
	Light Crude Oil	0.0000	ALR = [(0.073 x LKFRAC) + 2.4E-6]*2.2*24	1.267E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.055 x LKFRAC) + 1.5E-5]*2.2*24	7.920E-04
	Light Crude Oil	0.0000	ALR = [(0.044 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Heavy Crude Oil	0.0000	ALR = [(0.030 x LKFRAC) + 7.2E-6]*2.2*24	3.802E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 2,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.083 x LKFRAC) + 1.4E-5]*2.2*24	7.392E-04
	Light Crude Oil	0.0200	ALR = [(0.075 x LKFRAC) + 1.4E-5]*2.2*24	7.994E-02
	Heavy Crude Oil	0.0000	ALR = [(0.0013 x LKFRAC) + 7.8E-6]*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.082 x LKFRAC) + 1.9E-4]*2.2*24	1.003E-02
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.066 x LKFRAC) + 4.5E-5]*2.2*24	2.376E-03
	Light Crude Oil	0.0000	ALR = [(0.067 x LKFRAC) + 6.4E-5]*2.2*24	3.379E-03
	Heavy Crude Oil	0.0000	ALR = (3.2 E-5)*2.2*24	1.690E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.020 x LKFRAC) + 8.5E-6]*2.2*24	4.488E-04
	Light Crude Oil	0.0000	ALR = [(0.022 x LKFRAC) + 8.6E-6]*2.2*24	4.541E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.059 x LKFRAC) + 2.6E-6]*2.2*24	1.373E-04
	Light Crude Oil	0.0000	ALR = [(0.055 x LKFRAC) + 1.6E-6]*2.2*24	8.448E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.045 x LKFRAC) + 7.5E-6]*2.2*24	3.960E-04
	Light Crude Oil	0.0000	ALR = [(0.036 x LKFRAC) + 6.7E-6]*2.2*24	3.538E-04
	Heavy Crude Oil	0.0000	ALR = [(0.020 x LKFRAC) + 6.0E-6]*2.2*24	3.168E-04

EPA Protocol For Equipment Leak Emission Estimates (November 1995)

Average Leak Rates For Components At Oil and Natural Gas Processing Facilities

ALR - Fugitive Emissions Factors For A 1,000 ppmv Leak Threshold

Component Type	Component Service Type	Proposed Leak Fraction	EPA Table 5-7 ALR Equations For Proposed Leak Threshold (10,000 ppmv) And Specified leak fraction (LKFRAC)	ALR Factor lb/day per component
Valves	Gas/Light Liquid	0.0000	ALR = [(0.076 x LKFRAC) + 1.1E-5]*2.2*24	5.808E-04
	Light Crude Oil	0.0000	ALR = [(0.069 x LKFRAC) + 1.2E-5]*2.2*24	6.336E-04
	Heavy Crude Oil	0.0000	ALR = (0.0013 x LKFRAC) + 7.8E-6)*2.2*24	4.118E-04
Pump Seals	Gas/Light Liquid	0.0000	ALR = [(0.052 x LKFRAC) + 2.3E-4]*2.2*24	1.214E-02
	Light Crude Oil	0.0000	ALR = [(0.079 x LKFRAC) + 1.5E-4]*2.2*24	7.920E-03
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Others	Gas/Light Liquid	0.0000	ALR = [(0.061 x LKFRAC) + 3.1E-5]*2.2*24	1.637E-03
	Light Crude Oil	0.0000	ALR = [(0.058 x LKFRAC) + 4.4E-5]*2.2*24	2.323E-03
	Heavy Crude Oil	0.0000	ALR = [(0.0011 x LKFRAC) + 2.1E-5]*2.2*24	1.109E-03
Connectors	Gas/Light Liquid	0.0000	ALR = [(0.018 x LKFRAC) + 8.0E-6]*2.2*24	4.224E-04
	Light Crude Oil	0.0000	ALR = [(0.021 x LKFRAC) +8.3E-6]*2.2*24	4.382E-04
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Flanges	Gas/Light Liquid	0.0000	ALR = [(0.051 x LKFRAC) + 1.8E-6]*2.2*24	9.504E-05
	Light Crude Oil	0.0000	ALR = [(0.046 x LKFRAC) + 1.2E-6]*2.2*24	6.336E-05
	Heavy Crude Oil	0.0000	ALR = Below detection limit	0.000E+00
Open-ended Lines	Gas/Light Liquid	0.0000	ALR = [(0.039 x LKFRAC) + 5.0E-6]*2.2*24	2.640E-04
	Light Crude Oil	0.0000	ALR = [(0.032 x LKFRAC) + 4.7E-6]*2.2*24	2.482E-04
	Heavy Crude Oil	0.0000	ALR = [(0.015 x LKFRAC) + 4.9E-6]*2.2*24	2.587E-04

APPENDICES

CONSTRUCTION EMISSIONS

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2014																								
Motor Grader	1	Diesel	150	61	3.00E-02	3.95E-03	2.09E-02	3.54E+00	1.64E-03	3.98E-05	8	21.96	2.89	15.30	2591.28	1.20	0.03	3.3	0.04	0.00	0.03	4.28	0.00	0.00
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	4	2.14	0.24	0.82	297.14	0.08	0.00	62.7	0.07	0.01	0.03	9.32	0.00	0.00
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	4	13.42	2.00	11.07	1634.90	1.06	0.02	62.7	0.42	0.06	0.35	51.25	0.03	0.00
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	62.7	0.00	0.00	0.00	0.09	0.00	0.00
Motor Grader	1	Diesel	150	61	3.00E-02	3.95E-03	2.09E-02	3.54E+00	1.64E-03	3.98E-05	8	21.96	2.89	15.30	2591.28	1.20	0.03	13	0.14	0.02	0.10	16.84	0.01	0.00
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	4	2.14	0.24	0.82	297.14	0.08	0.00	248	0.27	0.03	0.10	36.85	0.01	0.00
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	4	13.42	2.00	11.07	1634.90	1.06	0.02	248	1.66	0.25	1.37	202.73	0.13	0.00
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	248	0.00	0.00	0.00	0.34	0.00	0.00
2015																								
Motor Grader	1	Diesel	150	61	2.76E-02	3.76E-03	2.12E-02	3.59E+00	1.52E-03	4.04E-05	8	20.20	2.75	15.54	2631.15	1.11	0.03	14.1	0.14	0.02	0.11	18.55	0.01	0.00
Cranes	1	Diesel	300	43	3.83E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	4	1.98	0.23	0.78	301.67	0.07	0.00	267.9	0.26	0.03	0.10	40.41	0.01	0.00
Backhoes	1	Diesel	70	55	8.05E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.26E-04	4	12.39	1.84	11.15	1658.60	0.94	0.02	267.9	1.66	0.25	1.49	222.17	0.13	0.00
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	267.9	0.00	0.00	0.00	0.37	0.00	0.00
Motor Grader	1	Diesel	150	61	2.76E-02	3.76E-03	2.12E-02	3.59E+00	1.52E-03	4.04E-05	8	20.20	2.75	15.54	2631.15	1.11	0.03	13	0.13	0.02	0.10	17.10	0.01	0.00
Cranes	1	Diesel	300	43	3.83E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	4	1.98	0.23	0.78	301.67	0.07	0.00	248	0.25	0.03	0.10	37.41	0.01	0.00
Backhoes	1	Diesel	70	55	8.05E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.26E-04	4	12.39	1.84	11.15	1658.60	0.94	0.02	248	1.54	0.23	1.38	205.67	0.12	0.00
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	248	0.00	0.00	0.00	0.34	0.00	0.00
2016																								
Motor Grader	1	Diesel	150	61	2.53E-02	3.57E-03	2.15E-02	3.65E+00	1.40E-03	4.10E-05	8	18.54	2.61	15.75	2670.44	1.02	0.03	17.7	0.16	0.02	0.14	23.63	0.01	0.00
Cranes	1	Diesel	300	43	3.53E-03	4.36E-04	1.46E-03	5.93E-01	1.27E-04	5.82E-06	4	1.82	0.23	0.75	306.19	0.07	0.00	336.3	0.31	0.04	0.13	51.49	0.01	0.00
Backhoes	1	Diesel	70	55	7.44E-02	1.10E-02	7.30E-02	1.09E+01	5.33E-03	1.28E-04	4	11.45	1.70	11.25	1682.06	0.82	0.02	336.3	1.93	0.29	1.89	282.84	0.14	0.00
Welders	1	Diesel	50	43	1.33E-04	3.09E-05	1.43E-04	1.64E-02	8.36E-06	2.12E-07	8	0.02	0.01	0.02	2.82	0.00	0.00	336.3	0.00	0.00	0.00	0.47	0.00	0.00
2017																								
Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03	11.3	0.10	0.01	0.09	15.31	0.01	0.00
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	4	1.67	0.22	0.73	310.71	0.06	0.00	214.7	0.18	0.02	0.08	33.35	0.01	0.00
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	4	10.59	1.57	11.34	1705.20	0.71	0.02	214.7	1.14	0.17	1.22	183.05	0.08	0.00
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.66E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	214.7	0.00	0.00	0.00	0.31	0.00	0.00
Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03	10	0.08	0.01	0.08	13.55	0.00	0.00
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	4	1.67	0.22	0.73	310.71	0.06	0.00	195	0.16	0.02	0.07	30.29	0.01	0.00
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	4	10.59	1.57	11.34	1705.20	0.71	0.02	195	1.03	0.15	1.11	166.26	0.07	0.00
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.66E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	195	0.00	0.00	0.00	0.28	0.00	0.00
2018																								
Motor Grader	1	Diesel	150	61	2.12E-02	3.20E-03	2.21E-02	3.75E+00	1.16E-03	4.22E-05	8	15.49	2.34	16.17	2747.81	0.85	0.03	4.35	0.03	0.01	0.04	5.98	0.00	0.00
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	4	1.53	0.21	0.72	315.21	0.06	0.00	82.65	0.06	0.01	0.03	13.03	0.00	0.00
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	4	9.80	1.45	11.45	1728.03	0.61	0.02	82.65	0.41	0.06	0.47	71.41	0.03	0.00
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	82.65	0.00	0.00	0.00	0.12	0.00	0.00
Motor Grader	1	Diesel	150	61	2.12E-02	3.20E-03	2.21E-02	3.75E+00	1.16E-03	4.22E-05	8	15.49	2.34	16.17	2747.81	0.85	0.03	15	0.12	0.02	0.12	20.61	0.01	0.00
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	4	1.53	0.21	0.72	315.21	0.06	0.00	293	0.22	0.03	0.10	46.18	0.01	0.00
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	4	9.80	1.45	11.45	1728.03	0.61	0.02	293	1.44	0.21	1.68	253.16	0.09	0.00
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	293	0.00	0.00	0.00	0.42	0.00	0.00

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2019																								
Motor Grader	1	Diesel	150	61	1.92E-02	3.02E-03	2.24E-02	3.81E+00	1.05E-03	4.28E-05	8	14.09	2.21	16.38	2786.01	0.77	0.03	11.75	0.08	0.01	0.10	16.37	0.00	0.00
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	4	1.39	0.20	0.70	319.70	0.05	0.00	223.3	0.16	0.02	0.08	35.69	0.01	0.00
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	4	9.09	1.35	11.55	1750.65	0.52	0.02	223.3	1.02	0.15	1.29	195.42	0.06	0.00
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	223.3	0.00	0.00	0.00	0.33	0.00	0.00
Motor Grader	1	Diesel	150	61	1.92E-02	3.02E-03	2.24E-02	3.81E+00	1.05E-03	4.28E-05	8	14.09	2.21	16.38	2786.01	0.77	0.03	5	0.04	0.01	0.04	6.97	0.00	0.00
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	4	1.39	0.20	0.70	319.70	0.05	0.00	97	0.07	0.01	0.03	15.51	0.00	0.00
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	4	9.09	1.35	11.55	1750.65	0.52	0.02	97	0.44	0.07	0.56	84.91	0.03	0.00
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	97	0.00	0.00	0.00	0.14	0.00	0.00
2020																								
Motor Grader	1	Diesel	150	61	1.75E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03	3.25	0.02	0.00	0.03	4.59	0.00	0.00
Cranes	1	Diesel	300	43	2.46E-03	3.79E-04	1.34E-03	6.28E-01	8.97E-05	6.17E-06	4	1.27	0.20	0.69	324.19	0.05	0.00	61.75	0.04	0.01	0.02	10.01	0.00	0.00
Backhoes	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	4	8.46	1.25	11.67	1773.34	0.44	0.02	61.75	0.26	0.04	0.36	54.75	0.01	0.00
Welders	1	Diesel	50	43	1.21E-04	2.03E-05	1.40E-04	1.73E-02	4.85E-06	2.24E-07	8	0.02	0.00	0.02	2.98	0.00	0.00	61.75	0.00	0.00	0.00	0.09	0.00	0.00
2021																								
Motor Grader	1	Diesel	150	61	1.75E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03	12	0.08	0.01	0.10	16.94	0.00	0.00
Cranes	1	Diesel	300	43	2.23E-03	3.66E-04	1.33E-03	6.37E-01	8.17E-05	6.25E-06	4	1.15	0.19	0.68	328.68	0.04	0.00	228	0.13	0.02	0.08	37.47	0.00	0.00
Backhoes	1	Diesel	70	55	5.13E-02	7.67E-03	7.65E-02	1.17E+01	2.43E-03	1.37E-04	4	7.90	1.18	11.79	1796.38	0.37	0.02	228	0.90	0.13	1.34	204.79	0.04	0.00
Welders	1	Diesel	50	43	1.19E-04	1.90E-05	1.41E-04	1.76E-02	4.18E-06	2.27E-07	8	0.02	0.00	0.02	3.02	0.00	0.00	228	0.00	0.00	0.00	0.34	0.00	0.00
2023																								
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03	3.6	0.02	0.00	0.03	5.29	0.00	0.00
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E-01	6.72E-05	6.42E-06	4	0.94	0.18	0.68	337.70	0.03	0.00	68.4	0.03	0.01	0.02	11.55	0.00	0.00
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	4	7.04	1.08	12.06	1843.46	0.27	0.02	68.4	0.24	0.04	0.41	63.05	0.01	0.00
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	68.4	0.00	0.00	0.00	0.11	0.00	0.00
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03	3	0.01	0.00	0.03	4.41	0.00	0.00
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E-01	6.72E-05	6.42E-06	4	0.94	0.18	0.68	337.70	0.03	0.00	62	0.03	0.01	0.02	10.47	0.00	0.00
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	4	7.04	1.08	12.06	1843.46	0.27	0.02	62	0.22	0.03	0.37	57.15	0.01	0.00
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	62	0.00	0.00	0.00	0.10	0.00	0.00
2024																								
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	9.9	0.04	0.01	0.09	14.73	0.00	0.00
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	188.1	0.08	0.02	0.06	32.19	0.00	0.00
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	188.1	0.63	0.10	1.15	175.64	0.02	0.00
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	188.1	0.00	0.00	0.00	0.30	0.00	0.00
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	3	0.01	0.00	0.03	4.46	0.00	0.00
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	60	0.03	0.01	0.02	10.27	0.00	0.00
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	60	0.20	0.03	0.37	56.03	0.01	0.00
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	60	0.00	0.00	0.00	0.09	0.00	0.00
2025																								
Motor Grader	1	Diesel	150	61	1.15E-02	2.27E-03	2.38E-02	4.07E+00	5.87E-04	4.57E-05	8	8.43	1.66	17.45	2975.71	0.43	0.03	13.5	0.06	0.01	0.12	20.09	0.00	0.00
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	4	0.85	0.17	0.68	342.22	0.03	0.00	237.5	0.10	0.02	0.08	40.64	0.00	0.00
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	4	6.71	1.05	12.21	1867.56	0.23	0.02	237.5	0.80	0.12	1.45	221.77	0.03	0.00
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	237.5	0.00	0.00	0.00	0.37	0.00	0.00

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2026																								
Motor Grader	1	Diesel	150	61	9.32E-03	2.07E-03	2.44E-02	4.17E+00	4.62E-04	4.69E-05	8	6.82	1.52	17.87	3050.36	0.34	0.03	11.4	0.04	0.01	0.10	17.39	0.00	0.00
Cranes	1	Diesel	300	43	1.34E-03	3.10E-04	1.33E-03	6.81E-01	4.85E-05	6.68E-06	4	0.69	0.16	0.69	351.32	0.03	0.00	216.6	0.07	0.02	0.07	38.05	0.00	0.00
Backhoes	1	Diesel	70	55	4.05E-02	6.54E-03	8.13E-02	1.24E+01	1.13E-03	1.46E-04	4	6.24	1.01	12.51	1916.82	0.17	0.02	216.6	0.68	0.11	1.36	207.59	0.02	0.00
Welders	1	Diesel	50	43	1.11E-04	1.58E-05	1.46E-04	1.88E-02	1.91E-06	2.43E-07	8	0.02	0.00	0.03	3.23	0.00	0.00	216.6	0.00	0.00	0.00	0.35	0.00	0.00
2027																								
Motor Grader	1	Diesel	150	61	8.40E-03	2.00E-03	2.47E-02	4.22E+00	4.11E-04	4.75E-05	8	6.15	1.46	18.08	3087.67	0.30	0.03	11.3	0.03	0.01	0.10	17.45	0.00	0.00
Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	214.7	0.07	0.02	0.07	38.20	0.00	0.00
Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	214.7	0.65	0.11	1.36	208.43	0.02	0.00
Welders	1	Diesel	50	43	1.10E-04	1.54E-05	1.48E-04	1.90E-02	1.61E-06	2.46E-07	8	0.02	0.00	0.03	3.27	0.00	0.00	214.7	0.00	0.00	0.00	0.35	0.00	0.00
2028																								
Motor Grader	1	Diesel	150	61	7.59E-03	1.93E-03	2.50E-02	4.27E+00	3.66E-04	4.80E-05	8	5.56	1.41	18.30	3125.02	0.27	0.04	9	0.03	0.01	0.08	14.06	0.00	0.00
Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	171	0.05	0.01	0.06	30.43	0.00	0.00
Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	171	0.52	0.08	1.08	166.01	0.01	0.00
Welders	1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	171	0.00	0.00	0.00	0.28	0.00	0.00
2029																								
Motor Grader	1	Diesel	150	61	6.88E-03	1.87E-03	2.53E-02	4.32E+00	3.26E-04	4.86E-05	8	5.04	1.37	18.51	3162.40	0.24	0.04	8.8	0.02	0.01	0.08	13.91	0.00	0.00
Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	4	0.62	0.16	0.69	355.88	0.02	0.00	167.2	0.05	0.01	0.06	29.75	0.00	0.00
Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	4	6.07	0.99	12.67	1941.63	0.15	0.02	167.2	0.51	0.08	1.06	162.32	0.01	0.00
Welders	1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	167.2	0.00	0.00	0.00	0.28	0.00	0.00
2030																								
Motor Grader	1	Diesel	150	61	6.27E-03	1.83E-03	2.56E-02	4.37E+00	2.92E-04	4.92E-05	8	4.59	1.34	18.73	3199.79	0.21	0.04	7.35	0.02	0.00	0.07	11.76	0.00	0.00
Cranes	1	Diesel	300	43	8.78E-04	2.80E-04	1.37E-03	7.16E-01	3.02E-05	7.03E-06	4	0.45	0.14	0.71	369.58	0.02	0.00	139.7	0.03	0.01	0.05	25.81	0.00	0.00
Backhoes	1	Diesel	70	55	3.74E-02	6.26E-03	8.53E-02	1.31E+01	6.91E-04	1.54E-04	4	5.76	0.96	13.14	2015.18	0.11	0.02	139.7	0.40	0.07	0.92	140.71	0.01	0.00
Welders	1	Diesel	50	43	1.11E-04	1.49E-05	1.52E-04	1.97E-02	1.06E-06	2.55E-07	8	0.02	0.00	0.03	3.39	0.00	0.00	139.7	0.00	0.00	0.00	0.24	0.00	0.00
2031																								
Motor Grader	1	Diesel	150	61	5.72E-03	1.78E-03	2.59E-02	4.42E+00	2.62E-04	4.98E-05	8	4.19	1.31	18.95	3237.24	0.19	0.04	1.15	0.00	0.00	0.01	1.86	0.00	0.00
Cranes	1	Diesel	300	43	7.95E-04	2.76E-04	1.39E-03	7.25E-01	2.77E-05	7.12E-06	4	0.41	0.14	0.72	374.14	0.01	0.00	21.85	0.00	0.00	0.01	4.09	0.00	0.00
Backhoes	1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	4	5.71	0.96	13.29	2039.33	0.10	0.02	21.85	0.06	0.01	0.15	22.28	0.00	0.00
Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.54E-04	2.00E-02	9.62E-07	2.58E-07	8	0.02	0.00	0.03	3.43	0.00	0.00	21.85	0.00	0.00	0.00	0.04	0.00	0.00
2032																								
Motor Grader	1	Diesel	150	61	5.23E-03	1.75E-03	2.62E-02	4.47E+00	2.37E-04	5.03E-05	8	3.83	1.28	19.17	3274.76	0.17	0.04	1.5	0.00	0.00	0.01	2.46	0.00	0.00
Cranes	1	Diesel	300	43	7.26E-04	2.73E-04	1.40E-03	7.34E-01	2.58E-05	7.20E-06	4	0.37	0.14	0.72	378.69	0.01	0.00	28.5	0.01	0.00	0.01	5.40	0.00	0.00
Backhoes	1	Diesel	70	55	3.69E-02	6.24E-03	8.73E-02	1.34E+01	5.96E-04	1.57E-04	4	5.68	0.96	13.45	2063.36	0.09	0.02	28.5	0.08	0.01	0.19	29.40	0.00	0.00
Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.56E-04	2.02E-02	8.74E-07	2.61E-07	8	0.02	0.00	0.03	3.47	0.00	0.00	28.5	0.00	0.00	0.00	0.05	0.00	0.00

Table A-1
Estimated Facility Installation Emissions (EOR Processing Facility, Tank Batteries, Satellite Stations)
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2033																								
Motor Grader	1	Diesel	150	61	4.81E-03	1.72E-03	2.65E-02	4.53E+00	2.16E-04	5.09E-05	8	3.52	1.26	19.39	3312.40	0.16	0.04	12	0.02	0.01	0.12	19.87	0.00	0.00
Cranes	1	Diesel	300	43	6.71E-04	2.71E-04	1.42E-03	7.43E-01	2.44E-05	7.29E-06	4	0.35	0.14	0.73	383.23	0.01	0.00	228	0.04	0.02	0.08	43.69	0.00	0.00
Backhoes	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	4	5.68	0.96	13.60	2087.32	0.09	0.02	228	0.65	0.11	1.55	237.95	0.01	0.00
Welders	1	Diesel	50	43	1.13E-04	1.49E-05	1.58E-04	2.04E-02	8.00E-07	2.64E-07	8	0.02	0.00	0.03	3.52	0.00	0.00	228	0.00	0.00	0.00	0.40	0.00	0.00

Data Sources/Notes:

Emission factors from California Air Resources Board, Offroad 2007, Kern County, Construction Year Specific
Facility installation equipment spread includes one motor grader, one crane, one backhoe, and one welding machine

Construction Equipment Exhaust Total (tons)

Year	NOX	ROG	CO	CO2	PM10	SOX
2014	2.60	0.37	1.97	321.69	0.19	0.00
2015	3.99	0.57	3.30	542.02	0.28	0.01
2016	2.40	0.35	2.16	358.43	0.16	0.00
2017	2.70	0.39	2.65	442.40	0.17	0.01
2018	2.28	0.34	2.45	410.90	0.13	0.00
2019	1.80	0.27	2.10	355.32	0.10	0.00
2020	0.32	0.05	0.41	69.44	0.02	0.00
2021	1.11	0.17	1.52	259.55	0.05	0.00
2023	0.55	0.09	0.89	152.11	0.02	0.00
2024	0.99	0.16	1.71	293.71	0.04	0.00
2025	0.96	0.16	1.65	282.87	0.03	0.00
2026	0.79	0.14	1.53	263.38	0.02	0.00
2027	0.76	0.13	1.54	264.43	0.02	0.00
2028	0.60	0.10	1.23	210.78	0.02	0.00
2029	0.58	0.10	1.20	206.26	0.02	0.00
2030	0.45	0.08	1.04	178.51	0.01	0.00
2031	0.07	0.01	0.16	28.27	0.00	0.00
2032	0.09	0.02	0.22	37.30	0.00	0.00
2033	0.71	0.13	1.75	301.92	0.01	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2014																								
Cranes	1	Diesel	300	43	4.15E-03	4.69E-04	1.58E-03	5.76E-01	1.50E-04	5.65E-06	8	4.28	0.48	1.63	594.28	0.16	0.01	85	0.18	0.02	0.07	25.26	0.01	0.00
Backhoes	1	Diesel	70	55	8.71E-02	1.30E-02	7.19E-02	1.06E+01	6.89E-03	1.25E-04	8	26.84	4.00	22.14	3269.80	2.12	0.04	32.02	0.43	0.06	0.35	52.34	0.03	0.00
Welders	1	Diesel	50	43	1.41E-04	3.80E-05	1.46E-04	1.59E-02	1.04E-05	2.06E-07	8	0.02	0.01	0.03	2.74	0.00	0.00	85	0.00	0.00	0.00	0.12	0.00	0.00
2015																								
Cranes	1	Diesel	300	43	3.83E-03	4.52E-04	1.51E-03	5.85E-01	1.38E-04	5.74E-06	8	3.95	0.47	1.56	603.34	0.14	0.01	285	0.56	0.07	0.22	85.98	0.02	0.00
Backhoes	1	Diesel	70	55	8.05E-02	1.20E-02	7.24E-02	1.08E+01	6.09E-03	1.26E-04	8	24.79	3.69	22.31	3317.20	1.88	0.04	100.2	1.24	0.18	1.12	166.25	0.09	0.00
Welders	1	Diesel	50	43	1.37E-04	3.43E-05	1.44E-04	1.62E-02	9.35E-06	2.09E-07	8	0.02	0.01	0.02	2.78	0.00	0.00	285	0.00	0.00	0.00	0.40	0.00	0.00
2016																								
Cranes	2	Diesel	300	43	3.53E-03	4.36E-04	1.46E-03	5.93E-01	1.27E-04	5.82E-06	8	7.28	0.90	3.02	1224.76	0.26	0.01	292	1.06	0.13	0.44	178.81	0.04	0.00
Backhoes	2	Diesel	70	55	7.44E-02	1.10E-02	7.30E-02	1.09E+01	5.33E-03	1.28E-04	8	45.81	6.80	44.99	6728.24	3.28	0.08	112.3	2.57	0.38	2.53	377.79	0.18	0.00
Welders	2	Diesel	50	43	1.33E-04	3.09E-05	1.43E-04	1.64E-02	8.36E-06	2.12E-07	8	0.05	0.01	0.05	5.63	0.00	0.00	292	0.01	0.00	0.01	0.82	0.00	0.00
2017																								
Cranes	1	Diesel	300	43	3.24E-03	4.22E-04	1.42E-03	6.02E-01	1.17E-04	5.91E-06	8	3.34	0.44	1.46	621.41	0.12	0.01	310	0.52	0.07	0.23	96.32	0.02	0.00
Backhoes	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	8	21.18	3.14	22.69	3410.41	1.42	0.04	149.2	1.58	0.23	1.69	254.42	0.11	0.00
Welders	1	Diesel	50	43	1.30E-04	2.77E-05	1.42E-04	1.66E-02	7.40E-06	2.15E-07	8	0.02	0.00	0.02	2.86	0.00	0.00	310	0.00	0.00	0.00	0.44	0.00	0.00
2018																								
Cranes	1	Diesel	300	43	2.96E-03	4.07E-04	1.39E-03	6.11E-01	1.08E-04	6.00E-06	8	3.06	0.42	1.43	630.42	0.11	0.01	41	0.06	0.01	0.03	12.92	0.00	0.00
Backhoes	1	Diesel	70	55	6.37E-02	9.42E-03	7.43E-02	1.12E+01	3.97E-03	1.32E-04	8	19.61	2.90	22.89	3456.05	1.22	0.04	21.71	0.21	0.03	0.25	37.52	0.01	0.00
Welders	1	Diesel	50	43	1.26E-04	2.48E-05	1.41E-04	1.68E-02	6.48E-06	2.18E-07	8	0.02	0.00	0.02	2.90	0.00	0.00	41	0.00	0.00	0.00	0.06	0.00	0.00
2019																								
Cranes	1	Diesel	300	43	2.70E-03	3.93E-04	1.36E-03	6.20E-01	9.83E-05	6.08E-06	8	2.79	0.41	1.40	639.41	0.10	0.01	230	0.32	0.05	0.16	73.53	0.01	0.00
Backhoes	1	Diesel	70	55	5.91E-02	8.74E-03	7.50E-02	1.14E+01	3.39E-03	1.33E-04	8	18.19	2.69	23.10	3501.30	1.04	0.04	114.7	1.04	0.15	1.33	200.80	0.06	0.00
Welders	1	Diesel	50	43	1.24E-04	2.21E-05	1.40E-04	1.71E-02	5.61E-06	2.21E-07	8	0.02	0.00	0.02	2.94	0.00	0.00	230	0.00	0.00	0.00	0.34	0.00	0.00
2020																								
Cranes	1	Diesel	300	43	2.46E-03	3.79E-04	1.34E-03	6.28E-01	8.97E-05	6.17E-06	8	2.53	0.39	1.38	648.38	0.09	0.01	82	0.10	0.02	0.06	26.58	0.00	0.00
Backhoes	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	8	16.92	2.51	23.33	3546.68	0.88	0.04	44.45	0.38	0.06	0.52	78.82	0.02	0.00
Welders	1	Diesel	50	43	1.21E-04	2.03E-05	1.40E-04	1.73E-02	4.85E-06	2.24E-07	8	0.02	0.00	0.02	2.98	0.00	0.00	82	0.00	0.00	0.00	0.12	0.00	0.00
2021																								
Cranes	1	Diesel	300	43	2.23E-03	3.66E-04	1.33E-03	6.37E-01	8.17E-05	6.25E-06	8	2.30	0.38	1.37	657.37	0.08	0.01	230	0.26	0.04	0.16	75.60	0.01	0.00
Backhoes	1	Diesel	70	55	5.13E-02	7.67E-03	7.65E-02	1.17E+01	2.43E-03	1.37E-04	8	15.81	2.36	23.58	3592.76	0.75	0.04	128.4	1.01	0.15	1.51	230.60	0.05	0.00
Welders	1	Diesel	50	43	1.19E-04	1.90E-05	1.41E-04	1.76E-02	4.18E-06	2.27E-07	8	0.02	0.00	0.02	3.02	0.00	0.00	230	0.00	0.00	0.00	0.35	0.00	0.00
2023																								
Cranes	1	Diesel	300	43	1.82E-03	3.42E-04	1.31E-03	6.54E-01	6.72E-05	6.42E-06	8	1.88	0.35	1.35	675.40	0.07	0.01	81	0.08	0.01	0.05	27.35	0.00	0.00
Backhoes	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	8	14.07	2.17	24.12	3686.91	0.54	0.04	45.33	0.32	0.05	0.55	83.56	0.01	0.00
Welders	1	Diesel	50	43	1.15E-04	1.72E-05	1.42E-04	1.81E-02	3.03E-06	2.33E-07	8	0.02	0.00	0.02	3.11	0.00	0.00	81	0.00	0.00	0.00	0.13	0.00	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2024																								
Cranes	1	Diesel	300	43	1.64E-03	3.31E-04	1.31E-03	6.63E-01	6.07E-05	6.51E-06	8	1.70	0.34	1.36	684.44	0.06	0.01	189	0.16	0.03	0.13	64.68	0.01	0.00
Backhoes	1	Diesel	70	55	4.35E-02	6.83E-03	7.93E-02	1.21E+01	1.52E-03	1.42E-04	8	13.41	2.10	24.42	3735.12	0.47	0.04	105.8	0.71	0.11	1.29	197.53	0.02	0.00
Welders	1	Diesel	50	43	1.13E-04	1.66E-05	1.44E-04	1.83E-02	2.60E-06	2.37E-07	8	0.02	0.00	0.02	3.15	0.00	0.00	189	0.00	0.00	0.00	0.30	0.00	0.00
2026																								
Cranes	1	Diesel	300	43	1.34E-03	3.10E-04	1.33E-03	6.81E-01	4.85E-05	6.68E-06	8	1.38	0.32	1.37	702.63	0.05	0.01	230	0.16	0.04	0.16	80.80	0.01	0.00
Backhoes	1	Diesel	70	55	4.05E-02	6.54E-03	8.13E-02	1.24E+01	1.13E-03	1.46E-04	8	12.47	2.01	25.03	3833.63	0.35	0.04	112.8	0.70	0.11	1.41	216.16	0.02	0.00
Welders	1	Diesel	50	43	1.11E-04	1.58E-05	1.46E-04	1.88E-02	1.91E-06	2.43E-07	8	0.02	0.00	0.03	3.23	0.00	0.00	230	0.00	0.00	0.00	0.37	0.00	0.00
2027																								
Cranes	1	Diesel	300	43	1.21E-03	3.01E-04	1.34E-03	6.90E-01	4.29E-05	6.77E-06	8	1.25	0.31	1.38	711.76	0.04	0.01	349	0.22	0.05	0.24	124.20	0.01	0.00
Backhoes	1	Diesel	70	55	3.94E-02	6.44E-03	8.23E-02	1.26E+01	9.84E-04	1.48E-04	8	12.14	1.98	25.34	3883.27	0.30	0.05	142.7	0.87	0.14	1.81	277.16	0.02	0.00
Welders	1	Diesel	50	43	1.10E-04	1.54E-05	1.48E-04	1.90E-02	1.61E-06	2.46E-07	8	0.02	0.00	0.03	3.27	0.00	0.00	349	0.00	0.00	0.00	0.57	0.00	0.00
2028																								
Cranes	2	Diesel	300	43	1.09E-03	2.93E-04	1.35E-03	6.99E-01	3.78E-05	6.86E-06	8	2.24	0.60	2.78	1441.80	0.08	0.01	187.5	0.21	0.06	0.26	135.17	0.01	0.00
Backhoes	2	Diesel	70	55	3.86E-02	6.36E-03	8.33E-02	1.28E+01	8.60E-04	1.50E-04	8	23.75	3.92	51.30	7865.40	0.53	0.09	83.5	0.99	0.16	2.14	328.38	0.02	0.00
Welders	2	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.04	0.01	0.05	6.62	0.00	0.00	187.5	0.00	0.00	0.00	0.62	0.00	0.00
2029																								
Cranes	1	Diesel	300	43	9.75E-04	2.86E-04	1.36E-03	7.07E-01	3.35E-05	6.94E-06	8	1.01	0.30	1.40	730.04	0.03	0.01	162	0.08	0.02	0.11	59.13	0.00	0.00
Backhoes	1	Diesel	70	55	3.86E-02	6.36E-03	8.33E-02	1.28E+01	8.60E-04	1.50E-04	8	11.88	1.96	25.65	3932.70	0.26	0.05	79.31	0.47	0.08	1.02	155.95	0.01	0.00
Welders	1	Diesel	50	43	1.10E-04	1.52E-05	1.49E-04	1.93E-02	1.35E-06	2.49E-07	8	0.02	0.00	0.03	3.31	0.00	0.00	162	0.00	0.00	0.00	0.27	0.00	0.00
2030																								
Cranes	1	Diesel	300	43	8.78E-04	2.80E-04	1.37E-03	7.16E-01	3.02E-05	7.03E-06	8	0.91	0.29	1.42	739.16	0.03	0.01	257	0.12	0.04	0.18	94.98	0.00	0.00
Backhoes	1	Diesel	70	55	3.74E-02	6.26E-03	8.53E-02	1.31E+01	6.91E-04	1.54E-04	8	11.52	1.93	26.28	4030.36	0.21	0.05	104	0.60	0.10	1.37	209.58	0.01	0.00
Welders	1	Diesel	50	43	1.11E-04	1.49E-05	1.52E-04	1.97E-02	1.06E-06	2.55E-07	8	0.02	0.00	0.03	3.39	0.00	0.00	257	0.00	0.00	0.00	0.44	0.00	0.00
2031																								
Cranes	1	Diesel	300	43	7.95E-04	2.76E-04	1.39E-03	7.25E-01	2.77E-05	7.12E-06	8	0.82	0.28	1.43	748.27	0.03	0.01	14	0.01	0.00	0.01	5.24	0.00	0.00
Backhoes	1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	8	11.42	1.92	26.59	4078.67	0.20	0.05	5.67	0.03	0.01	0.08	11.56	0.00	0.00
Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.54E-04	2.00E-02	9.62E-07	2.58E-07	8	0.02	0.00	0.03	3.43	0.00	0.00	14	0.00	0.00	0.00	0.02	0.00	0.00
2032																								
Cranes	1	Diesel	300	43	7.26E-04	2.73E-04	1.40E-03	7.34E-01	2.58E-05	7.20E-06	8	0.75	0.28	1.45	757.37	0.03	0.01	41	0.02	0.01	0.03	15.53	0.00	0.00
Backhoes	1	Diesel	70	55	3.69E-02	6.24E-03	8.73E-02	1.34E+01	5.96E-04	1.57E-04	8	11.37	1.92	26.90	4126.72	0.18	0.05	15.44	0.09	0.01	0.21	31.86	0.00	0.00
Welders	1	Diesel	50	43	1.12E-04	1.49E-05	1.56E-04	2.02E-02	8.74E-07	2.61E-07	8	0.02	0.00	0.03	3.47	0.00	0.00	41	0.00	0.00	0.00	0.07	0.00	0.00

Table A-2
Estimated Pipeline Installation Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)							Total Emissions (tons)					
Equipment	Number	Fuel Type	BHP	Load Factor (%)	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Day	NOX	ROG	CO	CO2	PM10	SOX	Days	NOX	ROG	CO	CO2	PM10	SOX
2033																								
Cranes	1	Diesel	300	43	6.71E-04	2.71E-04	1.42E-03	7.43E-01	2.44E-05	7.29E-06	8	0.69	0.28	1.47	766.46	0.03	0.01	230	0.08	0.03	0.17	88.14	0.00	0.00
Backhoes	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	8	11.36	1.93	27.21	4174.63	0.17	0.05	86.6	0.49	0.08	1.18	180.76	0.01	0.00
Welders	1	Diesel	50	43	1.13E-04	1.49E-05	1.58E-04	2.04E-02	8.00E-07	2.64E-07	8	0.02	0.00	0.03	3.52	0.00	0.00	230	0.00	0.00	0.00	0.40	0.00	0.00

Data Sources/Notes:

Emission factors from California Air Resources Board, Offroad 2007, Kern County, Year Specific
Backhoe not used for above ground locations and used 50% of days during below ground multi-line installation
Pipeline installation during 2016 & 2028 assume operation of two equipment spreads due to the total length of piping proposed for installation
Equipment pipeline installation spread includes one crane, backhoe, and welding machine

Construction Equipment Exhaust Total (tons)

Year	NOX	ROG	CO	CO2	PM10	SOX
2014	0.61	0.08	0.42	77.71	0.04	0.00
2015	1.81	0.25	1.34	252.62	0.11	0.00
2016	3.64	0.52	2.97	557.43	0.22	0.01
2017	2.10	0.30	1.92	351.18	0.13	0.00
2018	0.28	0.04	0.28	50.50	0.02	0.00
2019	1.37	0.20	1.49	274.67	0.07	0.00
2020	0.48	0.07	0.58	105.53	0.02	0.00
2021	1.28	0.20	1.67	306.55	0.06	0.00
2022						
2023	0.40	0.06	0.60	111.04	0.02	0.00
2024	0.87	0.14	1.42	262.51	0.03	0.00
2025						
2026	0.86	0.15	1.57	297.33	0.03	0.00
2027	1.09	0.20	2.05	401.93	0.03	0.00
2028	1.21	0.22	2.41	464.17	0.03	0.01
2029	0.55	0.10	1.13	215.35	0.01	0.00
2030	0.72	0.14	1.55	305.00	0.02	0.00
2031	0.04	0.01	0.09	16.82	0.00	0.00
2032	0.10	0.02	0.24	47.46	0.00	0.00
2033	0.57	0.12	1.35	269.31	0.01	0.00

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Rig Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2016																	
Motor Grader	1	Diesel	150	61	2.53E-02	3.57E-03	2.15E-02	3.65E+00	1.40E-03	4.10E-05	8	18.54	2.61	15.75	2670.44	1.02	0.03
Tracked Tractor	1	Diesel	285	64	1.16E-02	1.63E-03	5.73E-03	2.84E+00	4.08E-04	3.19E-05	8	16.89	2.38	8.36	4139.26	0.60	0.05
Backhoe	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	8	21.18	3.14	22.69	3410.41	1.42	0.04
Compactor	1	Diesel	200	59	3.22E-03	3.85E-04	1.51E-03	7.87E-01	1.08E-04	7.73E-06	4	1.52	0.18	0.71	371.52	0.05	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												75.94	10.45	54.10	13652.16	3.72	0.15

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Rig Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2017																	
Motor Grader	1	Diesel	150	61	2.32E-02	3.38E-03	2.18E-02	3.70E+00	1.28E-03	4.16E-05	8	16.97	2.48	15.96	2709.32	0.94	0.03
Tracked Tractor	1	Diesel	285	64	1.03E-02	1.57E-03	5.72E-03	2.88E+00	3.65E-04	3.24E-05	8	14.96	2.29	8.35	4196.22	0.53	0.05
Backhoe	1	Diesel	70	55	6.88E-02	1.02E-02	7.37E-02	1.11E+01	4.62E-03	1.30E-04	18	47.65	7.06	51.05	7673.42	3.20	0.09
Compactor	1	Diesel	200	59	2.87E-03	3.71E-04	1.51E-03	7.98E-01	9.76E-05	7.83E-06	4	1.35	0.18	0.71	376.62	0.05	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												98.75	14.15	82.66	18016.10	5.34	0.20

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Rig Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2020																	
Motor Grader	1	Diesel	150	61	1.75E-02	2.85E-03	2.27E-02	3.86E+00	9.41E-04	4.34E-05	8	12.78	2.09	16.59	2824.12	0.69	0.03
Tracked Tractor	1	Diesel	285	64	7.06E-03	1.39E-03	5.76E-03	2.99E+00	2.55E-04	3.36E-05	8	10.30	2.03	8.41	4363.88	0.37	0.05
Backhoe	1	Diesel	70	55	5.49E-02	8.15E-03	7.57E-02	1.15E+01	2.87E-03	1.35E-04	18	38.06	5.65	52.49	7980.02	1.99	0.09
Compactor	1	Diesel	200	59	1.99E-03	3.31E-04	1.53E-03	8.32E-01	6.95E-05	8.17E-06	4	0.94	0.16	0.72	392.67	0.03	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												79.89	12.07	84.81	18621.23	3.71	0.21

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Rig Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2022																	
Motor Grader	1	Diesel	150	61	1.42E-02	2.54E-03	2.33E-02	3.96E+00	7.47E-04	4.46E-05	8	10.42	1.86	17.02	2900.17	0.55	0.03
Tracked Tractor	1	Diesel	285	64	5.47E-03	1.29E-03	5.84E-03	3.07E+00	1.97E-04	3.45E-05	8	7.98	1.88	8.52	4478.08	0.29	0.05
Backhoe	1	Diesel	70	55	4.83E-02	7.32E-03	7.74E-02	1.18E+01	2.07E-03	1.39E-04	18	33.46	5.07	53.65	8188.84	1.43	0.10
Compactor	1	Diesel	200	59	1.54E-03	3.07E-04	1.56E-03	8.56E-01	5.37E-05	8.40E-06	4	0.73	0.15	0.74	403.88	0.03	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												70.40	11.09	86.51	19031.51	2.92	0.21

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2023																	
Motor Grader	1	Diesel	150	61	1.28E-02	2.40E-03	2.35E-02	4.01E+00	6.62E-04	4.52E-05	8	9.37	1.75	17.23	2938.04	0.48	0.03
Tracked Tractor	1	Diesel	285	64	4.83E-03	1.24E-03	5.89E-03	3.11E+00	1.73E-04	3.50E-05	8	7.05	1.81	8.60	4536.44	0.25	0.05
Backhoe	1	Diesel	70	55	4.57E-02	7.04E-03	7.83E-02	1.20E+01	1.77E-03	1.40E-04	18	31.67	4.88	54.28	8295.55	1.22	0.10
Compactor	1	Diesel	200	59	1.37E-03	2.97E-04	1.58E-03	8.68E-01	4.67E-05	8.52E-06	4	0.65	0.14	0.74	409.51	0.02	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												66.55	10.73	87.45	19240.06	2.61	0.22

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2025																	
Motor Grader	1	Diesel	150	61	1.03E-02	2.16E-03	2.41E-02	4.12E+00	5.20E-04	4.63E-05	8	7.57	1.58	17.66	3013.05	0.38	0.03
Tracked Tractor	1	Diesel	285	64	3.82E-03	1.17E-03	6.02E-03	3.19E+00	1.33E-04	3.59E-05	8	5.57	1.71	8.78	4656.05	0.19	0.05
Backhoe	1	Diesel	70	55	4.18E-02	6.67E-03	8.03E-02	1.23E+01	1.31E-03	1.44E-04	18	28.98	4.62	55.62	8514.29	0.91	0.10
Compactor	1	Diesel	200	59	1.06E-03	2.77E-04	1.61E-03	8.91E-01	3.48E-05	8.75E-06	4	0.50	0.13	0.76	420.58	0.02	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												60.44	10.18	89.41	19664.50	2.12	0.22

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2029																	
Motor Grader	1	Diesel	150	61	6.88E-03	1.87E-03	2.53E-02	4.32E+00	3.26E-04	4.86E-05	8	5.04	1.37	18.51	3162.40	0.24	0.04
Tracked Tractor	1	Diesel	285	64	2.58E-03	1.10E-03	6.30E-03	3.36E+00	9.08E-05	3.78E-05	8	3.76	1.60	9.20	4899.22	0.13	0.06
Backhoe	1	Diesel	70	55	3.79E-02	6.30E-03	8.43E-02	1.29E+01	7.62E-04	1.52E-04	18	26.26	4.37	58.42	8958.95	0.53	0.11
Compactor	1	Diesel	200	59	6.96E-04	2.58E-04	1.70E-03	9.37E-01	2.50E-05	9.19E-06	4	0.33	0.12	0.80	442.17	0.01	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												53.20	9.60	93.52	20523.27	1.54	0.23

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	Number	Fuel	BHP	% Load	NOX	ROG	CO	CO2	PM10	SOX	Hrs/ Rig Day	NOX	ROG	CO	CO2	PM10	SOX
2031																	
Motor Grader	1	Diesel	150	61	5.72E-03	1.78E-03	2.59E-02	4.42E+00	2.62E-04	4.98E-05	8	4.19	1.31	18.95	3237.24	0.19	0.04
Tracked Tractor	1	Diesel	285	64	2.29E-03	1.09E-03	6.45E-03	3.44E+00	8.50E-05	3.87E-05	8	3.34	1.60	9.42	5018.45	0.12	0.06
Backhoe	1	Diesel	70	55	3.71E-02	6.24E-03	8.63E-02	1.32E+01	6.39E-04	1.55E-04	18	25.68	4.33	59.83	9177.00	0.44	0.11
Compactor	1	Diesel	200	59	6.23E-04	2.58E-04	1.74E-03	9.60E-01	2.29E-05	9.42E-06	4	0.29	0.12	0.82	452.92	0.01	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												51.32	9.49	95.60	20946.13	1.39	0.24

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Rig Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2033																	
Motor Grader	1	Diesel	150	61	4.81E-03	1.72E-03	2.65E-02	4.53E+00	2.16E-04	5.09E-05	8	3.52	1.26	19.39	3312.40	0.16	0.04
Tracked Tractor	1	Diesel	285	64	2.15E-03	1.11E-03	6.61E-03	3.52E+00	8.16E-05	3.96E-05	8	3.14	1.61	9.64	5136.53	0.12	0.06
Backhoe	1	Diesel	70	55	3.69E-02	6.25E-03	8.83E-02	1.36E+01	5.60E-04	1.59E-04	18	25.57	4.33	61.22	9392.92	0.39	0.11
Compactor	1	Diesel	200	59	5.79E-04	2.59E-04	1.78E-03	9.82E-01	2.14E-05	9.64E-06	4	0.27	0.12	0.84	463.60	0.01	0.00
Generator (3 per drill rig)	2	Diesel	1020	74	4.92E-04	5.91E-05	1.82E-04	8.45E-02	1.72E-05	8.29E-07	24	17.81	2.14	6.59	3060.53	0.62	0.03
Criteria Pollutant Emissions per Rig Day												50.31	9.47	97.68	21365.98	1.30	0.24

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Emissions From Site Preparation (Tons/Year)								
Year	No. Sites	Site Days	NOX	ROG	CO	CO2	PM10	SOX
2016	18	36	1.05	0.15	0.86	190.65	0.06	0.00
2017	4	8	0.32	0.05	0.30	59.82	0.02	0.00
2020	8	16	0.50	0.08	0.63	124.49	0.02	0.00
2022	9	18	0.47	0.08	0.72	143.74	0.02	0.00
2023	27	54	1.32	0.23	2.18	436.85	0.05	0.01
2025	20	40	0.85	0.16	1.66	332.08	0.03	0.00
2029	20	40	0.71	0.15	1.74	349.25	0.02	0.00
2031	21	42	0.70	0.15	1.87	375.60	0.02	0.00
2033	23	46	0.75	0.17	2.09	421.03	0.02	0.00
Total	150	300	6.67	1.22	12.05	2,433.50	0.25	0.03

Emissions From Well Drilling (Tons/Year)								
Year	No. Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX
2016	18	252	2.24	0.27	0.83	385.63	0.08	0.00
2017	4	56	0.50	0.06	0.18	85.69	0.02	0.00
2020	8	112	1.00	0.12	0.37	171.39	0.03	0.00
2022	9	126	1.12	0.13	0.42	192.81	0.04	0.00
2023	27	378	3.37	0.40	1.25	578.44	0.12	0.01
2025	20	280	2.49	0.30	0.92	428.47	0.09	0.00
2029	20	280	2.49	0.30	0.92	428.47	0.09	0.00
2031	21	294	2.62	0.31	0.97	449.90	0.09	0.00
2033	23	322	2.87	0.34	1.06	492.75	0.10	0.00
Total	150	2,100	18.70	2.25	6.92	3,213.56	0.66	0.03

Emissions From Well Completion (Tons/Year)								
Year	Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX
2016	18	72	2.73	0.34	1.44	336.16	0.11	0.00
2017	4	16	0.56	0.07	0.30	74.70	0.02	0.00
2020	8	32	0.90	0.13	0.51	150.48	0.04	0.00
2022	9	36	0.86	0.13	0.53	117.58	0.03	0.00
2023	27	108	2.39	0.37	1.52	507.86	0.09	0.00
2025	20	80	1.50	0.25	1.05	376.19	0.06	0.00
2029	20	80	1.07	0.21	0.95	376.19	0.04	0.00
2031	21	84	1.10	0.22	0.99	395.00	0.04	0.00
2033	23	92	0.89	0.22	1.01	432.62	0.03	0.00
Total	150	-------	12.01	1.95	8.30	2,766.79	0.48	0.03

Table A-3
Estimated Well Site Preparation, Drilling and Completion Emissions
OEHI CO2 EOR PROJECT

Total Emissions From Well Installation (Tons/Year)								
Year	Well	Total	NOX	ROG	CO	CO2	PM10	SOX
2016	18	Total =	6.02	0.76	3.12	912.44	0.25	0.01
2017	4	Total =	1.38	0.18	0.79	220.22	0.06	0.00
2020	8	Total =	2.40	0.33	1.51	446.35	0.10	0.00
2022	9	Total =	2.46	0.35	1.66	454.13	0.09	0.01
2023	27	Total =	7.07	1.01	4.95	1523.15	0.27	0.02
2025	20	Total =	4.85	0.71	3.62	1136.75	0.18	0.01
2029	20	Total =	4.27	0.66	3.61	1153.92	0.15	0.01
2031	21	Total =	4.42	0.69	3.83	1220.50	0.15	0.01
2033	23	Total =	4.51	0.73	4.17	1346.39	0.15	0.01
Total	150	-------	37.37	5.42	27.26	8,413.84	1.39	0.09

NOTE: Total well installation emissions shown above include site preparation, well drilling and well completions. The summary of well installation emissions shown in Table A-3 include the summary of well completion emissions shown in Table A-4. Table A-4 is a detailed supplement to Table A-3.

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2016																	
Mobile Rig	1	Diesel	425	75.00	0.011693	0.001486	0.006622	1.267635	0.000492	0.000012	12	59.63	7.58	33.77	6464.94	2.51	0.06
Pump	1	Diesel	375	60.00	0.007174	0.000889	0.002742	1.276824	0.000257	0.000013	6	16.14	2.00	6.17	2872.85	0.58	0.03
Criteria Pollutant Emissions per Rig Day												75.77	9.58	39.94	9337.79	3.09	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2017																	
Mobile Rig	1	Diesel	425	75.00	0.010928	0.001410	0.006196	1.267635	0.000459	0.000012	12	55.73	7.19	31.60	6464.94	2.34	0.06
Pump	1	Diesel	375	60.00	0.006428	0.000847	0.002655	1.276824	0.000230	0.000013	6	14.46	1.91	5.97	2872.85	0.52	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												70.20	9.09	37.57	9337.79	2.86	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2020																	
Mobile Rig	1	Diesel	425	75.00	0.009046	0.001236	0.005196	1.279707	0.000372	0.000013	12	46.14	6.30	26.50	6526.51	1.90	0.06
Pump	1	Diesel	375	60.00	0.004528	0.000730	0.002528	1.279247	0.000166	0.000013	6	10.19	1.64	5.69	2878.31	0.37	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												56.32	7.94	32.19	9404.81	2.27	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2022																	
Mobile Rig	1	Diesel	425	75.00	0.007855	0.001125	0.004644	1.279707	0.000320	0.000013	12	40.06	5.74	23.69	6526.51	1.63	0.06
Pump	1	Diesel	375	60.00	0.003517	0.000655	0.002484	0.002484	0.000127	0.000013	6	7.91	1.47	5.59	5.59	0.29	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												47.97	7.21	29.28	6532.10	1.92	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2023																	
Mobile Rig	1	Diesel	425	75.00	0.007314	0.001075	0.004424	1.279707	0.000296	0.000013	12	37.30	5.48	22.56	6526.51	1.51	0.06
Pump	1	Diesel	375	60.00	0.003099	0.000620	0.002462	1.279247	0.000110	0.000013	6	6.97	1.39	5.54	2878.31	0.25	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												44.28	6.87	28.10	9404.81	1.75	0.09

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2025																	
Mobile Rig	1	Diesel	425	75.00	0.006321	0.000984	0.004049	1.279707	0.000253	0.000013	12	32.24	5.02	20.65	6526.51	1.29	0.06
Pump	1	Diesel	375	60.00	0.002330	0.000556	0.002440	1.279247	0.000078	0.000013	6	5.24	1.25	5.49	2878.31	0.18	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												37.48	6.27	26.14	9404.81	1.46	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2029																	
Mobile Rig	1	Diesel	425	75.00	0.004655	0.000838	0.003563	1.279707	0.000183	0.000013	12	23.74	4.28	18.17	6526.51	0.93	0.06
Pump	1	Diesel	375	60.00	0.001325	0.000473	0.002440	1.279247	0.000048	0.000013	6	2.98	1.06	5.49	2878.31	0.11	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												26.73	5.34	23.66	9404.81	1.04	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2031																	
Mobile Rig	1	Diesel	425	75.00	0.004655	0.000838	0.003563	1.279707	0.000183	0.000013	12	23.74	4.28	18.17	6526.51	0.93	0.06
Pump	1	Diesel	375	60.00	0.001081	0.000455	0.002440	1.279247	0.000040	0.000013	6	2.43	1.02	5.49	2878.31	0.09	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												26.18	5.30	23.66	9404.81	1.02	0.09

					Emission Factors (lbs/bhp-hr)							Emissions (lbs/day)					
Equipment	**Number**	**Fuel**	**BHP**	**% Load**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**	**Hrs/ Day**	**NOX**	**ROG**	**CO**	**CO2**	**PM10**	**SOX**
2033																	
Mobile Rig	1	Diesel	425	75.00	0.003398	0.000735	0.003243	1.279707	0.000133	0.000013	12	17.33	3.75	16.54	6526.51	0.68	0.06
Pump	1	Diesel	375	60.00	0.000923	0.000442	0.002440	1.279247	0.000035	0.000013	6	2.08	0.99	5.49	2878.31	0.08	0.03
												0.00	0.00	0.00	0.00	0.00	0.00
Criteria Pollutant Emissions per Rig Day												19.41	4.74	22.03	9404.81	0.76	0.09

Table A-4
Estimated Well Completion Emissions
OEHI CO2 EOR PROJECT

Emissions From Well Completion (Tons/Year)								
Year	Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX
2016	18	72	2.73	0.34	1.44	336.16	0.11	0.00
2017	4	16	0.56	0.07	0.30	74.70	0.02	0.00
2020	8	32	0.90	0.13	0.51	150.48	0.04	0.00
2022	9	36	0.86	0.13	0.53	117.58	0.03	0.00
2023	27	108	2.39	0.37	1.52	507.86	0.09	0.00
2025	20	80	1.50	0.25	1.05	376.19	0.06	0.00
2029	20	80	1.07	0.21	0.95	376.19	0.04	0.00
2031	21	84	1.10	0.22	0.99	395.00	0.04	0.00
2033	23	92	0.89	0.22	1.01	432.62	0.03	0.00
Total	150	600	12.01	1.95	8.30	2,766.79	0.48	0.03

NOTE: Total well installation emissions shown in Table A-3 include the well completion emissions shown above in Table A-4. Table A-4 is a detailed supplement to Table A-3.

Table A-5
Estimated Well Conversion Emissions
OEHI CO2 EOR PROJECT

Average emissions per well conversion (based on annual average of well completion emissions)

Emissions (lbs/day)					
NOX	ROG	CO	CO2	PM10	SOX
44.93	6.93	29.17	9070.73	1.80	0.09

Emissions From Well Conversion (Tons/Year)								
Year	Well	Rig Days	NOX	ROG	CO	CO2	PM10	SOX
2014	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2015	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2016	18	72	1.62	0.25	1.05	326.55	0.06	0.00
2017	32	128	2.88	0.44	1.87	580.53	0.12	0.01
2018	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2019	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2020	28	112	2.52	0.39	1.63	507.96	0.10	0.01
2021	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2022	27	108	2.43	0.37	1.58	489.82	0.10	0.00
2023	9	36	0.81	0.12	0.53	163.27	0.03	0.00
2024	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2025	16	64	1.44	0.22	0.93	290.26	0.06	0.00
2026	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2027	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2028	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2029	16	64	1.44	0.22	0.93	290.26	0.06	0.00
2030	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2031	15	60	1.35	0.21	0.88	272.12	0.05	0.00
2032	36	144	3.23	0.50	2.10	653.09	0.13	0.01
2033	13	52	1.17	0.18	0.76	235.84	0.05	0.00
Total	570	2280	51.22	7.90	33.25	10340.63	2.05	0.10

TABLE A-6
CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)
Main Plant

Location	Const. Days	Period	PM 2.5	PM10	PM30
RCF & CTB	522	1/1/2014 - 12/30/2015	0.71	7.08	17.97
EPC & CRP	615	4/1/2017 - 4/30/2019	0.83	8.34	21.18
CTB Phase 2	65	9/1/2023 - 11/30/2023	0.04	0.4	0.83
Additional CTB Tanks & Pumps	313	10/1/2024 - 12/30/2025	0.12	1.2	3.06

$E=0.15(s/12)^a(W/3)^b$
E=Lbs/vehicle mi traveled
s=silt content
W=mean vehicle weight
a & b factors from AP-42

Assumptions RCF & CTB
11 vehicles
8 mi/day/vehicle
3-hvy duty
3-front end loader
5-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions CTB Phase 2
5 vehicles
8 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions EPC & CRP
11 vehicles
8 mi/day/vehicle
3-hvy duty
3-front end loader
5-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

Assumptions Additional CTB Tanks & Pumps
5 vehicles
5 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
10.75 ton mean vehicle weight
80% dust control

TABLE A-7

FUGITIVE DUST CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)

SATELLITE LOCATIONS AND PIPELINES

Location	Const. Days	Period	PM 2.5	PM10	PM30
Satellite 1 & Flow Lines	173	10/1/2014 - 6/30/2015	0.05	0.5	1.28
Trunk Lines - 1&2	283	9/1/2014 - 9/30/2015	0.16	1.64	4.17
Satellite 2 & Flow Lines	151	1/1/2015 - 9/30/2015	0.04	0.44	1.11
Satellite 3 & Flow Lines	151	12/1/2015 - 1/30/2016	0.04	0.44	1.11
Trunk Lines 3	218	9/1/2015 - 6/30/2016	0.13	1.26	3.22
Satellite 4 & Flow Lines	270	2/1/2016 - 3/30/2017	0.08	0.78	1.99
Trunk Lines 4-9	262	3/1/2016 - 3/30/2017	0.61	1.52	3.86
Satellite 5 & Flow Lines	270	2/1/2017 - 3/30/2018	0.08	0.78	1.99
Satellite 6 & Flow Lines	270	2/1/2019 - 3/30/2020	0.08	0.78	1.99
Satellite 7 & Flow Lines	270	11/1/2020 - 12/30/2021	0.08	0.78	1.99
Satellite 8 & Flow Lines	270	9/1/2023 - 10/30/2024	0.08	0.78	1.99
Satellite 9 & Flow Lines	270	2/1/2026 - 3/30/2027	0.08	0.78	1.99
Satellite 10 & Flow Lines	270	4/1/2027 - 5/30/2028	0.08	0.78	1.99
Trunk Lines 10-13	304	3/1/2027 - 5/30/2028	0.18	1.76	4.48
Satellite 11 & Flow Lines	270	8/1/2028 - 8/30/2029	0.08	0.78	1.99
Satellite 12 & Flow Lines	270	6/1/2030 - 6/30/2031	0.08	0.78	1.99
Satellite 13 & Flow Lines	270	11/1/2032 - 12/30/2033	0.08	0.78	1.99

Assumptions

5 vehicles
5 mi/day/vehicle
2-hvy duty
1-front end loader
2-truck/tractors
silt content 8.5%
8.1 ton mean vehicle weight
80% dust control

E=0.15(s/12)a(W/3)b
E=Lbs/vehicle mi traveled
s=silt content
W=mean vehicle weight
a & b factors from AP-42

TABLE A-8
CONSTRUCTION EMISSIONS-Tons (Assumes 80% Reduction through Controls)
Total Fugitive Dust Emissions

Pollutant	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
PM 10	4.21	6.16	2.84	3.98	4.35	2.05	0.30	0.72	0.00	0.64	0.77	1.03	0.66	1.92	1.20	0.48	0.42	0.36	0.12	0.72

TABLE A-9
All Estimated Onroad Vehicle Emissions (Construction Personnel, Supply Transport, and Operations Personnel)
OEHI CO2 EOR PROJECT

			NOX		ROG						CO		CO2		PM10				SOX		Emissions (lbs/day)						
Vehicle Class	Number (trips)	VMT	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Hot-Soak (g/trip)	Rest Loss (g/hr)	Run Evap (g/hr)	Diurnal Evap (g/hr)	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Tire Wear (g/mi)	Brake Wear (g/mi)	Run Exhaust (g/mi)	Start-Up (g/st)	NOX	ROG	CO	CO2	PM10	SOX	Days
2014																											
LDA-All	140	60	0.123	0.26	0.031	0.601	0.159	0.041	0.031	0.091	1.497	6.885	295.358	207.1	0.009	0.0017	0.008	0.013	0.003	0.002	2.44	1.00	31.97	5597.45	0.56	0.06	250
HDD-All	3	60	9.806	1.286	0.601	1.658	0.007	0	0.001	0	3.344	30.89	1738.184	42.31	0.334	0.003	0.036	0.028	0.017	0.001	3.91	0.26	1.74	690.32	0.16	0.01	250
2015																											
LDA-All	256	60	0.109	0.229	0.026	0.529	0.15	0.038	0.029	0.083	1.338	6.184	294.585	206.6	0.009	0.016	0.008	0.013	0.003	0.002	3.95	1.56	52.29	10208.54	1.03	0.10	250
HDD-All	5	60	8.599	1.258	0.546	3.896	0.006	0	0.001	0	3.048	29.1	1737.649	43.12	0.295	0.003	0.036	0.028	0.017	0.001	5.71	0.45	2.66	1150.19	0.24	0.01	250
2016																											
LDA-All	50	60	0.097	0.203	0.022	0.468	0.142	0.036	0.027	0.076	1.21	5.576	293.965	206.1	0.009	0.016	0.008	0.013	0.003	0.002	0.69	0.27	9.23	1989.65	0.20	0.02	250
HDD-All	2	60	7.505	1.229	0.495	1.417	0.005	0	0.001	0	2.781	28.39	1737.172	44.31	0.259	0.003	0.036	0.028	0.017	0.001	2.00	0.14	0.99	459.96	0.09	0.00	250
2017																											
LDA-All	174	60	0.086	0.179	0.019	0.414	0.135	0.034	0.025	0.07	1.096	5.021	293.425	205.7	0.009	0.016	0.008	0.013	0.003	0.002	2.12	0.81	29.08	6911.24	0.70	0.07	250
HDD-All	4	60	6.526	1.202	0.448	1.315	0.004	0	0.001	0	2.537	27.62	1736.753	45.49	0.226	0.003	0.036	0.028	0.017	0.001	3.47	0.26	1.83	919.72	0.15	0.01	250
2018																											
LDA-All	186	60	0.078	0.157	0.016	0.367	0.127	0.032	0.023	0.065	0.997	4.521	292.781	205.2	0.009	0.016	0.008	0.013	0.003	0.002	2.05	0.75	28.24	7371.66	0.75	0.08	250
HDD-All	4	60	5.666	1.178	0.405	1.237	0.005	0	0.001	0	2.318	27.37	1736.386	46.82	0.197	0.003	0.036	0.028	0.017	0.001	3.02	0.24	1.71	919.55	0.14	0.01	250
2019																											
LDA-All	268	60	0.07	0.139	0.014	0.326	0.121	0.03	0.022	0.06	0.914	4.081	292.23	204.8	0.009	0.016	0.008	0.013	0.003	0.002	2.65	0.95	37.22	10601.52	1.08	0.11	250
HDD-All	5	60	4.947	1.153	0.368	1.16	0.003	0	0	0	2.134	27.17	1736.144	47.91	0.173	0.003	0.036	0.028	0.017	0.001	3.30	0.27	2.01	1149.30	0.16	0.01	250
2020																											
LDA-All	46	60	0.064	0.123	0.013	0.291	0.114	0.028	0.021	0.056	0.845	3.659	291.753	204.5	0.008	0.016	0.008	0.013	0.003	0.002	0.41	0.15	5.88	1816.69	0.18	0.02	250
HDD-All	2	60	4.362	1.126	0.338	1.084	0.003	0	0	0	1.981	26.93	1735.996	48.8	0.153	0.003	0.036	0.028	0.017	0.001	1.16	0.10	0.76	459.69	0.06	0.00	250
2021																											
LDA-All	52	60	0.059	0.109	0.012	0.261	0.109	0.026	0.02	0.052	0.787	3.362	291.337	204.1	0.009	0.016	0.008	0.013	0.003	0.002	0.43	0.16	6.18	2050.71	0.21	0.02	250
HDD-All	2	60	3.92	1.105	0.315	1.021	0.003	0	0	0	1.866	26.84	1735.988	49.6	0.139	0.003	0.036	0.028	0.017	0.001	1.05	0.09	0.73	459.69	0.05	0.00	250
2022																											
LDA-All	27	60	0.055	0.097	0.011	0.235	0.104	0.025	0.019	0.048	0.736	3.069	290.961	203.8	0.009	0.016	0.008	0.013	0.003	0.002	0.21	0.07	2.99	1063.41	0.11	0.01	250
HDD-All	1	60	3.576	1.083	0.297	0.953	0.003	0	0	0	1.775	26.59	1736.02	50.26	0.036	0.003	0.036	0.028	0.127	0.001	0.48	0.04	0.35	229.85	0.01	0.02	250
2023																											
LDA-All	31	60	0.051	0.087	0.01	0.212	0.099	0.023	0.019	0.045	0.692	2.813	290.616	203.5	0.009	0.016	0.008	0.013	0.003	0.002	0.22	0.08	3.22	1219.50	0.13	0.01	250
HDD-All	2	60	3.305	1.07	0.282	0.81	0.003	0	0	0	1.703	26.51	1736.078	50.8	0.118	0.003	0.036	0.028	0.017	0.001	0.88	0.08	0.68	459.73	0.05	0.00	250
2024																											
LDA-All	73	60	0.047	0.079	0.009	0.192	0.094	0.022	0.018	0.041	0.652	0.259	290.305	203.3	0.009	0.016	0.008	0.013	0.003	0.002	0.48	0.17	6.38	2868.64	0.29	0.03	250
HDD-All	2	60	3.087	1.057	0.27	0.896	0.003	0	0	0	1.644	26.4	1736.134	51.2	0.11	0.003	0.036	0.028	0.017	0.001	0.83	0.08	0.67	459.75	0.05	0.00	250
2025																											
LDA-All	81	60	0.045	0.071	0.008	0.175	0.09	0.02	0.017	0.038	0.62	2.402	290.032	203.1	0.009	0.016	0.008	0.013	0.003	0.002	0.51	0.17	7.50	3180.01	0.33	0.03	250
HDD-All	3	60	2.916	1.048	0.26	0.829	0.003	0	0	0	1.597	26.2	1736.174	51.5	0.104	0.003	0.036	0.028	0.017	0.001	1.17	0.11	0.98	689.64	0.07	0.01	250
2026																											
LDA-All	28	60	0.042	0.065	0.008	0.161	0.086	0.019	0.017	0.036	0.592	2.24	289.79	202.9	0.009	0.016	0.008	0.013	0.003	0.002	0.16	0.06	2.47	1098.34	0.11	0.01	250
HDD-All	1	60	2.779	1.033	0.253	0.777	0.003	0	0	0	1.559	25.63	1736.194	51.64	0.099	0.003	0.036	0.028	0.017	0.001	0.37	0.04	0.32	229.88	0.02	0.00	250
2027																											
LDA-All	52	60	0.05	0.059	0.007	0.147	0.082	0.018	0.017	0.033	0.567	2.099	289.575	202.7	0.009	0.016	0.008	0.013	0.003	0.002	0.36	0.09	4.38	2038.25	0.21	0.02	250
HDD-All	2	60	2.672	1.032	0.246	0.758	0.003	0	0	0	1.53	25.71	1736.185	51.93	0.095	0.004	0.036	0.028	0.017	0.001	0.72	0.07	0.63	459.77	0.04	0.00	250

TABLE A-9
All Estimated Onroad Vehicle Emissions (Construction Personnel, Supply Transport, and Operations Personnel)
OEHI CO2 EOR PROJECT

			NOX		ROG						CO		CO2		PM10				SOX		Emissions (lbs/day)						
Vehicle Class	Number (trips)	VMT	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Hot-Soak (g/trip)	Rest Loss (g/hr)	Run Evap (g/hr)	Diurnal Evap (g/hr)	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Run Exhaust (g/mi)	Start-Up (g/st)	Tire Wear (g/mi)	Brake Wear (g/mi)	Run Exhaust (g/mi)	Start-Up (g/st)	NOX	ROG	CO	CO2	PM10	SOX	Days
2028																											
LDA-All	89	60	0.038	0.054	0.007	0.136	0.078	0.017	0.016	0.03	0.546	1.975	289.384	202.5	0.009	0.016	0.008	0.013	0.003	0.002	0.47	0.15	7.20	3486.23	0.36	0.04	250
HDD-All	2	60	2.587	1.033	0.241	0.736	0.003	0	0	0	1.506	25.72	1736.161	52.15	0.092	0.004	0.036	0.028	0.017	0.001	0.69	0.07	0.63	459.76	0.04	0.00	250
2029																											
LDA-All	47	60	0.036	0.05	0.006	0.125	0.075	0.016	0.016	0.027	0.526	1.864	289.215	202.3	0.009	0.016	0.008	0.013	0.003	0.002	0.23	0.07	3.66	1839.96	0.19	0.02	250
HDD-All	2	60	2.515	1.027	0.236	0.703	0.003	0	0	0	1.484	25.37	1736.117	52.28	0.089	0.004	0.036	0.028	0.017	0.001	0.67	0.07	0.62	459.75	0.04	0.00	250
2030																											
LDA-All	28	60	0.035	0.046	0.006	0.116	0.071	0.014	0.016	0.025	0.51	1.768	289.077	202.2	0.009	0.016	0.008	0.013	0.003	0.002	0.14	0.04	2.11	1095.62	0.11	0.01	250
HDD-All	1	60	2.456	1.029	0.233	5.791	0.003	0	0	0	1.467	25.57	1736.057	52.52	0.086	0.004	0.036	0.028	0.017	0.001	0.33	0.06	0.31	229.87	0.02	0.00	250
2031																											
LDA-All	46	60	0.034	0.042	0.006	0.108	0.068	0.013	0.015	0.023	0.496	1.684	288.959	202.1	0.009	0.016	0.008	0.013	0.003	0.002	0.22	0.07	3.36	1799.21	0.19	0.02	250
HDD-All	2	60	2.405	1.027	0.229	0.675	0.003	0	0	0	1.451	25.69	1735.987	52.71	0.084	0.004	0.036	0.028	0.017	0.001	0.65	0.07	0.61	459.72	0.04	0.00	250
2032																											
LDA-All	28	60	0.033	0.039	0.006	0.1	0.065	0.012	0.015	0.021	0.483	1.608	288.858	202	0.009	0.016	0.008	0.013	0.003	0.002	0.13	0.04	1.99	1094.78	0.11	0.01	250
HDD-All	1	60	2.636	1.023	0.226	0.654	0.003	0	0	0	1.438	25.82	1735.928	52.84	0.083	0.004	0.036	0.028	0.017	0.001	0.35	0.03	0.30	229.85	0.02	0.00	250
2033																											
LDA-All	44	60	0.032	0.036	0.045	0.094	0.062	0.012	0.015	0.019	0.472	1.54	288.77	201.9	0.009	0.016	0.008	0.013	0.003	0.002	0.19	0.29	3.05	1719.85	0.18	0.02	250
HDD-All	2	60	2.329	1.021	0.224	0.64	0.003	0	0	0	1.427	25.98	1735.877	53.01	0.081	0.004	0.036	0.028	0.017	0.001	0.63	0.06	0.61	459.69	0.04	0.00	250

Assumptions/Notes:

Onroad emissions factors from EMFAC 2007
SJVAPCD, 2013-2035, 70 degrees F, 50% RH
Assumes startup after 12 hours
Vehicle speed = 40 mph
20 min hot soak per trip
15 min rest each trip
45 min run time
Light-Duty Automobile (LDA) assumes all fuel types
Heavy-Duty Truck (HDD) assumes all fuel types
VMT = Vehicle Miles Traveled

Total (tons)	NOX	ROG	CO	CO2	PM10	SOX
2014	**0.79**	**0.16**	**4.21**	**785.97**	**0.09**	**0.01**
2015	**1.21**	**0.25**	**6.87**	**1419.84**	**0.16**	**0.01**
2016	**0.34**	**0.05**	**1.28**	**306.20**	**0.04**	**0.00**
2017	**0.70**	**0.13**	**3.86**	**978.87**	**0.11**	**0.01**
2018	**0.63**	**0.12**	**3.74**	**1036.40**	**0.11**	**0.01**
2019	**0.74**	**0.15**	**4.90**	**1468.85**	**0.15**	**0.01**
2020	**0.20**	**0.03**	**0.83**	**284.55**	**0.03**	**0.00**
2021	**0.18**	**0.03**	**0.86**	**313.80**	**0.03**	**0.00**
2022	**0.09**	**0.01**	**0.42**	**161.66**	**0.02**	**0.00**
2023	**0.14**	**0.02**	**0.49**	**209.90**	**0.02**	**0.00**
2024	**0.16**	**0.03**	**0.88**	**416.05**	**0.04**	**0.00**

Total (tons)	NOX	ROG	CO	CO2	PM10	SOX
2025	**0.21**	**0.03**	**1.06**	**483.71**	**0.05**	**0.00**
2026	**0.07**	**0.01**	**0.35**	**166.03**	**0.02**	**0.00**
2027	**0.13**	**0.02**	**0.63**	**312.25**	**0.03**	**0.00**
2028	**0.15**	**0.03**	**0.98**	**493.25**	**0.05**	**0.01**
2029	**0.11**	**0.02**	**0.53**	**287.46**	**0.03**	**0.00**
2030	**0.06**	**0.01**	**0.30**	**165.69**	**0.02**	**0.00**
2031	**0.11**	**0.02**	**0.50**	**282.37**	**0.03**	**0.00**
2032	**0.06**	**0.01**	**0.29**	**165.58**	**0.01**	**0.00**
2033	**0.10**	**0.04**	**0.46**	**272.44**	**0.02**	**0.00**

Table A-10
Total Estimated Construction Emissions
OEHI CO2 EOR Project

Year	NOX (tons)	ROG (tons)	CO (tons)	CO2 (tons)	PM10 (tons)	SOX (tons)
2014	7.24	1.11	8.71	1,838.46	4.66	0.02
2015	10.24	1.58	13.61	2,867.58	6.84	0.03
2016	14.01	1.93	10.59	2,461.04	3.57	0.03
2017	9.76	1.45	11.09	2,573.19	4.56	0.03
2018	6.43	1.00	8.57	2,150.89	4.74	0.02
2019	7.14	1.12	10.60	2,751.93	2.50	0.03
2020	5.91	0.87	4.96	1,413.83	0.57	0.01
2021	5.81	0.89	6.16	1,532.98	0.99	0.02
2022	4.97	0.73	3.65	1,105.61	0.21	0.01
2023	8.97	1.30	7.45	2,159.48	1.00	0.02
2024	5.26	0.84	6.12	1,625.36	1.01	0.02
2025	7.45	1.12	7.27	2,193.59	1.35	0.02
2026	4.96	0.80	5.55	1,379.83	0.86	0.01
2027	5.21	0.85	6.32	1,631.71	2.13	0.02
2028	5.18	0.85	6.71	1,821.30	1.43	0.02
2029	6.96	1.11	7.41	2,153.27	0.74	0.02
2030	4.46	0.73	4.99	1,302.29	0.59	0.01
2031	5.98	0.94	5.45	1,820.08	0.60	0.02
2032	3.49	0.55	2.84	903.43	0.26	0.01
2033	7.06	1.20	8.49	2,425.90	0.96	0.03
TOTALS	136.51	20.97	146.55	38,111.74	39.54	0.40
ANNUAL AVERAGE	6.83	1.05	7.33	1,905.59	1.98	0.02

APPENDICES

APPENDIX B
NOISE MODELS

SUPPLEMENTAL ENVIRONMENTAL INFORMATION
NOISE ANALYSIS
OEHI CO2 EOR PROJECT

Noise Scenario: Construction Equipment Operating in CO2 EOR Processing Facility Area

Receptor: R1 (Tupman)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	7920	34.8	4.8	30.0
Air Compressor	0.73	81	7920	36.2	4.8	31.4
Backhoe	0.73	85	7920	40.2	4.8	35.4
Generator	0.73	78	7920	33.2	4.8	28.4
Pneumatic Tool	0.05	86	7920	34.2	4.8	29.4
Grader	0.73	82.5	7920	37.7	4.8	32.9
Dozer	0.73	83	7920	38.2	4.8	33.4
Welding Machine	0.73	81	7920	36.2	4.8	31.4
Supply Truck	0.73	82	7920	37.2	4.8	32.4

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	30.0	5.4	1.5
Air Compressor	31.4	4.0	1.45
Backhoe	35.4	0.0	3
Generator	28.4	7.0	0.79
Pneumatic Tool	29.4	6.0	2.53
Grader	32.9	2.5	1.96
Dozer	33.4	2.0	2.12
Welding Machine	31.4	4.0	1.45
Supply Truck	32.4	3.0	2.53

Total Attenuated Construction Noise LEQ (dBA) at Receptor During Scenario = 49.7
Estimated LEQ (dBA) at Receptor with Addition of Construction Noise = 62.4

Assumed Daytime Ambient Noise Level: 62.2

Assumed Nighttime Ambient Noise Level: 50.0

Est Ldn at Receptor with Construction R1: 61.2 **Ambient Ldn: 61.0**

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION
NOISE ANALYSIS
OEHI CO2 EOR PROJECT

Noise Scenario: Equipment Operating in CO2 EOR Processing Facility
Receptor: R1 (Tupman)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Compressors (8)	1.00	61	7920	38.0	4.8	33.2
Pumps (5)	1.00	61	7920	29.0	4.8	24.2

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Compressors (8)	33.2	0.0	3.0
Pumps (5)	24.2	0.0	0.5

Total Attenuated Operation Noise LEQ (dBA) at Receptor During Scenario = 33.7
Estimated LEQ (dBA) at Receptor with Addition of Operation Noise = 62.2
Estimated LEQ (dBA) at Receptor with Addition of OEHI and HECA Operation Noise (Cumulative) = 62.2

Assumed Daytime Ambient Noise Level:	62.2		
Assumed Nighttime Ambient Noise Level:	50.0		
Est Ldn at Receptor with Plant Operation R1:	**61.2**	**Ambient Ldn:**	**61.0**

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION
NOISE ANALYSIS
OEHI CO2 EOR PROJECT

Noise Scenario: Piping Installation

Receptor: R2 (North of Dustin Acres), R3 & R4 (Dustin Acres), R7 (Valley Acres)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	5280	38.3	4.8	33.5
Backhoe	0.73	85	5280	43.7	4.8	38.9
Backhoe	0.73	85	5280	43.7	4.8	38.9
Welding Machine	0.73	81	5280	39.7	4.8	34.9
Welding Machine	0.73	81	5280	39.7	4.8	34.9
Supply Truck	0.73	82	5280	40.7	4.8	35.9

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	33.5	3.7	
Backhoe	38.9	0.0	3
Backhoe	38.9	0.0	3
Welding Machine	34.9	4.0	
Welding Machine	34.9	4.0	
Supply Truck	35.9	3.0	1.83

Total Attenuated Construction Noise LEQ (dBA) at Receptors During Scenario = 43.7

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R2) = 73.2

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R3) = 71.9

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R4) = 66.8

Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R7) = 76.0

Assumed Daytime Ambient Noise Level R2:	73.2		
Assumed Daytime Ambient Noise Level R3:	71.9		
Assumed Daytime Ambient Noise Level R4:	66.8		
Assumed Daytime Ambient Noise Level R7:	76.0		
Assumed Nighttime Ambient Noise Level:	50.0		
Est Ldn at Receptor with Construction R2:	**72.0**	**Ambient Ldn:**	**72.0**
Est Ldn at Receptor with Construction R3:	**70.7**	**Ambient Ldn:**	**70.7**
Est Ldn at Receptor with Construction R4:	**65.6**	**Ambient Ldn:**	**65.6**
Est Ldn at Receptor with Construction R7:	**74.8**	**Ambient Ldn:**	**74.8**

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

SUPPLEMENTAL ENVIRONMENTAL INFORMATION
NOISE ANALYSIS
OEHI CO2 EOR PROJECT

Noise Scenario: Piping Installation
Receptor: R5 and R6 (Valley Acres)

Construction Noise Source (Point Source)	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)
Crane	0.20	83	6336	36.7	4.8	32.0
Backhoe	0.73	85	6336	42.1	4.8	37.3
Backhoe	0.73	85	6336	42.1	4.8	37.3
Welding Machine	0.73	81	6336	38.1	4.8	33.3
Welding Machine	0.73	81	6336	38.1	4.8	33.3
Supply Truck	0.73	82	6336	39.1	4.8	34.3

Construction Noise Source (Point Source)	Attenuated Noise Level Rounded to Nearest Whole Decibel	Noise Level Below Loudest	Additive Noise Level
Crane	32.0	3.7	
Backhoe	37.3	0.0	3
Backhoe	37.3	0.0	3
Welding Machine	33.3	4.0	
Welding Machine	33.3	4.0	
Supply Truck	34.3	3.0	1.83

Total Attenuated Construction Noise LEQ (dBA) at Receptors During Scenario = 42.2
Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R5) = 63.8
Estimated LEQ (dBA) at Receptor with Addition of Construction Noise (R6) = 61.3

Assumed Daytime Ambient Noise Level R5:	63.8		
Assumed Daytime Ambient Noise Level R6:	61.2		
Assumed Nighttime Ambient Noise Level:	50.0		
Est Ldn at Receptor with Construction R5:	**62.6**	**Ambient Ldn:**	**62.6**
Est Ldn at Receptor with Construction R6:	**60.1**	**Ambient Ldn:**	**60.0**

Estimated Ldn conservatively estimates 15 hours of equipment operation during daytime & evening (6 am - 9 pm), 0 hours during nighttime.

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground

Data Source: EPA (1971), Noise From Construction Equipment and Operations

Appendix A-2

OEHI Modified CO_2 Supply

Modified CO2 Supply Line Alignment Data Gap Analysis

An analysis of potential changes in environmental consequences from a modified CO2 Supply Line alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility

APRIL 2012

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1.0 INTRODUCTION

This Data Gap Analysis evaluates potential changes in environmental consequences that could result from a modification of the CO2 supply line alignment from what was considered in Hydrogen Energy California's (HECAs) 2009 Application for Certification (AFC) filing with the California Energy Commission (CEC).

The CO2 supply line alignments evaluated within HECA's CEC AFC filing are shown in Figure 1. Further evaluation of the previously proposed CO2 supply line alignment since HECA's 2009 CEC AFC filing has resulted in a modification of the preferred alignment (Figure 2). As a result of this modification, Stantec has reviewed the evaluation of environmental consequences that were considered in HECA's 2009 CEC AFC filing to determine the need for further environmental analysis based on the alignment modification. The Data Gap Analysis identifies the issue areas that would remain insubstantially different as a result of the alignment modification as well as the issue areas that warrant further environmental analysis to close potential data gaps. The Data Gap Analysis provides the rationale of why the environmental consequences for some issue areas would remain unchanged and also presents supplemental information to close identified data gaps.

1.1 ISSUE AREAS WHERE NO FURTHER ANALYSIS IS WARRANTED

The evaluation of environmental consequences contained in HECA's 2009 CEC AFC filing determined that no further analysis based on the modification of the CO2 supply line alignment was warranted for the following issue areas:

- Air Quality;
- Land Use;
- Public Health;
- Worker Safety and Health;
- Socioeconomics Environmental Justice;
- Soils;
- Traffic and Transportation;
- Visual Resources;

- Waste Management;
- Water Resources; and,
- Geological Hazards and Resources.

Section 2.0 of this Data Gap Analysis provides a summary of why potential environmental consequences for the above issue areas as analyzed in HECA's 2009 CEC AFC filing remain substantially unchanged as result in the modification of the CO2 supply line alignment.

1.2 ISSUE AREAS WHERE FURTHER ANALYSIS IS WARRANTED

The evaluation of environmental consequences contained in HECA's 2009 CEC AFC filing determined that further analysis based on the modification of the CO2 supply line alignment was warranted for the following issue areas:

- Biological Resources;
- Cultural Resources;
- Noise;
- Hazardous Materials Handling; and
- Paleontological Resources.

Section 2.0 of this Data Gap Analysis provides a summary of why potential environmental consequences for the above issue areas as analyzed in HECA's 2009 CEC AFC filing could substantially be changed as result in the modification of the CO2 supply line alignment. Section 2.0 provides a summary of the approach that was taken to close the data gaps identified.

1.3 DISTURBANCE ESTIMATES

The CO2 supply line alignment evaluated within HECA's CEC AFC filing shown in Figure 1 is approximately 4 miles in linear length and includes one use of horizontal directional drilling techniques (HDD). HECA's calculated disturbance estimates were 25 acres of temporary disturbance and 0.11 acres of permanent disturbance.

The modified CO2 supply line alignment shown in Figure 2 is 3.36 miles in linear length and includes two HDDs. One HDD will be approximately 500 feet in length under the levee and the second HDD will be approximately 2,000 feet in length under the West Side Canal and California Aqueduct. The remainder of the CO2 supply line will be installed using conventional trenching techniques. Calculated disturbance estimates are 28.89 acres of temporary disturbance (which includes two entry and two exit excavations), and 0.11 acres of permanent

disturbance. The temporary disturbance estimates are based on a 80 foot wide construction disturbance along 15,240.8 feet of pipe anticipated to be installed utilizing conventional trenching methods as well as two HDD entry excavations (120 feet x 100 feet each) and two HDD exit excavations (75 feet x 100 feet each). Temporary disturbances as a result of pipe string fabrication and layout are assumed to occur on lands already disturbed by trenching activities. Permanent disturbances resulting from installing two valve boxes (50 feet x 50 feet each) remain unchanged from HECA's previous disturbance estimates.

1.4 SUMMARY OF DATA GAP ANALYSIS

The following table identifies the issue areas evaluated in HECA's 2009 CEC AFC filing, where no data gaps exist based on the alignment modification, where data gaps do exist that warrant further analysis, and how the identified data gaps will be closed.

HECA 2009 CEC AFC Filing CO2 Supply Line Alignment		Modified CO2 Supply Line Alignment	
Issue Area Evaluated	**Section #**	**Data Gap Present?**	**Action to Close Data Gap**
Air Quality	5.1	No	No Gap - Not applicable
Biological Resources	5.2	Yes	New Biological Survey and Biological Resources Technical Report for Modified Alignment
Cultural Resources	5.3	Yes	New Records Search, Cultural Resources Survey and Cultural Resources Technical Report for Modified Alignment
Land Use	5.4	No	No Gap - Not applicable
Noise	5.5	Yes	Prepare Construction Noise Evaluation for Modified Alignment
Public Health	5.6	No	No Gap - Not applicable
Worker Safety and Health	5.7	No	No Gap - Not applicable
Socioeconomics Environmental Justice	5.8	No	No Gap - Not applicable
Soils	5.9	No	No Gap - Not applicable
Traffic and Transportation	5.10	No	No Gap - Not applicable
Visual Resources	5.11	No	No Gap - Not applicable
Hazardous Materials Handling	5.12	Yes	Prepare Worst-Case Pipeline Release Hazard Assessment
Waste Management	5.13	No	No Gap - Not applicable
Water Resources	5.14	No	No Gap - Not applicable
Geological Hazards and Resources	5.15	No	No Gap - Not applicable
Paleontological Resources	5.16	Yes	Prepare Paleontological Resources Study

2.0 ISSUE SPECIFIC DATA GAP ANALYSIS

The following section provides a brief analysis of potential changes in environmental consequences as a result of the modification to the CO2 supply line alignment. A summary is provided for each of the sixteen issue areas evaluated by HECA in the 2009 CEC AFC filing.

2.1 AIR QUALITY

The modified CO2 supply line alignment at 3.36 miles in length is approximately 0.6 miles shorter than the original 4 mile alignment evaluated by HECA. The installation methodology remains unchanged as a result of the alignment modification. As such, the estimated installation emissions will be comparative to what was previously considered. It is also likely that the installation emissions will incrementally be reduced as a result of the decrease in total line length and corresponding construction schedule. In addition, operational emissions from the pipeline which would be limited to both routine and potentially non-routine pipeline maintenance activities would remain substantially unchanged. As a result, potential air quality impacts resulting from the alignment modification would remain comparatively the same as considered in the 2009 CEC AFC filing and no further analysis is warranted.

2.2 BIOLOGICAL RESOURCES

The environmental consequences to biological resources evaluated by HECA from installation and operation of the CO2 supply line were based on the habitat type and potential presence of sensitive flora and fauna that could be present along the pipeline alignment. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial biological resources data gap has been identified based on the modification to the pipeline alignment. Therefore a supplemental biological survey has been performed and a technical biological resources report completed to evaluate the modification of the CO2 supply line alignment (Attachment A).

2.3 CULTURAL RESOURCES

The environmental consequences to cultural resources evaluated by HECA from installation and operation of the CO2 supply line were based on a records search, cultural resources survey, and technical cultural resources report that were alignment specific. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial cultural resources data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental cultural resources survey has been performed and a technical cultural resources report completed to evaluate the modification of the CO2 supply line alignment (Attachment B). It should be noted that the cultural resources survey and technical report also collectively consider paleontological resources (see Section 2.16 below).

2.4 LAND USE

The pipeline alignment evaluated by HECA was located in areas with land use designations Extensive Agriculture and Mineral and Petroleum zoned from Extensive Agriculture and Limited Agriculture. Although the modification to the pipeline alignment will result in temporary disturbances to different parcels, the lands have the same land use and zoning designations. The modified CO2 supply line alignment would not require a change in or conflict with existing land uses. As such, environmental consequences to land use would remain substantially unchanged from what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis based on the alignment modification is warranted.

2.5 NOISE

Potential noise impacts from installation of the CO2 supply line in HECA's 2009 CEC AFC filing focused on the distance away from sensitive receptors. HECA specifically evaluated construction noise impacts from construction of the main HECA Facility. As the main HECA Facility was located closer to sensitive receptors than the CO2 supply line and potential noise impacts from construction were determined to not be significant, construction impacts resulting from pipeline installation were also determined not to be significant. However, the modification of the CO2 supply line alignment results in the pipeline being located closer to the community of Tupman (a sensitive receptor) than what was previously considered. As a result of the decrease in distance to a sensitive receptor, a substantial noise data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental construction noise evaluation has been prepared to re-evaluate potential noise impacts from the alignment modification (Attachment C).

2.6 PUBLIC HEALTH

Installation of the CO2 supply line will result in emissions of toxic air contaminants/hazardous air pollutants in the form of diesel particulate matter emissions from the operation of diesel-fueled internal combustion engines. Because equipment used during the installation process will primarily be mobile in nature and will only be operated during the short-term construction period, pollutant concentrations of diesel particulate matter are not expected to result in public health impacts. Although the alignment modification places construction activities closer to the community of Tupman, construction activities will be in excess of 1.25 miles from Tupman. Considering the above, construction-related emissions of hazardous air pollutants are not expected to expose sensitive receptors to substantial pollutant concentrations in excess of what was considered in HECA's 2009 CEC AFC filing and no further analysis is warranted. Public health consequences related to a pipeline release are further discussed in Section 2.12.

2.7 WORKER SAFETY AND HEALTH

The modified CO2 supply line alignment will not add additional worker safety and health issues nor does it include any component with the potential to significantly or otherwise contribute to a worker safety and health impact beyond what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The modified CO2 supply line alignment does not change the demographic data for the vicinity, nor does it include any component with the potential to magnify or otherwise contribute to an environmental justice impact. There would be no change to socioeconomics environmental justice beyond those considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.9 SOILS

The modified CO2 supply line alignment is located in an area with the same soil types present as the previously evaluated pipeline alignment. The installation methodologies are also the same as previously evaluated. As such, the alignment modification does not present the potential for new or magnified environmental consequences related to soils than what was considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.10 TRAFFIC AND TRANSPORTATION

The modified CO2 supply line alignment will result in the same route use, traffic patterns and equivalent traffic volumes considered and evaluated for the previously analyzed pipeline alignment. As such, the alignment modification does not present the potential for new or magnified environmental consequences related to traffic and transportation than what was considered and evaluated in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.11 VISUAL RESOURCES

The modified CO2 supply line alignment will place conventional construction equipment closer to the community of Tupman than what was considered for the previously evaluated pipeline alignment. However, construction activities will be limited to a short-term duration and will still be located in excess of 1.25 miles from the community of Tupman. Due to the limited duration of construction activities and distance to sensitive receptors, no substantial consequence to visual resources beyond what was considered and evaluated in HECA's 2009 CEC AFC filing is anticipated. Therefore, no additional analysis is warranted.

2.12 HAZARDOUS MATERIALS HANDLING

Installation for the CO2 supply line will require the use of hazardous materials in the form of fuels and lubricants used in support of construction equipment operation. As the installation methodology remains unchanged as a result of the alignment modification, the use, handling practices, and volumes anticipated also remain unchanged from what was previously considered. HECA evaluated the potential consequences of a worst-case CO2 release scenario from pipeline operation as part of the 2009 CEC AFC filing. This scenario and the resulting dispersion of CO2 were based on a worst-case volume release that was dependent on pipeline length, block valve locations, and distance to receptors. As a result of these changes, a substantial hazards data gap has been identified based on the modification to the pipeline alignment. Therefore, a supplemental pipeline operation hazards assessment has been prepared to re-evaluate the potential consequences of a worst-case pipeline release scenario (Attachment D).

2.13 WASTE MANAGEMENT

The modified CO2 supply line alignment would not generate additional waste or change handling practices beyond what was considered in HECA's 2009 CEC AFC filing. Therefore, no additional analysis is warranted.

2.14 WATER RESOURCES

The supply line alignment considered and evaluated by HECA in the 2009 CEC AFC filing crossed the West Side Canal, California Aqueduct, and some unnamed ephemeral channels. Crossings of the West Side Canal and California Aqueduct were proposed to be accomplished using HDD. Specifically the pipeline would be installed approximately 50 feet underneath the waterways and would have entry and exit offsets of approximately 550 feet from the water edge. Although the pipeline alignment has been modified, the new alignment will still cross the West Side Canal, California Aqueduct, and some unnamed ephemeral channels. The only difference is the location of the crossings. However, potential environmental consequences to water resources that were considered and evaluated within HECA's 2009 CEC AFC filing, remain substantially unchanged. Therefore, no additional analysis is warranted.

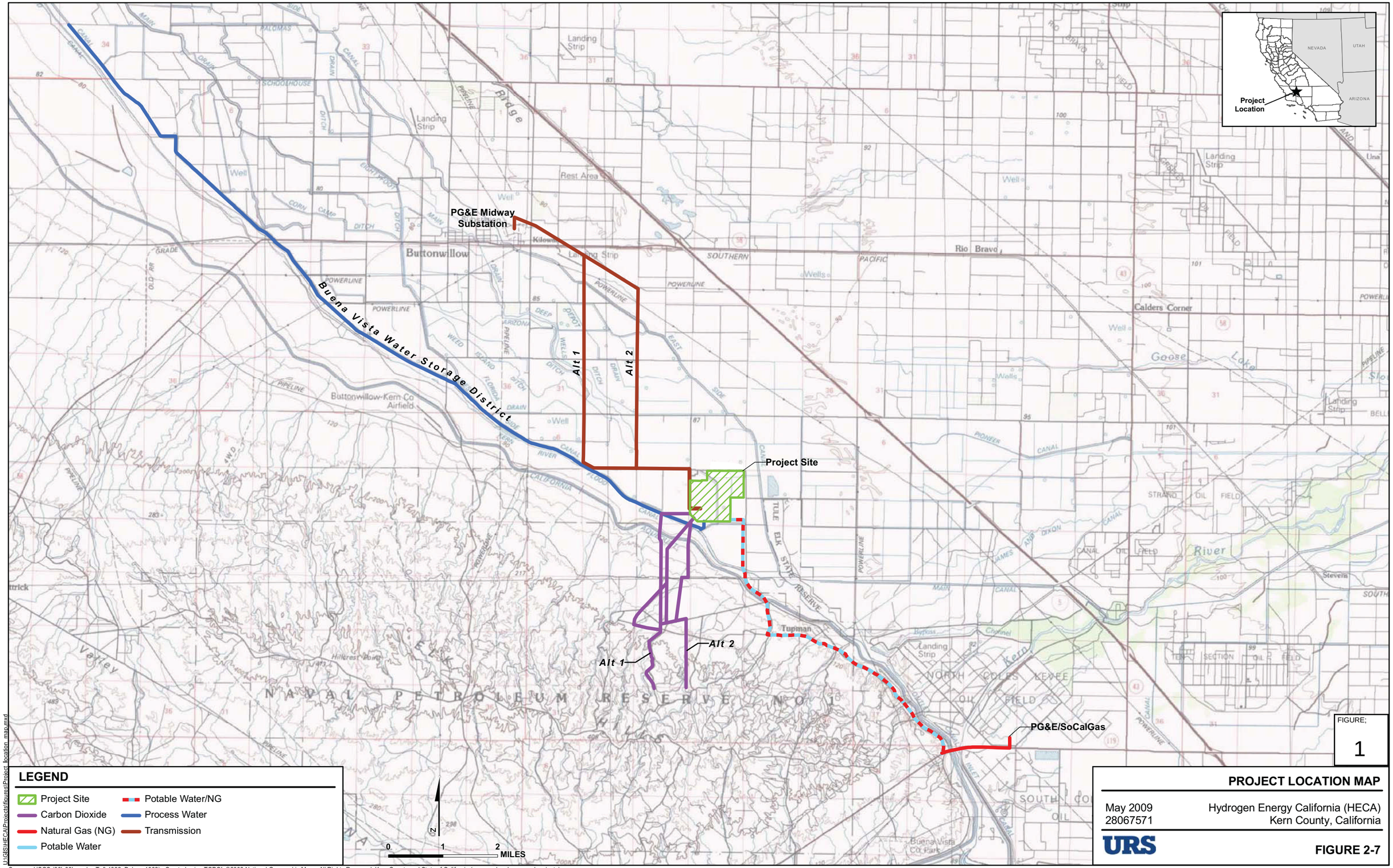
2.15 GEOLOGICAL HAZARDS AND RESOURCES

The geologic hazards present and considered for the pipeline alignment evaluated in HECA's 2009 CEC AFC filing are the same hazards present for the modified pipeline alignment. The alignment modification does not introduce the presence of additional geologic hazards that were not previously evaluated or considered. As a result, the potential environmental consequences for the alignment modification are the same as previously evaluated and no further analysis is warranted.

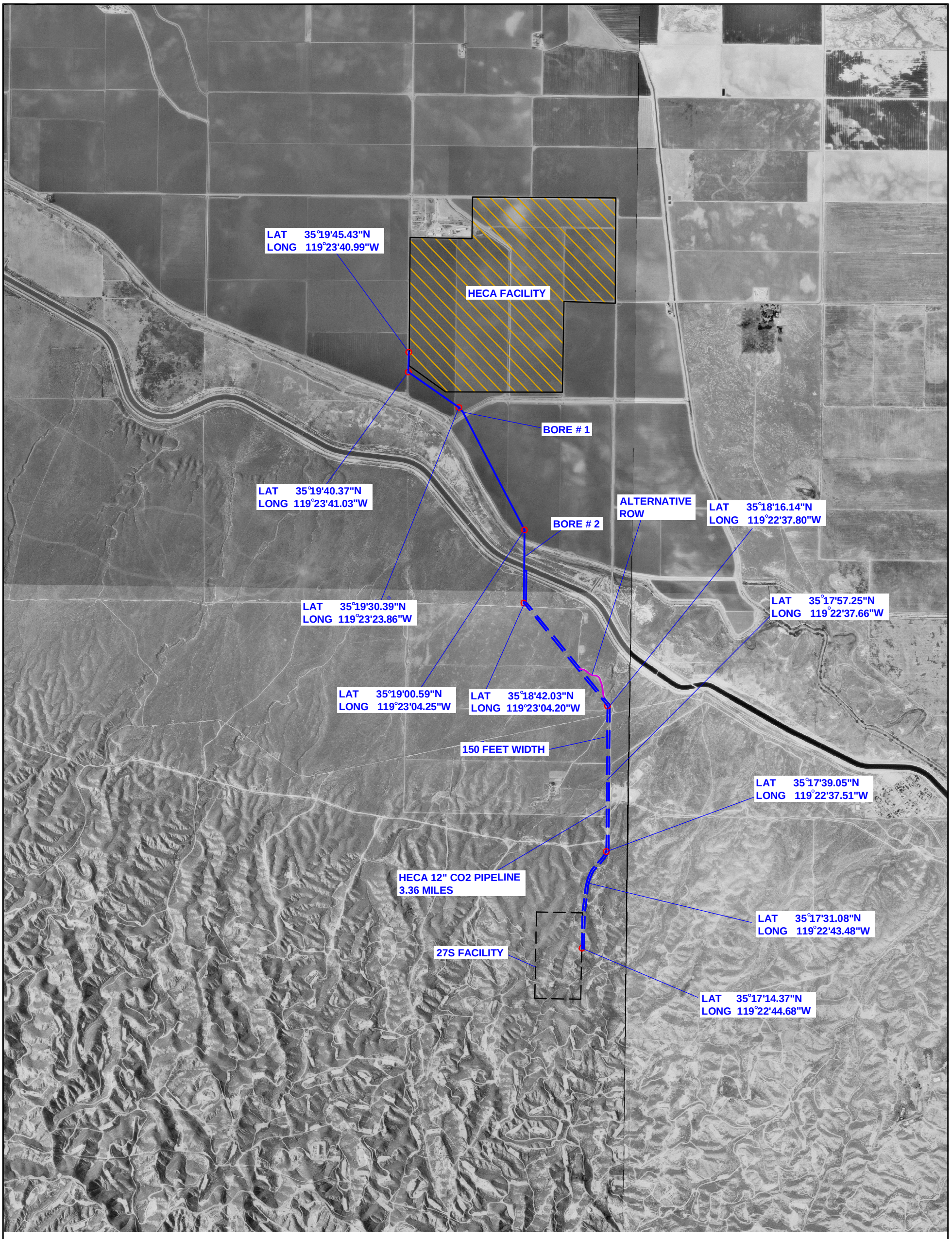
2.16 PALEONTOLOGICAL RESOURCES

The environmental consequences to paleontological resources evaluated by HECA from installation and operation of the CO2 supply line were based on a records search and a paleontological resources study that were alignment specific. Modification of the pipeline alignment would disturb areas that have not been previously considered. As a result, a substantial paleontological resources data gap has been identified based on the modification to the pipeline alignment. Therefore a supplemental paleontological resources study has been completed to evaluate the modification of the CO2 supply line alignment (Attachment B).

FIGURES



Sources: USGS (30'x60' quads: Taft 1982, Delano 1982). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. Kern County and State of California (proposed and approved projects).



NOTES:

1. MAP COORDINATES SYSTEM; NAD 83 CALIFORNIA STATE PLANES, ZONE 5 (FT.)
2. USGS 7.5 MINUTE TOPOGRAPHIC MAPS; EAST ELKS HILLS QUADRANGLE 1954, PHOTOREVISED 1973, TUPMAN QUADRANGLE 1954, PHOTOREVISED 1973.
3. TOPOGRAPHIC CONTOUR INTERVALS; EAST ELKS HILLS= 20 FEET; TUPMAN 20 FEET.

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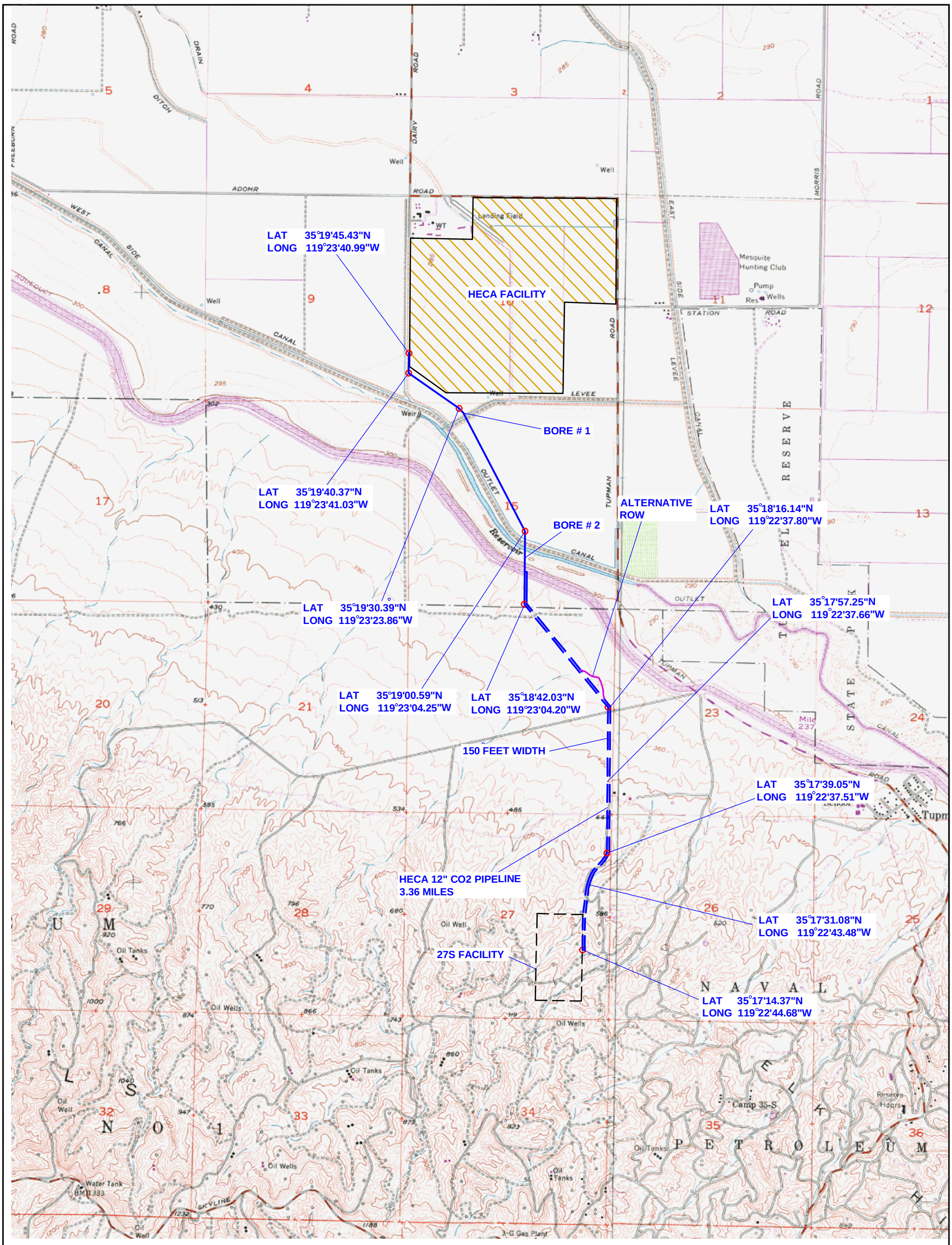
FOR:			FIGURE:
CO2 EOR PROJECT TUPMAN, KERN COUNTY, CALIFORNIA		CO2 SUPPLY LINE ALIGNMENT	2A
JOB NUMBER: 211302586	DRAWN BY: J.Barboza	CHECKED BY: J. May	APPROVED BY: M.Weber	DATE: 2/22/11



NOTES:

1. MAP COORDINATES SYSTEM;
   NAD 83 CALIFORNIA STATE PLANES,
   ZONE 5 (FT.)

2. USGS 7.5 MINUTE TOPOGRAPHIC MAPS;
   EAST ELKS HILLS QUADRANGLE 1954,
   PHOTOREVISED 1973,
   TUPMAN QUADRANGLE 1954,
   PHOTOREVISED 1973.

3. TOPOGRAPHIC CONTOUR INTERVALS;
   EAST ELKS HILLS= 20 FEET;
   TUPMAN 20 FEET.

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FOR:			FIGURE:
CO2 EOR PROJECT TUPMAN, KERN COUNTY, CALIFORNIA		CO2 SUPPLY LINE ALIGNMENT	2B
JOB NUMBER: 211302586	DRAWN BY: J.Barboza	CHECKED BY: J. May	APPROVED BY: M.Weber	DATE: 2/22/11

ATTACHMENT A

BIOLOGICAL RESOURCES STUDY FOR MODIFIED ALIGNMENT OF CO2 SUPPLY LINE

Biological Assessment for Modified Alignment of CO2 Supply Pipe Line

CO2 supply pipeline alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility
Tupman, Kern County, CA

April 18, 2012

Executive Summary

Occidental of Elk Hills, Inc. (OEHI) retained Stantec Consulting Corporation (Stantec) to conduct a field survey on February 24th and February 25th, 2011 to study and evaluate the potential impacts to biological resources based on the new proposed alignment for the carbon dioxide (CO2) supply pipeline for the CO2 Enhanced oil Recovery (EOR) Project (Project).

Several comprehensive technical biological assessment studies have been conducted within the existing Elk Hills Oil Field (EHOF) boundaries and adjacent lands (Project area). The most recent and comprehensive resource document that describes impacts to sensitive biological resources by oil field related activities within the EHOF is the Habitat Conservation Plan (HCP) for the Elk Hills Oil Field (Live Oak Associates, 2006). This HCP was initially prepared to obtain incidental take authorization for State of California and federally listed species and provides a comprehensive review of the species and their habitats mitigation measures to reduce impacts by oilfield related activities.

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1.0 INTRODUCTION

Occidental of Elk Hills, Inc. (OEHI) retained Stantec Consulting Corporation (Stantec) to conduct a field survey on February 24th and February 25th, 2011 to study and evaluate the potential impacts to biological resources based on the new proposed alignment for the carbon dioxide (CO2) supply pipeline for the CO2 Enhanced Oil Recovery (EOR) Project (Project).

The purpose of this report is to summarize the biological resources encountered during the field survey and evaluate the baseline environmental characteristics of the OEHI carbon dioxide (CO2) Enhanced Oil Recovery (EOR) delivery CO2 supply pipeline from the Hydrogen Energy of California (HECA) plant to the OEHI CO2 Processing Facility (Project area), which is proposed to be constructed in Section 27S. In addition, current baseline conditions will be documented and analyzed along the proposed CO2 supply pipeline alignment and surrounding areas should any changes to alignment be required in the future. This report has been prepared in addition to the Supplemental Environmental Information (SEI) for the OEHI CO2 EOR project.

Such evaluations are required by California Environmental Quality Act (CEQA) to ensure that potentially significant environmental impacts are assessed, mitigated and the public has an opportunity to review and comment on the proposed mitigation measures (Bass 1999).

1.1 BACKGROUND

The OEHI operates a large, mature oil production field in the Elk Hills Oil Field (EHOF) located approximately 26 miles southwest of Bakersfield in western Kern County, California, and covers approximately 48,000 acres. OEHI is proposing to extend its existing EOR operations by utilizing CO2 from the proposed HECA project to facilitate oil production from its Elk Hills operations.

2.0 PROJECT DESCRIPTION

2.1 GENERAL DESCRIPTION

The HECA project, which will be located approximately 4-miles north of Section 27S will generate CO2 from an Integrated Gasification Combined Cycle (IGCC) power plant. A CO2 supply pipeline alignment was initially proposed in order to facilitate the transportation of CO2 from the HECA facility to the CO2 OEHI CO2 Processing Facility within the EHOF boundaries in Section 27S ***(Figure 1)***. The most recent proposed alignment would have the CO2 supply pipeline being routed from the HECA facility and trending south towards the OEHI CO2 Processing Facility in Section 27S ***(Figure 2)***. The compound CO2 will be compressed from a gaseous to semi-aqueous state at the HECA plant and be transported by a CO2 supply pipeline to the OEHI CO2 Processing Facility to distribute the CO2 for EOR and sequestration. The CO2 supply pipeline route would utilize Horizontal Directional Drilling (HDD) technology to pass beneath the West Side Canal, the Kern River Flood Control Canal, and the California Aqueduct. South of the California Aqueduct the route trends primarily south towards the OEHI CO2 EOR Processing Facility. The exact location of the main OEHI CO2 Processing Facility will be determined by OEHI but is currently proposed for southeastern quarter of Section 27S.

With the exception of these water crossings, the CO2 supply pipeline will be installed below ground using cut and fill techniques. Installation of the CO2 supply pipeline will involve typical construction activities, including trenching; hauling and stringing pipe along routes; welding; radiographic inspection and coating pipe welds; lowering welded pipe along routes; hydrostatic testing; and backfilling and restoring the approximate surface grade.

2.2 ENVIRONMENTAL SETTING

This section includes a description of the land and surrounding land uses in the vicinity of the proposed Project area. Conditions on the Project area to be addressed include: climate, drainages, soil, and vegetation communities. Anthropomorphic, or human land uses, on and off the proposed Project area are also described.

The modified CO2 supply pipeline alignment currently trends north-south approximately 3.4 miles from the Section 27S facility, towards the HECA facility. Within the EHOF, the proposed alignment trends north along established roads and a current pipeline right-of-way (ROW) for most of its length until it bends 45 degrees to the west for approximately 2/3 of a mile before bending back 45 degrees to the north and exiting the EHOF. The Project area north of the California Aqueduct consists primarily of agricultural development and does not support habitat suitable for the target species of this technical report and was not analyzed. Additionally, current construction plans call for HDD techniques to be used in order to drill under the California Aqueduct. South of the California Aqueduct the land is relatively undisturbed until the alignment reaches the borders of the active oil production area within the OEHI unit.

A 250 ft wide corridor was surveyed along the entire alignment length of the proposed CO2 supply pipeline in order to establish a buffer zone. For most of its length within the EHOF the proposed alignment follows roads and or current pipeline line ROW's. Outside those disturbed areas and along the alignment where it does not follow disturbed roads or ROW's consist of large swaths of habitat and localized areas of heavy disturbance.

There are several unpaved, dirt roads that occur throughout the Project area. Access to these roads is limited. Several boundary fences and gates are also present throughout various portions of the Project area. Such fences and an abandoned homestead suggest the land was historically used for grazing.

The nearest community is Tupman, which is located 0.45 miles east of the northeastern most point along the proposed alignment of the CO2 supply pipeline, and the nearest large city is Bakersfield, which is located approximately 26 miles northeast.

2.2.1 Climate

The San Joaquin Valley is classified as having a Mediterranean climate (Kottek et al. 2006). Areas of the Southern San Joaquin Valley are further classified as having a climate of a low-latitude desert. Summers are relatively hot and dry, and temperatures frequently reach 90˚F and can reach up to 104˚F. In contrast, winters are cold and wet, with the regular occurrence of fog in many areas. The rainy season typically occurs during mid-autumn to spring; however, thunderstorms may occur during the late summer months. With an average rainfall of only 5.75 inches per year, most precipitation falls during winter and spring. Typically, no rain falls from May through September (NOAA 2010).

2.2.2 Drainages

The Project area lies on a transition zone between valley floor and foothill terrain. Drainages in the foothill areas consisted of undeveloped washes approximately 3-10 feet wide with very little vertical erosion. Lowland area drainages consisted of low (sink) zones and developed washes with approximately 4 to 10 feet of vertical erosion. During periods of intense rainfall, these drainages can fill up and most of the erosion occurs during these brief intervals of rainfall.

2.2.3 Vegetation Communities

The proposed Project area is located in the western portion of the southern San Joaquin Valley. The majority of the proposed Project area is characterized as Upper Sonoran grassland (Twisselman 1967, Holland 1995), Valley Sink Scrub, and Valley Saltbush Scrub. Large expanses of non native grassland are interspersed with patches of valley saltbush scrub along the length of the survey area.

Valley Saltbush scrub habitat is characterized by blue-green, grayish chenopod shrubs and other subshrubs located on mostly alkaline soils. Valley Saltbush Scrub habitat at Elk Hills is

dominated by desert saltbush (*Atriplex polycarpa*), although spiny saltbush (*Atriplex spinifera*), cheesebush (*Hymenoclea salsola*), and matchweed (*Gutierrezia bracteata*) are often present in less abundance (Elk Hills HCP 2006). Traditionally, empty spaces within the canopy were sparsely populated by native grasses and forbs. With the introduction of non-native invasive grasses and forbs, areas of open canopy are typically dominated by grasses and forbs found in the non-native grassland described below.

Non-native grassland is typically comprised of introduced species of European origin. Previous site surveys of the EHOF and surround properties identify several dominant species including: red brome (*Bromus madritensis ssp. rubens*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), rattail fescue (*Vulpia myuros*), and wild oats (*Avena fatua*). The most dominant forbs found within non-native grasslands include red-stemmed Filaree (*Erodium cicutarium*), and ranchers fireweed (*Amsinckia intermedia*). Other commonly observed species include buckwheat (Eriogonum sp.), prickly lettuce (*Latuca serriola*), and lupines (*Lupinus sp.)* (Elk Hills HCP 2006).

Valley Sink Scrub is extremely limited in extent within the Project area. Where present, this habitat generally consists of low-lying arroyos or sandy washes surrounded by valley saltbush scrub habitat. Although rainwater may flow through these washes during storm events, sink scrub habitats are dry most of the year. Plants within this habitat are generally taller and denser than those of surrounding scrub-lands, but consist of the same species found in the valley saltbush scrub (Elk Hills HCP 2006).

2.2.4 Wildlife Communities

The proposed Project is located in the southwestern San Joaquin Valley, which historically, was composed of millions of acres of wetlands (CERES 2010), Valley Saltbush Scrub, Valley Sink Scrub, and native grasslands that supported diverse populations of wildlife. The proposed Project area is not expected to support any wetland or riparian habitats, though canals and other irrigations features on the northern portion of the proposed Project have often been used by wetland species. The Project is located in a transitional zone between valley and foothill ecological communities and resulting in a variety of plant and wildlife species occurring within the area.

3.0 METHODS

3.1 LITERATURE SEARCH

Prior to the field surveys conducted on February 24 and 25, a literature search and desktop analysis of the proposed Project area was conducted to gather any pertinent information for sensitive species that may occur in the area. Desktop analysis included the review of the California Natural Diversity Data Base (CNDDB)(2011), the California Native Plant Society (CNPS) Online Rare Plant Inventory (2011), CNPS's A Manual of California Vegetation (2000); the U.S. Fish and Wildlife Service Critical Habitat for Threatened and Endangered Species mapper (2011), U.S Fish and Wildlife Service species lists by quad search (2011), the Elk Hills Habitat Conservation Plan (2006), the Kern Valley Floor Habitat Conservation Plan (2006), and the 2001 Special status plant species survey results at Elk Hills Oil Field, Kern County, CA, and professional experience in the area. ***Table 1*** lists sensitive species with potential to occur in and around the proposed Project area, federal/state and other status, preferred habitat, and potential for occurring within the Project area.

Desktop analysis also included the review of topographical maps and aerials. A preliminary vegetation map was also produced to aid in the field and was finalized after field surveys to confirm the presence of the vegetation found on the Project area. The vegetation classification schemes used were based on the CNPS' A Manual of California Vegetation (2000) and Holland and Keil's California Vegetation (1995). Maps were constructed using aerial photographs and ground surveys.

A map was also produced that depicted the GPS locations of occurrences of sensitive species in the area from the CNDDB data obtained for the proposed Project area ***(Figure 3)***.

3.2 SURVEY TECHNIQUES

A terrestrial survey was conducted on February 24th and 25th, 2011. A qualified biologist conducted linear pedestrian transects along the most recent proposed alignment of the CO2 supply pipeline, provided prior to surveying. Figure 1 depicts a general vicinity map of the area, and Figure 2 shows the latest proposed alignment of the CO2 supply pipeline, which includes the area surveyed. Surveys were conducted along the proposed Project boundaries identifying vegetative and topographic conditions. Surveys to identify and/or observe wildlife and plants, confirmation of vegetation communities, and presence of sensitive habitats were concurrently conducted. Survey methods and results are described in greater detail below. Survey results were mapped in ***Figure 3***.

3.2.1 Vegetation

Botanical surveys following CDFG 2009 survey guidelines have not been conducted for the CO2 supply line alignment. However, terrestrial surveys were conducted on the proposed Project area to confirm the existence of the vegetation classes expected to occur on the Project area. Surveys were also performed to examine existing drainages on the Project area for any significant vegetation groups not anticipated on the Project area. Surveys concentrated on areas where construction was planned to occur according to proposed Project plans and descriptions provided by OEHI.

3.2.2 Wildlife

Wildlife surveys were conducted to determine if habitat existed for any sensitive wildlife species that may occur in the area. The survey was also conducted to determine the presence of all wildlife species and their signs. Identification of species and potential habitat was determined by searching for burrows, tracks, scat, nests, prey remains, hair, calls, other signs and direct observations. Linear pedestrian transects were conducted in areas that were accessible and where construction was to occur according to the Project plans and descriptions provided prior to the start of surveys. Areas that contained high burrowing activity were especially scrutinized. Global Positioning System (GPS) locations were taken for marking and mapping the location of notable findings.

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area

Species	Listing Status	Habitat Association	Potential within Project area
BIRDS			
Tricolored blackbird (*Agelaius tricolor*)	CSC	Freshwater marsh, and other freshwater wetland habitats.	Suitable Habitat is not present within survey boundaries. **Low Potential**
Burrowing owl (*Athene cunicularia*)	MBTA, CSC	Inhabits open, dry annual or perennial grasslands, desert and scrublands characterized by low-growing vegetation.	Suitable habitat is present on site. Several CNDDB records near proposed project area. **High Potential**
Mountain plover (*Charadrius montanus*)	FC, CSC	Chenopod Scrub and Valley and foothill grasslands.	Suitable habitat exists within survey boundaries. **Moderate Potential**
Le Conte's thrasher (*Toxostoma lecontei*)	MBTA, CSC	Commonly nests in a dense, spiny shrub or densely branched cactus in desert wash habitat, usually 0.6-2.4m above the ground.	Marginal habitat is present within survey boundaries. **Low Potential**
Loggerhead shrike (*Lanius ludovicianus*)	MBTA, CSC	Inhabits broken woodlands, savannah, pinyon-juniper, Joshua tree and riparian woodlands,	Marginal habitat is present within survey boundaries. One individual was observed during surveys.

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area			
Species	**Listing Status**	**Habitat Association**	**Potential within Project area**
		desert oases, scrub and washes.	**High Potential**
MAMMALS			
American badger (*Taxidea taxus*)	CSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils.	This species was not observed during surveys, however, burrows consistent with badger burrows were observed near within the survey boundaries. **High Potential**
Giant kangaroo rat (*Dipodomys ingens*)	FE, SE	Inhabits annual grasslands on the western side of the San Joaquin Valley, marginal habitat in alkali scrub.	Suitable habitat is present along the proposed CO2 supply pipeline alignment. CNDDB indicates several occurrences within or near survey boundaries. **High Potential**
San Joaquin antelope squirrel (*Ammospermophilus nelsoni*)	ST	Found on the western San Joaquin Valley from 50-350m elevation on dry, sparsely vegetated loam soils.	Suitable habitat is present along proposed alignment. Several occurrences in CNDDB near survey boundaries. **High Potential**
San Joaquin kit fox (*Vulpes macrotis mutica*)	FE, ST	Inhabits annual grasslands or grassy open stages with scattered shrubby vegetation.	Suitable habitat is present along proposed alignment, CNDDB occurrences in area and potential dens observed during surveys. **High Potential**
Short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*)	CSC	Found on the western side of San Joaquin Valley in grassland and desert scrub associations, especially *Atriplex*.	Potential habitat occurs within survey areas on the west side of the California Aqueduct. **High Potential**
Tipton kangaroo rat (Dipodomys nitratoides nitratoides)	FE, SE	Historically found in the saltbush scrub and sink communities of the southern san Joaquin Valley and Tulare lake basin. Now restricted to scattered isolated areas.	Several sightings recorded in the CNDDB near survey boundaries on the northeast side of the California Aqueduct. **Low Potential**
Tulare grasshopper mouse *(Onychomys torridus tularensis)*		Inhabits hot, arid valleys and scrub deserts in the Southern San Joaquin Valley.	Potential habitat occurs along proposed alignment. **Moderate Potential**
Buena Vista Lake Shrew (*Sorex ornatus relictus*)	FE, CSC	Marsh, swamp and riparian scrub.	No suitable habitat found within survey boundaries.

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area			
Species	**Listing Status**	**Habitat Association**	**Potential within Project area**
			Low Potential
REPTILES			
Blunt-nosed leopard lizard (*Gambelia sila*)	FE, SE, SP	Inhabits sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief.	Suitable habitat is present on the lowland portions of proposed alignment. CNDDB occurrences near area and prior protocol level surveys conducted near project showed presence of several individuals. **High Potential**
San Joaquin whipsnake (*Masticophis flagellum ruddocki*)	CSC	Found in the San Joaquin Valley in open, dry areas with little or no tree cover within grassland and saltbush scrub communities.	Suitable habitat found within survey boundaries. **High Potential**
Giant Garter snake (*Thamnophis gigas)*	FT, ST	Highly aquatic snake found in the San Joaquin valley riparian and wetland areas.	Suitable habitat is found near survey boundaries and a CNDDB search revealed an occurrence near Project area on the east/north side of the California Aqueduct. **Moderate Potential**
Western pond turtle (*Actinemys marmorata*)	CSC	Thoroughly aquatic turtle of ponds, marshes, streams, and canals with aquatic vegetation.	Suitable habitat is found within project area and occurrences near the project area are recorded in the CNDDB on the east/north side of the California Aqueduct. **Low Potential**
PLANTS			
California jewelflower (*Caulanthus californicus*)	FE, SE, CNPS 1B.1	Inhabits flats, gentle slopes generally in non-alkaline grassland. Also found in open juniper woodland from 70-1000 m. Found in southern San Joaquin Valley.	This species was not observed during botanical surveys And has never been recorded within the EHOF. **Low Potential**
Slough thistle (*Cirsium crassicaule*)	1B.1	Chenopod Scrub, Freshwater marsh and riparian scrub.	Potential habitat exists near Buena vista slough. **Low Potential**
Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*)	CNPS 1B.1	Inhabits saline places and vernal pools below 1000 m. Found in Tehachapi, southern	This species was not observed during botanical surveys And has never been recorded within the

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area			
Species	**Listing Status**	**Habitat Association**	**Potential within Project area**
		Outer South Coast Ranges, South Coast, Peninsular Ranges and western Mojave Desert.	EHOF. **Low Potential**
Heartscale (*Atriplex cordulata*)	CNPS 1B.2	Inhabits saline or alkaline soils below 200 m. Found in Sacramento and San Joaquin Valleys.	This species was not observed during botanical surveys And has never been recorded within the EHOF. **Low Potential**
Horn's milk vetch (*Astragalus hornii var. hornii*)	CNPS 1B.1	Inhabits salty flats and lakeshores from 60-150 m. Found in southern San Joaquin Valley, Western Transverse Range and the western edge of the Mojave Desert.	This species was not observed during botanical surveys and has never been recorded within the EHOF. **Low Potential**
Hoover's eriastrum (*Eriastrum hooveri*)	CNPS 4.2	Inhabits drying grassy areas below 170 m. Found in southern and eastern South Coast Range.	Suitable habitat exists within the survey area and surroundings. The species has been recorded in 66 sections throughout the EHOF. **High Potential**
Jared's pepper-grass (*Lepidium jaredii* ssp. *jaredii*)	CNPS 1B.2	Inhabits alkali bottoms, slopes and washes below 500 m. Found in South Coast Interior Range and San Joaquin Valley.	This species was not observed during botanical surveys and has never been recorded within the EHOF. **Low Potential**
Kern mallow (*Eremalche kernensis*)	FE, CNPS 1B.1	Found in Kern and San Luis Obispo Counties on eroded hillsides and alkali flats with shadscale from 100-1000 m.	Suitable habitat is present within the survey area; however the species has never been recorded within the EHOF. **Low Potential**
Lemmon's jewelflower (*Caulanthus coulteri* var. *lemmonii*)	CNPS 1B.2	Inhabits dry, exposed slopes from 80-2000 m. Found in San Joaquin Valley, San Francisco Bay, and South Coast Ranges.	This species was not observed during botanical surveys and the species has never been recorded within the EHOF. **Low Potential**
Lost Hills crownscale (*Atriplex vallicola*)	CNPS 1B.2	Inhabits dried ponds and alkaline soils below 200 m. Found in San Joaquin Valley.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present and it is known to occur within the EHOF. **Moderate Potential**

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area			
Species	**Listing Status**	**Habitat Association**	**Potential within Project area**
Munz's tidy-tips (*Layia munzii*)	CNPS 1B.2	Inhabits alkaline clay soils below 700 m. Found in San Joaquin Valley.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present. **Low Potential**
Oil neststraw (*Stylocline citroleum*)	CNPS 1B.1	Inhabits flats and clay soils in oil-producing areas from 50-400 m. Found in southern San Joaquin Valley and San Diego county.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present and CNDDB records show multiple occurrences in the survey area. **High Potential**
Pale-yellow layia (*Layia heterotricha*)	CNPS 1B.1	Inhabits open, clay soils below 1600 m. Found in southern Tehachapi, western San Joaquin Valley, and South Coast and Western Transverse Ranges.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present. **Low Potential**
Recurved larkspur (*Delphinium recurvatum*)	CNPS 1B.2	Inhabits poorly drained, fine, alkaline soils in grassland and *Atriplex* scrub from 30-600 m. Found in Sacramento and San Joaquin Valleys.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present, and CNDDB records show multiple occurrences within the survey area and its surroundings. **Moderate Potential**
San Joaquin bluecurls (*Trichostema ovatum*)	CNPS 4.2	Inhabits valley and foothill grasslands from 65-300 m. Found in southwestern San Joaquin Valley.	Potential habitat exists within the survey area. **Low Potential**
San Joaquin woollythreads (Lembertia [*Monolopia*] *congdonii*)	FE, CNPS 1B.2	Inhabits sandy grasslands and alkali sink from 90-700 m. Found in southwestern San Joaquin Valley.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present. **Low Potential**
Tejon poppy (*Eschscholzia lemmonii* ssp. *kernensis*)	CNPS 1B.1	Inhabits grassy, open areas from 0-2000 m. Found in southwestern Tehachapi, and the northern portion of the Western Transverse Ranges.	This species was not observed during botanical surveys; however, habitat is suitable for the species to be present. CNDDB records and floristic survey data show

Table 1: Regionally Present Sensitive Species and their Potential to Occur on the Project Area			
Species	**Listing Status**	**Habitat Association**	**Potential within Project area**
			occurrences near survey areas. **High Potential**
Temblor buckwheat (*Eriogonum temblorense*)	CNPS 1B.2	Inhabits barren clay in grassland and sandstone outcrops from 300–1000 m. Found in east Monterey, east San Luis Obispo and West Kern Counties.	This species was not observed during botanical surveys; however, habitat is marginally suitable for the species to be present. **Low Potential**

LISTING STATUS	
FE = Federally listed Endangered FT = Federally listed Threatened FC = Federal Candidate FD = Federally de-listed CNPS 1B = Plants considered by CNPS to be rare, threatened, or endangered in California, and elsewhere CNPS 4= Plants considered by CNPS to have limited distribution. CNPS .1= seriously threatened in California. CNPS .2= fairly threatened in California.	SE = State listed Endangered ST = State Listed Threatened SP = State Protected Species CSC = California Species of Special Concern MBTA = Migratory Bird Treaty Act

4.0 RESULTS

The areas covered during the biological surveys conducted on February 24th and 25th, 2011 and the findings are discussed in the following sections.

4.1 VEGETATION

Vegetation observed during the biological survey was limited to common native and invasive plant species found in the EHOF and surrounding areas. These plant species are summarized in **Table 2**. No threatened, endangered, or any other sensitive plant species were observed during the biological survey period. The survey was not conducted during the optimal phenological period and the biologist used common identification methods in order to identify annual forbs and grasses. As such, Table 2 should only be used as a baseline for identifying community type and should not be treated as a comprehensive species list for the CO2 supply pipeline alignment. Additional general vegetation surveys and protocol level rare plant surveys should be conducted during optimal periods once the CO2 supply pipeline alignment is finalized.

The current iteration of the CO2 supply pipeline alignment places it directly through three plant communities and an agricultural zone along a transition from valley floor to foothill communities.

Generally, the project area is flat to gently sloping in the northern portion, moderately sloped in the central portion and steeply sloped in the southern portion. Non-native grassland dominates the steeper slopes of the southern-most portions of the project area. Vegetation associated with valley sink scrub is intermixed in the southern foothill regions in low lying washes and drainages. Vegetation in these areas is comprised of thick carpets of non-native invasive grasses and native grasses and forbs. Significant stands of fiddleneck (*Amsinckia sp.*) and (*Bromus sp.*) were the dominant plant species throughout much of the upland sloped terrain. An occasional saltbush (*Atriplex polycarpa*) stand was interspersed among the grasses and forbs. In general, shrub density increased as slope angle decreased along the foothill-valley transition. Vegetation density was highest in higher elevations and increased slope angles.

In more northerly, shallow sloped areas of the survey, vegetation consists almost entirely of non-native and native grasses and forbs. Very few shrubs were observed in these areas. Vegetation density in these areas was highest in low lying seeps and drainages.

Table 2: Botanical Survey Results for the OEHI CO2 EOR CO2 Supply Pipeline Alignment	
Plant Species Observed	
Scientific Name	**Common Name**
Amsinckia sp.	Fiddleneck
Astragalus lentiginosus	Speckled Milkvetch or Mottled Locoweed
Atriplex polycarpa	Valley/desert Saltbush
Atriplex spinifera	Spiny Saltbush
Avena fatua	Common wild oats
Brassica nigra	Black mustard
Bromus diandrus	Ripgut brome
Bromus madritensis spp. rubens	Red brome
Bromus hordeaceus	Soft chess
Camissonia californica	California Sun Cup
Centaurea melitensis	Tocalote
Eremocarpus setigerus	Turkey mullein
Erodium cicutarium	Red-stemmed filaree
Gutierrezia braceata	Matchweed
Helianthus annus	Annual sunflower
Hemizonia pungens	Common Spikeweed
Hordeum sp.	Barley
Hymenoclea salsola	Cheesebush
Layia glandulosa	White Tidy Tips
Lepidium dictyotum.	Peppergrass
Phacelia tanacetifolia	Tansy Leafed Phacelia
Plagiobothrys sp.	Popcorn flower
Poa sp.	Blue grass
Stephanomeria sp.	Wire Lettuce
Vulpia myuros	Rattail fescue

4.1.1 Listed and Sensitive Plant Species

No federal and/or state listed or otherwise sensitive plant species were observed on any portion of the proposed Project area during biological field surveys. Surveys were not conducted during the proper phenological blooming periods and thus detection is difficult if not impossible. Federally listed plants known to be found in similar habitat in surrounding areas include the federally endangered San Joaquin woollythreads (*Lembertia [Monolopia] congdonii*); Federally endangered Kern mallow (*Eremalche kernensis*); and federally and state endangered California jewelflower (*Caulanthus californicus*). Protocol level rare plant surveys should be conducted following finalization of CO2 supply pipeline alignment. A complete list of listed and sensitive plants, required habitat, and potential to occur within the Project area are located in Table 1.

4.2 WILDLIFE

Wildlife species and/or signs of presence observed during field surveys conducted on February 24th and February 25th, 2011 are presented in ***Table 3***. No visual observations of threatened,

endangered, or otherwise sensitive species were visually observed during the biological field survey. A lone Coyote (*Canis latrans*) was observed east of the survey area. Numerous small mammal and reptile burrows were found within the surveyed areas. Several large mammal dens (Coyote, San Joaquin Kit Fox, badger) were located within the survey area. The large mammal dens did not exhibit any signs of current occupancy and were partially backfilled and/or collapsed.

Small mammal and reptile burrows were most numerous on gently sloped or flat surfaces south of the California Aqueduct. Vegetation in these areas consisted of marginal native and non-native grasses and forbs. A high concentration of small mammal and reptile burrows was also located on the perimeter of the roads and current CO2 supply pipeline ROW's that the current alignment follows for most of its length within EHOF. While no definitive evidence was found, certain characteristics of Giant Kangaroo Rat habitation (vertical, appropriately sized burrows, elaborate burrow systems, and clear cutting) were observed in shallow sloped areas near previously identified CNDDB observations.

Large mammal burrows were most numerous on the steeper sloped terrain in the southern portion of the survey areas.

Focused surveys for Swainson's hawk nests, golden eagle nests, and burrowing owls have not been performed for the CO2 supply line. As required by the EHOF HCP, biological pre-activity surveys are conducted by qualified biologist's prior to ground disturbance activities. Biological data associated with these species are provided in the EHOF HCP semi-annual and annual reports provide to the wildlife agencies.

Table 3: Wildlife Species Observed Results for the OEHI CO2 EOR CO2 Supply Pipeline Alignment		
Wildlife Species Observed		
Scientific Name	**Common Name**	**Occurrence**
Buteo jamaicensis	Red-tailed hawk	Visual
Canis latrans	Coyote	Visual, Appropriate dens (size, shape), scat
Cathartes aura	Turkey vulture	Visual
Corvus corax	Common raven	Visual
Circus cyaneus	Northern harrier	Visual
Falco sparverius	American Kestrel	Visual
Lanius ludovicianus	Loggerhead Shrike	Visual
Sturnella neglecta	Western Meadowlark	Visual, Audible Calls
Taxidea taxus	American badger	Appropriate den (indicative horizontal claw marks, size)
Uta stansburiana	Common side blotched lizard	Visual

Vulpes macrotis mutica	San Joaquin kit fox	Appropriate dens (size, shape, layout)

4.2.1 Listed and Sensitive Wildlife Species

With the exception of the Logger head shrike, no federal and/or state listed or otherwise sensitive wildlife species were observed on any portion of the proposed Project area during the initial biological field survey. However, the Project area is within the known range of multiple listed or sensitive species. Protocol levels surveys should be conducted for all federal and state threatened or endangered species in project areas with suitable habitat prior to construction.

Federal and State listed species with known ranges, suitable habitat, or have occurrences listed in the CNDDB near the Project area include: the federal and state endangered, and state fully protected blunt-nosed leopard lizard (*Gambelia sila*); federal and state threatened giant garter snake (*Thamnophis gigas*); federal and state endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*); federal endangered and state threatened San Joaquin kit fox (Vulpes macrotis mutica); state threatened San Joaquin antelope squirrel (*Ammospermophilus nelson*) and the federal and state endangered giant kangaroo rat (*Dipodomys ingens*).

Other sensitive species with known ranges, suitable habitat, or have occurrences listed in the CNDDB near the Project area include: the California species of special concern (CSC) listed Western burrowing owl (*Athene cunicularia*), Le Conte's thrasher (*Toxostoma lecontei*), loggerhead shrike (*Lanius ludovicanius*), American badger (*Taxidea taxus*), short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*), Tulare grasshopper mouse (*Onychomys torridus tularensis*), San Joaquin whipsnake (*Masticophis flagellum ruddocki*), and western pond turtle (*Actinemys marmorata*).

5.0 CONCLUSIONS

The modified CO2 supply pipeline alignment follows previously disturbed roads and above ground CO2 supply pipelines for most of its length within the EHOF (***Figure 2***). Vegetation communities and habitat types within the survey area are similar to those in surrounding areas. The 250 foot wide survey area included the proposed CO2 supply pipeline alignment and 125 foot wide buffer on either side. In cases where the CO2 supply pipeline alignment followed roads and/or disturbed areas already containing above ground supply pipelines, the buffer areas were established outside the disturbed areas. Additional protocol level surveys should be conducted for all areas of the CO2 supply pipeline alignment within EHOF upon initiation of any trenching. Trenches left open during construction should have earthen wildlife escape ramps spaced no greater than 1,000 feet apart at a slope no greater than 2:1. Trenches should be monitored daily by a qualified biologist prior to beginning work each day. Special care should be taken in areas where the proposed alignment does not follow roads and or existing lines. In areas where the proposed CO2 supply pipeline follows roads and existing CO2 supply pipelines, construction should be confined to previously disturbed areas when possible in order to reduce impacts to surrounding undisturbed habitat.

One sensitive species; the CSC listed Loggerhead Shrike was observed during the survey. Potential habitat and signs of other listed species were observed within the survey area. Species specific surveys should be conducted prior to any disturbance.

It should also be noted that OEHI holds a 12 year site-wide streambed alternation maintenance permit as required by 14 CCR Sections 1601 and 1603 of the Fish and Game Code. The current permit for OEHI expires in the year 2020. If it is determined that the activity may substantially adversely affect fish and wildlife resources within state jurisdictional waters, a Lake or Streambed Alteration Agreement will be prepared.

Some activities proposed as part of the CO2 EOR Project could be covered by the Maintenance Streambed Alteration Agreement, could affect drainages not under the jurisdiction of the CDFG, or could necessitate issuance of a Standard Streambed Alteration Agreement. OEHI will comply with the requirements of the CDFG Code, including permitting and reporting. In addition, the EHOF contains no U.S. Army Corps of Engineers jurisdictional waters and installing the CO2 supply line under the California Aqueduct and nearby canal via HDD techniques is expected to avoid the need to obtain a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers.

6.0 ADDENDUM INTRODUCTION

As part of a comprehensive biological evaluation, Stantec conducted a second survey of the Modified CO2 supply pipeline alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility on April 14, 2011. This survey was designed to evaluate botanical and wildlife resources located on or adjacent to the Modified Alignment. When taken in conjunction with the previous survey in March, the results of the April survey reflect a wide time period that corresponds with typical early and late blooming flora found on the EHOF and surrounding lands. By conducting surveys during both early and late spring, Stantec was able to ensure far greater accuracy regarding the presence or absence of sensitive plant species.

7.0 ADDENDUM METHODS

Prior to conducting the April 2011 survey, Stantec biologists thoroughly reviewed previous research referenced in the Biological Assessment for Modified Alignment of CO2 Supply Pipe Line. Special attention was given to plant species known to bloom in April and May.

The terrestrial survey was conducted on April 14, 2011. A qualified biologist conducted linear, 10 Meter wide, pedestrian transects along the most recent proposed alignment of the CO2 supply pipeline, provided prior to the initial March survey. Surveys were conducted along the proposed Project boundaries identifying vegetative and topographic conditions. Surveys to identify and/or observe wildlife and plants, confirmation of vegetation communities, and presence of sensitive habitats were concurrently conducted. Survey methods and results are described in greater detail below.

7.1 VEGETATION

Terrestrial surveys were conducted on the proposed Project area to confirm the presence or absence of sensitive plant species expected to occur on the Project area. Surveys concentrated on areas where construction was planned to occur according to proposed Project plans and descriptions provided by OEHI.

7.2 WILDLIFE

Wildlife surveys were conducted to determine if habitat existed for any sensitive wildlife species that may occur in the area. The survey was also conducted to determine the presence of all wildlife species and their signs. Identification of species and potential habitat was determined by searching for burrows, tracks, scat, nests, prey remains, hair, calls, other signs, and direct observations. Linear pedestrian transects were conducted in areas that were accessible and where construction was to occur according to the Project plans and descriptions provided prior to the start of surveys. Areas that contained high burrowing activity were especially scrutinized. Global Positioning System (GPS) locations were taken for marking and mapping the location of notable findings.

8.0 ADDENDUM RESULTS

The findings of the April 14, 2011 biological assessment survey are discussed in detail below.

8.1 VEGETATION

Vegetation observed during the terrestrial survey was typical of that found on the EHOF and surrounding lands. A complete list of common plants species observed during the April 2011 survey can be found in ***Table 4*** below.

Table 4: Botanical Survey Results for the OEHI CO2 EOR CO2 Supply Pipeline Alignment	
Common Plant Species Observed April 14, 2011	
Scientific Name	**Common Name**
Achracheana mollis	Blow wives
Amsinckia sp.	Fiddleneck
Astragalus lentiginosus	Speckled Milkvetch or Mottled Locoweed
Atriplex polycarpa	Valley/desert Saltbush
Atriplex spinifera	Spiny Saltbush
Avena barbatus	Slender wild oats
Avena fatua	Common wild oats
Brassica nigra	Black mustard
Bromus diandrus	Ripgut brome
Bromus madritensis spp. rubens	Red brome
Bromus hordeaceus	Soft chess
Camissonia californica	California Sun Cup
Castilleja exserta ssp. exserta	Purple owl's clover
Centaurea melitensis	Tocalote
Chamomilla sauveolens	Pineapple weed
Cryptantha sp.	Cryptantha
Cucurbita palmate	Coyote melon
Dichelostemma capitatum	Blue dicks
Eremocarpus setigerus	Turkey mullein
Erodium cicutarium	Red-stemmed filaree
Eastwoodia elegans	Yellow mock aster
Gutierrezia braceata	Matchweed
Filago californica	Filago
Helianthus annus	Annual sunflower
Hemizonia pungens	Common Spikeweed
Hirshfeldia incana	Mustard
Hordeum sp.	Barley
Hymenoclea salsola	Cheesebush
Isomeris arborea	Bladderpod
Layia glandulosa	White Tidy Tips

Table 4: Botanical Survey Results for the OEHI CO2 EOR CO2 Supply Pipeline Alignment	
Common Plant Species Observed April 14, 2011	
Scientific Name	**Common Name**
Lepidium dictyotum.	Peppergrass
Linanthus liniflorous	Lewis' flax
Lupinus bicolor	Bi-colored lupine
Malocothrix californica	Wild marigold
Melilotus indica	Sour clover
Mentzelia affinis	Blazing star
Phacelia tanacetifolia	Tansy Leafed Phacelia
Plagiobothrys sp.	Popcorn flower
Poa secunda var. secunda	Blue grass
Salvia carduacea	Thistle sage
Schismus arabicus	Arabian grass
Stephanomeria pauciflora var. pauciflora	Wire Lettuce
Stylocline gnaphaloides	Everlasting nestraw
Vulpia myuros	Rattail fescue
Note: Table 4 only includes a list of common plants species observed. Listed and sensitive plant species observed are discussed in Section 8.1.1.	

8.1.1 Listed and Sensitive Plant Species

Two listed or sensitive plant species were observed during the survey: *Stylocline citroleum* (Oil nestraw) and *Eriastrum hooveri* (Hoover's eriastrum). Both species were found concurrently at 35° 17' 57.493"N, 119° 22' 35.844"W (Datum WGS 1984) along a roadside running north-south parallel to power lines. Hoover's eriastrum is listed as a CNPS 4.2, while Oil nestraw is listed as a CNPS 1B. No other listed or sensitive plant species were observed during the survey.

8.1.2 Wildlife Species Observed

Wildlife species and/or signs of presence observed during field surveys conducted during the April 14, 2011 survey are presented in ***Table 5***.

Numerous small mammal and reptile burrows were found within the surveyed areas. Several large mammal dens (*Canis latrans, Vulpes macrotis mutica, Taxidea taxus*) were located within the survey area. The large mammal dens did not exhibit any signs of current occupancy and were partially backfilled and/or collapsed. All dens corresponded with the March 2011 survey. No new signs of activity or new den locations were observed.

Multiple small mammal and reptile burrows were observed during the survey.

While no definitive evidence was found, certain characteristics of Giant Kangaroo Rat habitation (vertical, appropriately sized burrows, elaborate burrow systems, and clear cutting) were

observed in shallow sloped areas near previously identified CNDDB observations. These observations concur with the March 2011 survey.

Table 5: Wildlife Species Observed Results for the OEHI CO2 EOR CO2 Supply Pipeline Alignment		
Wildlife Species Observed April 14, 2011		
Scientific Name	**Common Name**	**Occurrence**
Aspidoscelis tigris	Western whiptail	Visual
Canis latrans	Coyote	Appropriate dens (size, shape), scat
Corvus corax	Common raven	Visual
Lanius ludovicianus	Loggerhead Shrike	Visual
Sturnella neglecta	Western Meadowlark	Visual, Audible Calls
Taxidea taxus	American badger	Appropriate den (indicative horizontal claw marks, size)
Uta stansburiana	Common side blotched lizard	Visual
Vulpes macrotis mutica	San Joaquin kit fox	Appropriate dens (size, shape, layout)

8.1.3 Listed or Sensitive Wildlife Species

Only one listed or sensitive species was directly observed during surveys. One *Lanius ludovicianus* (Loggerhead Shrike) individual was observed perched on a power line near a tank farm. The Loggerhead shrike is listed as a CDFG Species of Special Concern. While some evidence of Dipodomys ingens (Giant kangaroo rat) activity was observed adjacent to the Project, trapping would be necessary to confirm presence.

9.0 ADDENDUM CONCLUSION

The April 2011 survey results allow for a more comprehensive and accurate biological analysis. The March and April surveys showed many of the same species to be present and no new large mammal dens or signs of activity were found during the April 2011 survey. No Blunt-nosed leopard lizards were observed. Certain characteristics of Giant kangaroo rat activity were observed but no conclusive determination of presence or absence can be made. Two sensitive plants species were observed: Oil nestraw, and Hoover's eriastrum. No other listed or otherwise sensitive flora or fauna were observed during the April 2011 survey.

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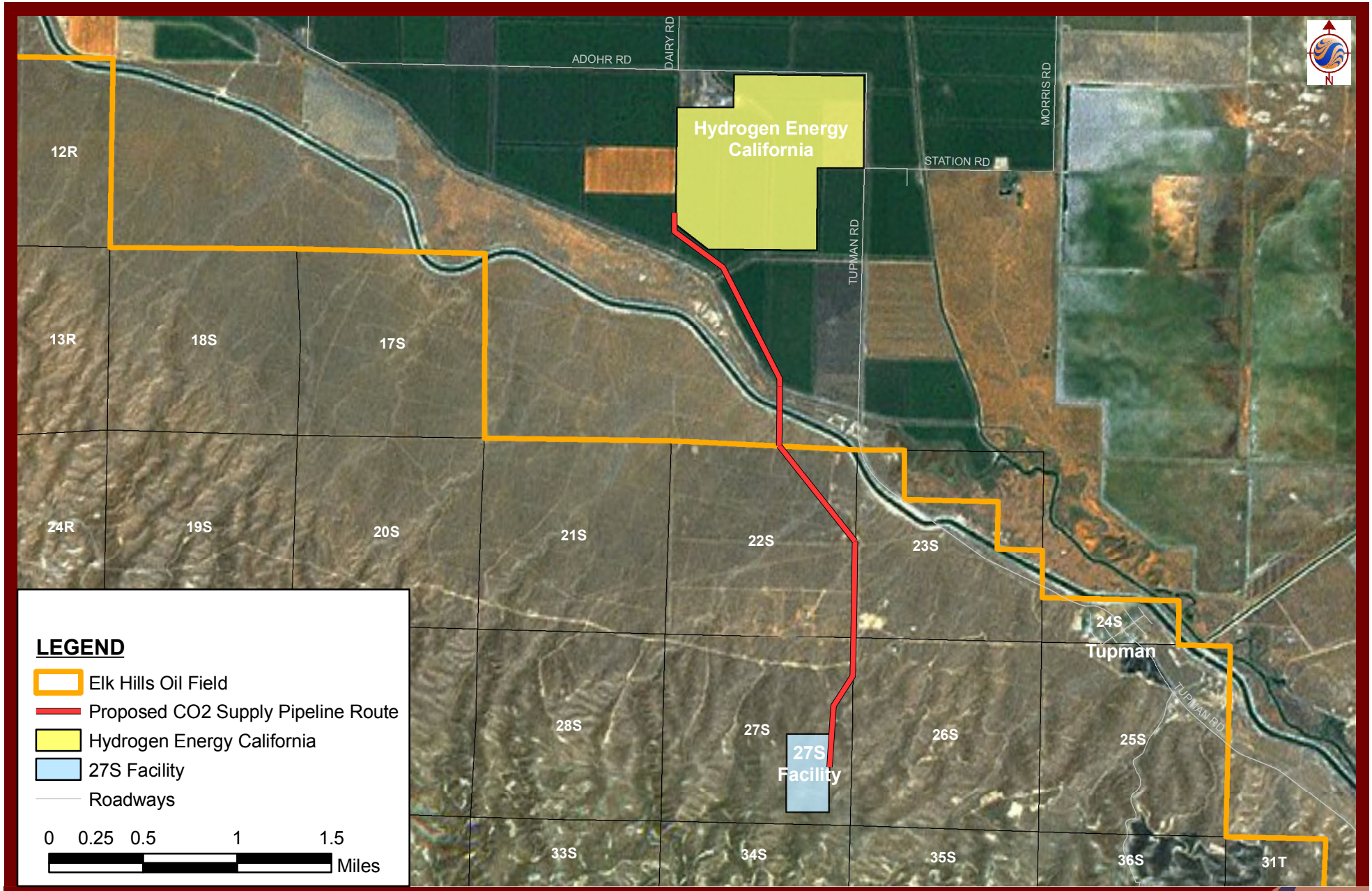
FIGURES



Cartographic Design By: C. Flinders | Environmental Remediation

Stantec does not certify the accuracy of the data. This map is for reference only and should not be used for construction.

Figure 1

Proposed Alignment of CO2 Supply Pipeline Route

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Phone 916.569.2500 Fax 916.921.9274 www.stantec.com
Project # 185802314

OEHI CO2 EOR Project - Supplemental Environmental Assessment

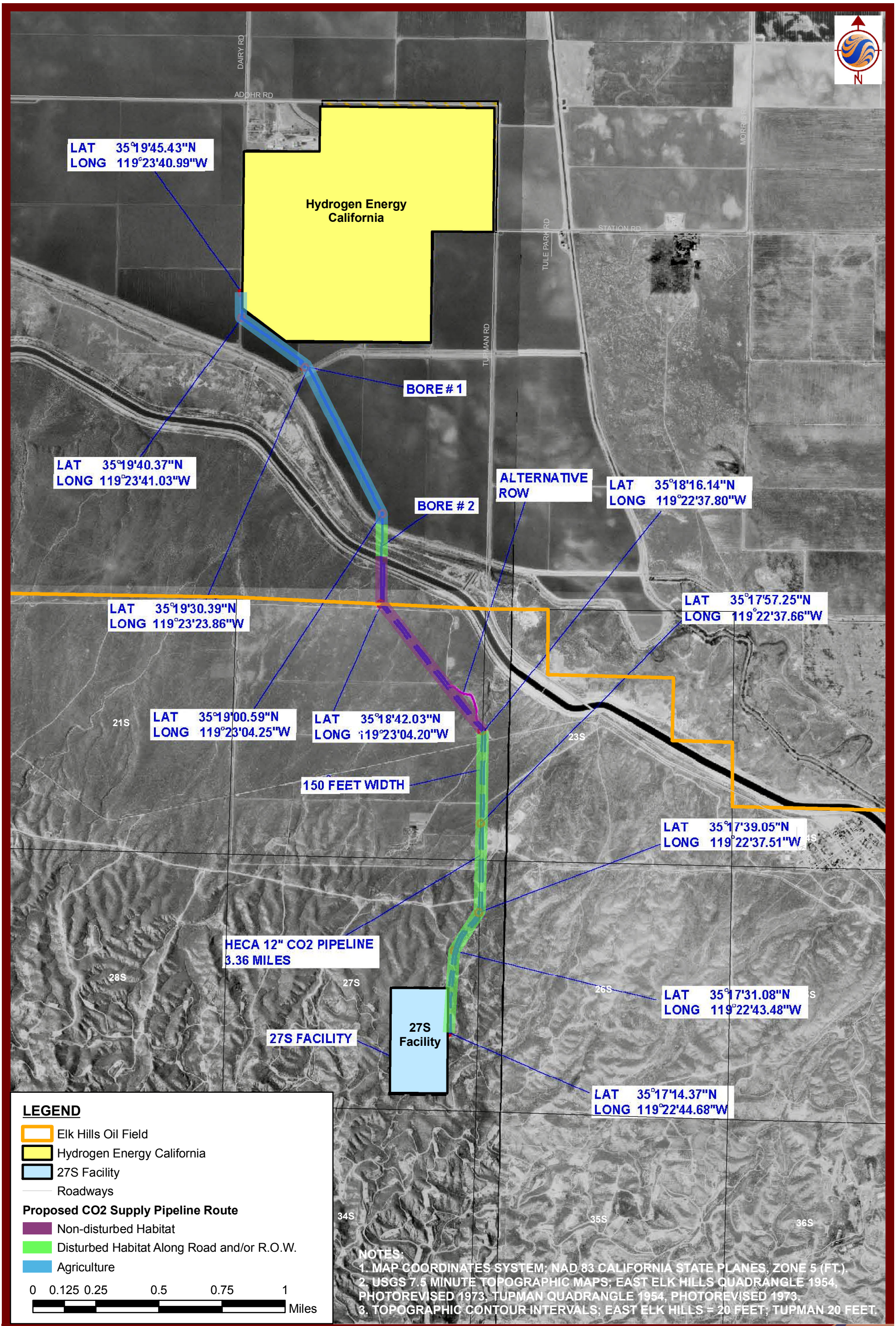

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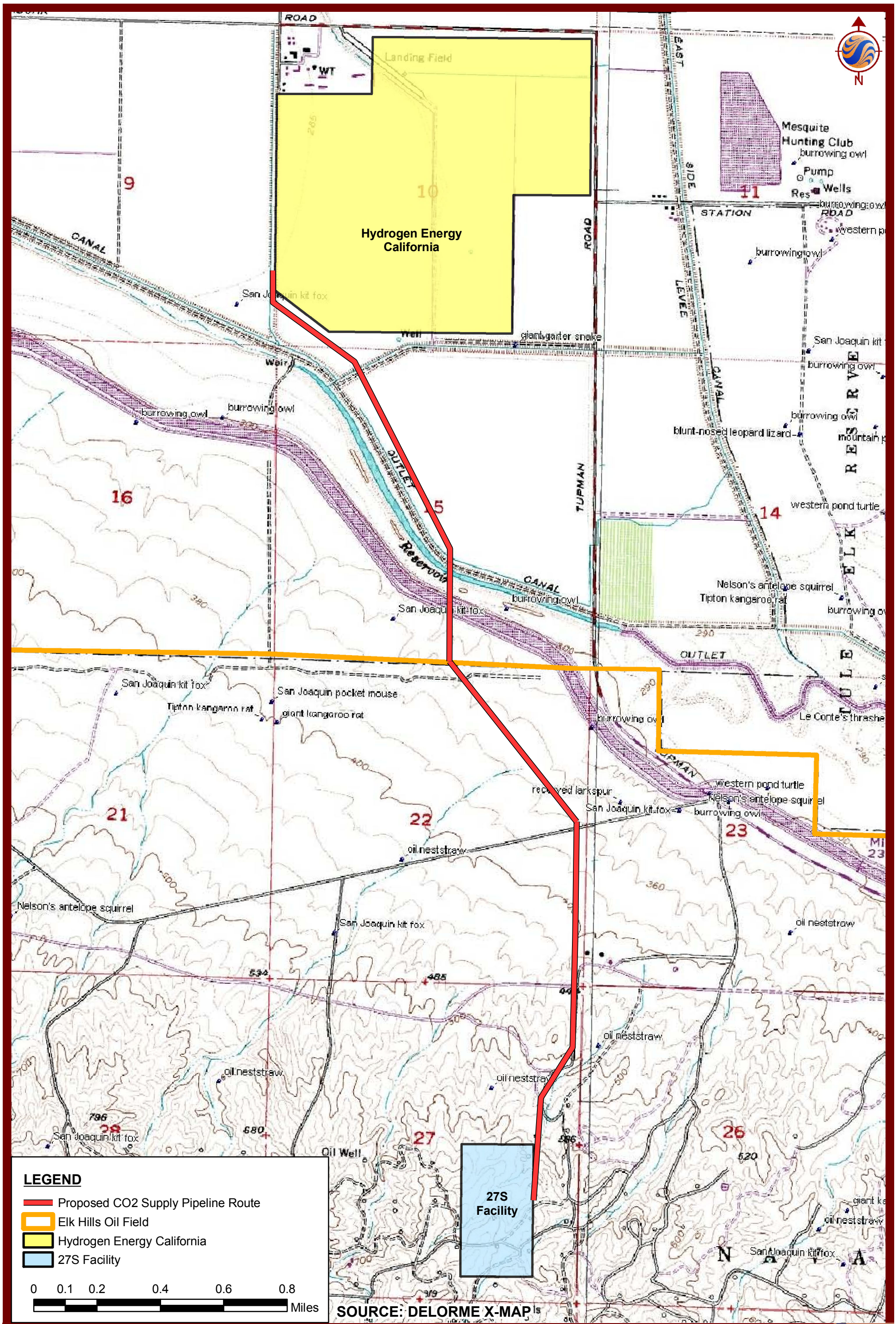
Figure 2

CO2 Supply Pipeline Alignment and Survey Area Map

OEHI CO2 EOR Project - Supplemental Environmental Assessment



Cartographic Design By: C. Flinders | Environmental Remediation

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Figure 3

California Natural Diversity Database Map

OEHI CO2 EOR Project - Supplemental Environmental Assessment

ATTACHMENT B

CULTURAL AND PALEONTOLOGICAL RESOURCES STUDY FOR MODIFIED ALIGNMENT OF CO2 SUPPLY LINE

Cultural and Paleontological Resources Survey for Modified Alignment of CO2 Supply Line

Cultural and Paleontological Resources Survey for modified CO2 Supply Line alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility

April 2011

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1.0 CULTURAL RESOURCES SURVEY

1.1 SUMMARY OF FINDINGS

No additional cultural resources were discovered during the survey. However, previously recorded site number PS-15-006776 is adjacent to, or within the proposed pipeline alignment. Additional survey and possibly testing is recommended to ensure significant cultural resources are not adversely impacted during pipeline construction. Site PS-15-000124 was recorded in 1963. It is depicted as being within the proposed alignment, but was probably destroyed during the construction of the California Aqueduct. No surface evidence of the site was detected. Two additional sites, PS-15-6734 and 6735, are located directly east of the proposed pipeline alignment, but are outside the Area of Potential Effect (APE).

1.2 PROPOSED UNDERTAKING

The proposed project is the construction of a main pipeline for the conveyance of CO2 from the HECA facility in Section 10, T30S, R24E, to the 27S facility in Section 27 of the same township in the Elk Hills Oil Field. The proposed alignment traverses Sections 10, 15, 22 and 27, T30S, R24E.

1.3 PURPOSE AND SCOPE OF THE SURVEY

A cultural resources survey was undertaken along the proposed alignment of the CO2 pipeline for a distance of 2.5 miles and a width of approximately 150 feet. The project includes a total of 3.36 miles of pipeline, most of which has been previously surveyed. The northern portion of the corridor was surveyed in 1999 by URS with negative results. The purpose of the current survey was to document any cultural resources within the corridor that could be adversely affected during construction of the pipeline.

1.4 CONSTRAINTS TO THE SURVEY EFFORT

Access to the entire area of potential effect was unconstrained. However, the survey was affected by lack of ground visibility. As a result of dense grasses and shrubs, the ground visibility was estimated to be 10 to 20% throughout the entire APE.

1.5 NUMBER AND TYPES OF IDENTIFIED ARCHAEOLOGICAL RESOURCES AND THEIR RELATION TO THE PROPOSED PROJECTS LIMITS

No newly discovered sites were found during the survey. Information from the Southern San Joaquin Valley Information Center indicated 22 previously recorded sites within a .5 mile radius

of the proposed alignment (see Section 1.6) Site PS-15-000124 was recorded in 1963 and the recorded site map indicates it being within the APE for the proposed pipeline. However, no evidence of the site was found during the current survey, and the site was probably destroyed during construction of the California Aqueduct. Additionally, there is no further surface disturbance planned in this area, as the pipeline construction will involve deep boring under both the California Aqueduct and an adjacent outlet canal. Site PS-15-006776 is a lithic/groundstone and shell midden site that was tested for eligibility (Jackson, Shapiro and King, 1999).

1.6 SOURCES CONSULTED

1.6.1 Summary of Methods and Results

The records search for this project was conducted on February 21, 2011 by Celeste Thomson of the Southern San Joaquin Valley Information Center (See Appendix B). The materials consulted during the background search included:

- Sites in or within a .5 mile radius of the project area
- Studies in or within .5 mile radius of the project area
- OHP Historic Properties Directory
- Historic Property Data File (10/5/10)
- California Inventory of Historical Resources
- California Register
- National Register
- Ethnographic information
- California Points of Historic Interest

The search was designed to include all known cultural resources recorded within .5 mile of the project area, and all survey project reports produced within .5 mile of the project area.

The background research indicated that one previously recorded site was located within the project area. There have been 22 recorded cultural resources within .5 mile of the project area. None of the known sites are listed in the National Register, California Register, California Inventory of Historic Resources, California Points of Historical Interest, or the California State Historic Landmarks.

Table 1. Previously Recorded Sites within .5-miles of the Project Area				
Site Number (PS15-00…)	**Site Type**	**Located within Area of Potential Effect?**	**Eligibility**	**Recommendation**
0124	Lithics/shell midden	Yes	Not Eligible	No Effect
0125	Lithics/shell midden	No	Not Eligible	No Effect
6776	Lithics/ground stone/shell midden	Yes	Potentially Eligible	Survey/Testing
3253	Historic trash scatter	No	Not Eligible	No Effect
3255	Badly disturbed small flake and shell scatter	No	Not Eligible	No Effect
6734	Shell scatter	No	Not Eligible	No Effect
6735	Shell midden	No	Not Eligible	No Effect
6771	Shell midden	No	Not Eligible	No Effect
6770	Lithics/shell midden	No	Not Eligible	No Effect
9319	Chert flake Isolate	No	Not Eligible	No Effect
9320	Chert biface fragment and flake	No	Not Eligible	No Effect
3254	Historic trash scatter	No	Not Eligible	No Effect
2329	Lithics/shell midden	No	Not Eligible	No Effect
3861	Lithics/shell midden	No	Not Eligible	No Effect
3213	Historic kiln	No	Not Eligible	No Effect
6774	Shell midden/historic debris	No	Not Eligible	No Effect
3252	Historic trash scatter	No	Not Eligible	No Effect
3248	Can scatter	No	Not Eligible	No Effect
3247	Historic kilns	No	Not Eligible	No Effect
3246	Historic household trash and well rig hardware	No	Not Eligible	No Effect
3241	Historic well complex	No	Not Eligible	No Effect
3140	Not available	No	Not Eligible	No Effect
3242	Historic well site	No	Not Eligible	No Effect

1.6.2 Previous Surveys Conducted within One Half Mile of the Project Area

Jackson, Thomas, Lisa Shapiro and Jerome King

1998, Prehistoric Archaeological Resources Inventory and Evaluation at Naval Petroleum Reserve No. 1 (Elk Hills), Kern County, California. Pacific Legacy Inc.

Jackson, Thomas, Lisa Shapiro, and Gwyn Alcock

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PAR environmental services Inc.

1997, Historic Resources Evaluation and Assessment Report of Western Naval Petroleum Reserve Number One, Elk Hills, Kern County, California. PAR Environmental Services Inc.

Peak and Associates

1991, Cultural Resource Assessment of Sample Areas of Naval Petroleum Reserve No. 1, Kern County, California. Peak and Associates, Inc. (Sacramento)

1.7 SUMMARY OF OTHERS WHO WERE CONSULTED

Section 5097.91 of the California PRC established the Native American Heritage Commission (NAHC), whose duties include the inventory of places of religious or social significance to Native Americans and the identification of known graves and cemeteries of Native Americans on private lands. Section 5097.98 of the PRC specifies a protocol to be followed when the NAHC receives notification of a discovery of Native American human remains from a county coroner.

Coordination with the NAHC is required for this project in order to determine if any areas of sacred significance are located near the project area. In addition, the NAHC provides an updated list of tribal contacts for each proposed project. Tribal consultation for this project is currently in progress.

1.8 ENVIRONMENT

The project is located in the southern San Joaquin Valley which is bounded by the Tehachapi Mountains to the east, the Sacramento-San Joaquin River Delta to the north, the Coast Range to the west and the Sierra Nevada Mountains to the east. Rivers and streams cross the valley from eastern slopes of the Sierras. The region is known for extensive, shallow inland lakes, as the rivers and streams had no historical natural outlet to the west. The climate is Mediterranean, with hot, dry summers and moist winters. Prior to historic times the area supported large woodlands, grasslands and marshes. The majority of the region in which the project is located is dominated by agricultural development.

1.9 ETHNOGRAPHY

The Yokuts were the Native American group that occupied the Southern San Joaquin Valley at the point of modern contact. A number of ethnographers have published descriptions of the Yokuts, including Kroeber (1925), Latta (1977) and Wallace (1978). There were over 40 different groups of the Yokuts, but the Southern Valley Yokuts were located in the region of the project area. The culture of the Southern Valley Yokuts included village life in which large groups were located in, or near a single, dominant village. Villages were inhabited on a permanent basis due to the ease of acquiring natural resources including roots, seeds, waterfowl, fish and shellfish.

Both villages and smaller settlements were located adjacent to, or within a short distance of permanent lakes and streams. Subsistence centered upon fishing, however, a mixed strategy of subsistence was employed. Fishing was accomplished by the use of nets. Mussels were also gathered, and hunting activities produced elk, pronghorn and rabbits.

Baskets were made with the tule grass that was very common near the water environments. The same resource was also employed in the construction of canoes utilized for fishing and travel, and in making mats for houses. Basket weaving was recognized as the primary technological skill of the Southern Valley Yokuts (Valdez 1993). Other material culture included knives, scraping tools and projectile points. Ground stone included mortars and pestles. Trade occurred for the acquisition of marine shells that were fashioned into pendants, disks, beads, etc. for use in both personal adornment and for money.

Two types of houses were constructed by the Yokuts. Smaller structures for single families were oval-shaped huts covered with tule grass mats. Communal dwellings were also constructed which were large enough to hold as many as ten families, with different areas separated for each family. Nuclear families were patrilineal and tribes were divided into moieties.

1.10 PRE-HISTORY SETTING

Archaeological research has been conducted for many years in the southern part of the San Joaquin Valley. Much of the research has been focused on the Buena Vista Lake and Elk Hills areas. One of the first publications regarding early archaeological research was published in 1926. Gifford and Schenk of the University of California documented approximately 40 sites, as well as their excavation of nine of them. They noted the appearance of very little change over extended periods of time.

Five sites were excavated by the Civil Works administration during the Depression in 1933 and 1934 on the shore of Buena Vista Lake. These were highly stratified midden sites exhibiting prehistoric, protohistoric and historic occupations. Between 1899 and 1925, data recovery at large village sites at Buena Vista Lake as well as other proximal locations were conducted, focusing on the recovery of burial sites and grave goods (Gifford and Schenk 1926; Hartzell 1992). Significant data recovery occurred in the 1930's when a Yokuts cemetery (KER-64) was excavated at Elk Hills in 1935 by Edwin Walker (Walker 1947:3). A number of burials were excavated, some of which included grave goods identified as aboriginal artifacts, while others contained both aboriginal and European artifacts.

Importantly, later excavations in the 1960s by Fredrickson and Grossman (1977) at one of the original sites near Buena Vista Lake indicated a deeply buried component that dated to ca. 6,250 BC (Moratto 1984). Subsequent work around Buena Vista Lake led to the discovery of a number of temporal components that have been used to describe the general prehistory of the region. A chronological framework was developed from the numerous testing and excavation projects around the lake. Refinement of the chronology by several researchers has led to three broad temporal periods in the Southern San Joaquin Valley area, including the Early Holocene, the Middle Holocene and the Late Holocene.

1.10.1 Early Holocene: 10,000 to 5,000 BC

This is the earliest known period of human existence in the San Joaquin Valley. People lived in small camps around lakes and relied on the lake environment for natural resources. Populations were small during this time period.

1.10.2 Middle Holocene: 5,000 to 2,000 BC

Very few preserved sites from this time period are known to exist in the region. Most were undoubtedly destroyed as a result of fluctuating lake levels. This time marks a change from primarily big game hunting to the increasing practice of gathering resources as evidenced by the increased number of milling stones. Extended burials were common, and evidence of trade items grew in type and number. During this time, the focus was still on the lake environments.

1.10.3 Late Holocene: 2,000 BC to A.D. 1,850

More evidence of lake fluctuations occurred during this period. Human inhabitants of the area were highly mobile, undoubtedly taking advantage of resources on a seasonal basis. Numerous different artifacts show up in the archaeological record, indicating a more refined means of hunting and gathering. Flexed and semi-flexed burials became the norm. During the late Holocene, or protohistoric period, the artifact assemblage became even more diverse, with more elaborate projectile points, specialized mortars, beads, etc. (Frederickson 1986).

From approximately 1,000 BC to the modern era, the archaeological evidence in the Elk Hills area indicates almost a continuous period of human occupation. The extensive marshlands around the region's lakes had interconnected sloughs that were fed by the seasonal flooding of the Kern River.

1.11 HISTORICAL SETTING

1.11.1 Spanish Period

The first record of contact with the Southern Valley Yokuts occurred in 1772 by a band of Spanish soldiers. In 1776, Francisco Garces arrived in the region. Attempts were made to establish missions in the region, but they were unsuccessful. When the U.S. annexed California, the Valley was inundated with settlers and the extant cultural practices began to wane. The remaining Southern Valley Yokuts were initially sent to the Tejon and Fresno Reservations, but were later moved to the Tule Reservation in 1859. Modern land use in the region is the result of both agricultural and oil field development.

1.11.2 Historic Period

The Elk Hills Oilfield itself has an extensive history. Established in 1912, it eventually produced a steady supply of petroleum products and stood out as one of the largest gas producers in the world. The management for the oilfield became the responsibility of the U.S. Department of Energy in 1977. By the late 1990’s, the majority of the oilfield was owned by the federal government, but Congress instructed the Department to relinquish ownership of the field.

The Kern River Oilfield was discovered in 1899, which started a different type of “gold rush” in the area. Within five years after this date, most of the land in the Elk Hills Oilfield had been claimed. In the early 1900’s, the federal government became concerned about ensuring continued supplies of petroleum, and took control of the Elk Hills in 1909. Prior to the government claiming compete control, wildcatters began drilling throughout the field. A great deal of activity occurred, as small and large companies operated lease camps throughout the area. Standard Oil drilled a very successful well in 1919, thereby increasing the interest in the area. Camps continued to be set up, and a great deal of development occurred. The camps included barracks, dining halls, residences, etc.

Most of the early historic equipment is long gone, but of the known historic archaeological sites in the area, at least 175 of them have been recorded within the oilfield itself. The initial cultural resources work conducted in the area classified these historic sites into five property types: domestic occupation, transportation, military, industrial manufacturing and technology, and oil exploration and production.

Since the oilfield was somewhat isolated, a surprising amount of domestic life occurred there. Evidence of women and children is very clear in the archaeological record.

There are still a number of historic components representing the early oil industry on the property. The old road network still exists, along with a pipeline system and foundations and many of the early structures and equipment.

1.12 FIELD METHODS

Major portions of the APE for this project were surveyed previously by consulting firms in the 1990's for the privatization of the Elk Hills Oil Field. For this project, the pipeline APE was surveyed in 15 m transects and covered a corridor width of approximately 150 feet and length of approximately 2.5 miles. On Wednesday, February 23, 2011, two surveyors covered the southern half of the pipeline route. The remaining portion of the APE was surveyed on Thursday, February 24th.

1.13 STUDY FINDINGS AND CONCLUSIONS

Previously recorded sites were relocated if they were originally recorded as being within close proximity to the proposed pipeline corridor. During the survey, no new sites were discovered, but site number PS-15-006776, located in the northeast quarter of Section 22 does extend beyond the previously determined site boundaries. One isolated chert biface was located during the current survey. Previous researchers did not locate the western boundary of the site, as it extended into areas disturbed by agriculture. In addition, the current project APE extends both west and north of the original efforts at PS-15-006776. The fieldwork conducted for this project verified that the site does extend westerly and northerly beyond its current boundary description, and possibly into the APE. Testing conducted at PS-15-006776 produced data that indicated the site was not eligible for listing on the National Register of Historic Places. We agree with that assessment. However, the current survey indicates the site is larger, and possibly substantially larger, than originally thought. Due to current issues regarding land ownership, as well as limited ground surface visibility, we did not establish a revised site boundary. It is recommended that further survey, and possibly additional testing be conducted in the area of site number PS-15-006776 when the exact pipeline corridor is established and ground visibility has improved. It is also recommended that a Native American monitor be present during any future testing activities. One or more specific Native American monitors are very knowledgeable of archaeological investigations in the project area.

Previously recorded site PS-15-000124, originally recorded as including a sparse shell scatter in 1963, appears to have been destroyed by the construction of the California Aqueduct, as no surface manifestations of the site remain. Additionally, the portion of the pipeline in this area will be deeply buried by horizontal directional drilling.

Two other previously recorded sites, PS-15-6734 and 6735 were relocated, as they appeared to be in proximity to the APE. These two sparse shell scatters are located directly east of the pipeline corridor, but outside the APE.

In conclusion, one isolated artifact was discovered during this survey, and additional shell deposition west and north of site PS-15-006776 were identified. Neither the newly discovered isolated artifact, nor any of the other previously discovered sites are currently considered eligible for listing on the national register. However, additional survey and or testing should be conducted on the western and northern borders of site PS-15-006776. At the current time, the site should therefore be considered potentially eligible under the California and/or the federal criterion that it has yielded, or may be likely to yield, information important in history or prehistory.

2.0 PALEONTOLOGICAL RESOURCES

2.0 BACKGROUND

Elk Hills Oilfield has been the subject of a number of paleontological investigations. As a result of the planned Hydrogen Energy International Plant located directly north of the oilfield, background investigations, as well as field research has been conducted in and surrounding the current project area.

Much of the recent summary information regarding the paleontology of the oilfield was prepared by Lanny Fisk, PhD, and Stephen Blakely, both paleontologists with Paleo Resource Consultants. These investigators looked at the background of the entire oilfield, but primarily, the proposed location of the hydrogen facility just north of the oilfield, as well as the ancillary pipelines and other facilities that would extend southward into the oilfield.

Extensive information is available regarding the geology of the San Joaquin Valley. See Mendenhall 1908, Mendenhall et al., 1916, Hoots et al. 1954, Davis et al., 1957, 1959, 1964, Davis and Hall 1959. Hoffman 1964, Croft and Wahrhaftig 1965, Hackel 1966, Croft and Gordon 1968, Bull 1973, Page 1986, Marchand 1977, Bartow and Marchand 1979, Marchand and Allwardt 1981, Lettis 1988, Bartow 1987 and 1991, Beyer and Barto 1988, as well as others.

2.1 THE PROJECT AREA

As indicated by the geologic map of the region, the project area for the proposed pipeline is located in two of the major regional area divisions described by geologists and paleontologists. The northern portion of the pipeline corridor is located in Quaternary alluvium, while the southern portion (beginning at the southeast corner of Section 22, and continuing south) is the beginning of the Tulare Formation. The Tulare Formation is well known as a fossil bearing marine and non-marine sediment.

The majority of the information gathered for this report was obtained from the section on paleontological resources prepared by URS in the HECA final report (see Fisk and Blakely 2009). The authors of the 2009 report gathered information at the University Of California Museum Of Paleontology at Berkeley, the Los Angeles County Natural History Museum and the San Bernardino County Museum of Natural History. After their background research, the paleontologists from URS conducted extensive field surveys through the numerous sections that would be affected by the construction of the HECA facility. While no digging was undertaken and no samples were taken, the field inspection occurred during numerous site visits and focused upon areas of visible stratigraphy including hill slopes, cut slopes, road cuts, etc.

An important point should be made related to the difference between archaeological site significance and paleontological site significance. Archaeological sites are recorded as point data, as their surface expressions can be observed and site form and size can be easily recorded. Fossil strata, on the other hand, extend over large expanses of geographic area and are not point specific. It is therefore very difficult for a paleontologist to predict the potential impact on subsurface fossil beds, and monitoring is usually recommended when projects are proposed in known fossil localities.

Several organizations have established categories of sensitivity for paleontological resources. Of primary relevance are those developed by the Society of Vertebrate Paleontology (SVP) in 1995. Based upon the criteria advanced by the SVP, the entire length of the proposed pipeline is considered of high sensitivity.

While fossils are well known to exist in the Tulare Formation in the southern portion of the pipeline corridor, it is also known that the Quaternary alluvium in Sections 15 and 22 covers additional areas of the Tulare Formation to a depth of approximately 5 -10 feet. In addition, the Quaternary alluvium itself also has known fossil locations in other parts of Kern County.

2.2 KNOWN FIOSSIL INVENTORY

2.2.1 Tulare Formation

The formation is known to include algal stromatolites, shells of snails and clams, diatoms, petrified wood, bones and teeth of bony fishes, lizards, snakes, turtles, amphibians, birds, and a diversity of extinct land mammals, including gophers, pocket mice, squirrels, rabbits, ground sloths, kangaroo rats, pack rats, dogs, saber tooth cats, peccaries, camels, horses, tapirs and deer. The location of the proposed pipeline corridor extends through the Tulare Formation in Section 27. The formation is considered to have high sensitivity for fossil locations.

2.2.2 Quaternary Alluvium

There have been no reports of fossil localities in the Quaternary alluvium along the actual proposed pipeline corridor for this project. However, a number of vertebrate fossils have been discovered in Holocene and Pleistocene deposits elsewhere in Kern County. Fossils located in Quaternary alluvium can offer valuable data for reconstruction of paleoenvironments. The proposed pipeline corridor extends through Quaternary alluvium in Sections 15 and 22. The Quaternary alluvium is considered to have high sensitivity for fossil locations.

2.3 FIELD REVIEW RESULTS

A pedestrian survey of the proposed pipeline corridor was conducted on February 23 and 24. The survey width for the area of potential effect was 150 feet. Several locations of freshwater mussel shells were seen either directly on the surface or in the back dirt from animal burrowing. The locations of the freshwater shells were in previously recorded archaeological sites and have

been described previously as shell middens. The individual pieces of shell were soft and pliable. No excavations were made and no deep existing excavations were seen along the pipeline route.

2.4 POTENTIAL IMPACTS

As a result of the high potential for fossil locations in both the Quaternary alluvium and the Tulare formation, the construction of the proposed pipeline could cause significant damage to the existing fossil strata. It is unlikely that activities conducted after the construction phase would further impact the fossil bearing sediments.

2.5 SUMMARY / RECOMMENDATIONS

It is recommended that paleontological monitoring be conducted by a qualified paleontologist during construction of the pipeline. A monitoring and mitigation program should be developed in order to define activities and emergency measures before, during and after construction. The monitoring plan should be consistent with SVP guidelines (1995), and specify how fossil specimens can be collected, reported and curated. The plan should contain a section on education of construction personnel in the event of fossil discoveries.

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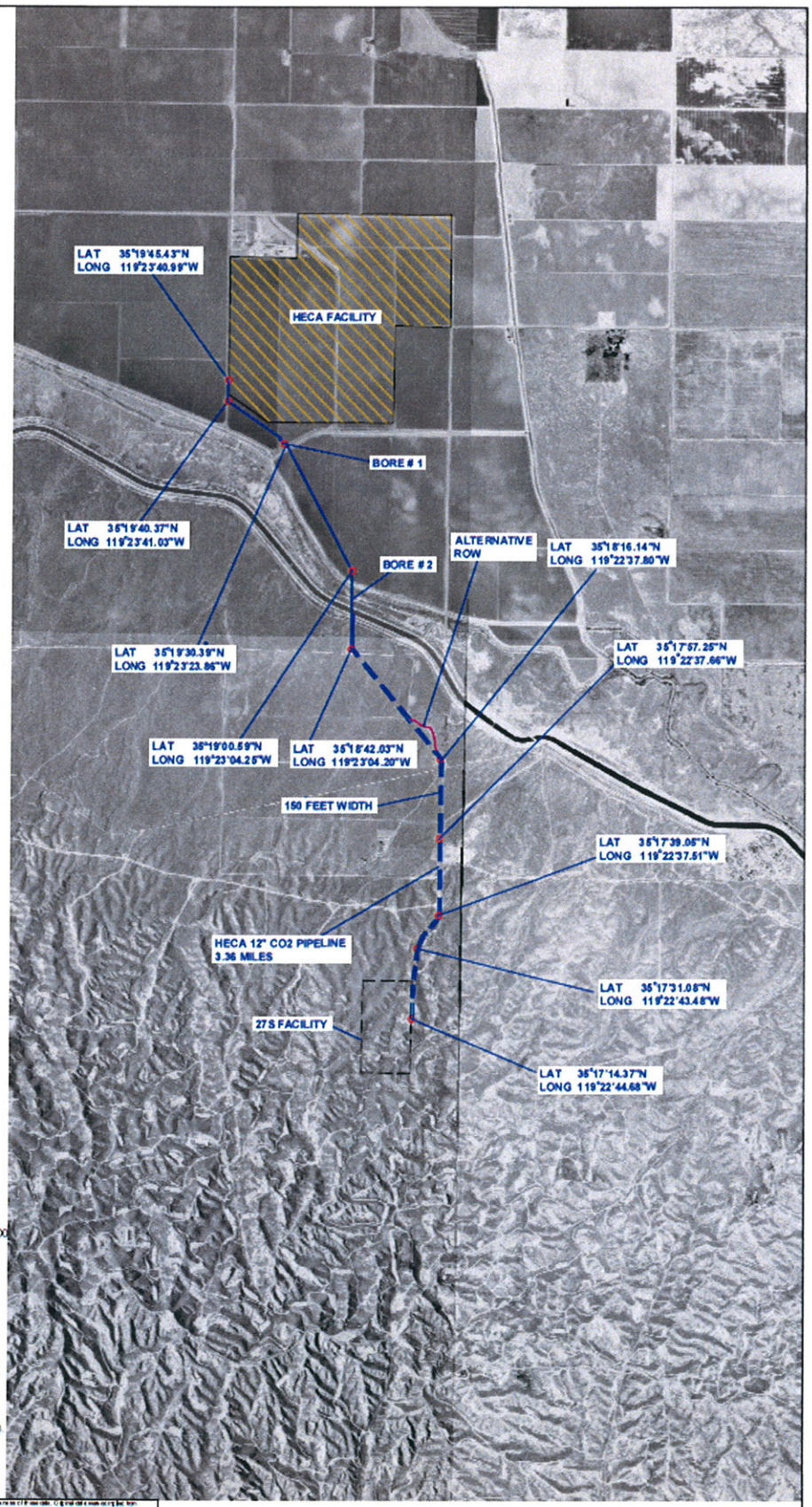
FIGURES



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APPROXIMATE SCALE (FEET)

NOTES:

1. MAP COORDINATES SYSTEM, NAD 83 CALIFORNIA STATE PLANES, ZONE 5 (FT)
2. USGS 7.5 MINUTE TOPOGRAPHIC MAPS, EAST ELKS HILLS QUADRANGLE 1954, PHOTOREVISED 1973, TUPMAN QUADRANGLE 1954, PHOTOREVISED 1973.
3. TOPOGRAPHIC CONTOUR INTERVALS, EAST ELKS HILLS= 20 FEET; TUPMAN 20 FEET.

Figure 1 Project Area

Stantec
290 Conejo Ridge Avenue
Thousand Oaks, CA 91361

FOR:
CO2 EOR PROJECT
TUPMAN, KERN
COUNTY, CALIFORNIA

C02 SUPPLY LINE
ALIGNMENT

FIGURE
1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:

Figure 2 – Cultural Resource Site Locations Adjacent to Proposed Pipeline

CONFIDENTIAL – NOT INCLUDED IN PUBLIC VERSION

APPENDIX A

SITE RECORDS

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

FRESNO KERN KINGS MADERA TULARE

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TO: Robert Larkin
Stantec Consulting Services, Inc.
8211 South 48th Street
Phoenix, AZ 85044-5355

(RS# 11-057)

DATE: February 21, 2011

RE: Proposed Pipeline, Elk Hills Oilfield

Counties: Kern

Map(s): East Elk Hills & Tupman 7.5's

The Southern San Joaquin Valley Information Center is under contract to the State Office of Historic Preservation and is responsible for the local management of the California Historical Resources Inventories. The Center is funded by research fees and a grant from the State Office of Historic Preservation. The Information Center does not conduct fieldwork and is not affiliated with any archaeological consultants who conduct fieldwork.

CULTURAL RESOURCES RECORDS SEARCH

The following are the results of a search of the cultural resources files at the Southern San Joaquin Valley Information Center. These files include known and recorded archaeological and historic sites, inventory and excavation reports filed with this office, and properties listed on the National Register of Historic Places, the Historic Property Data File (10/5/10), the California State Historical Landmarks, the California Register, the California Inventory of Historic Resources, and the California Points of Historical Interest.

PRIOR CULTURAL RESOURCE INVENTORIES WITHIN THE PROJECT AREA AND A ONE-HALF MILE RADIUS

According to the information in our files, there have been seven (7) previous cultural resource studies conducted within the project study area, KE-00924, 02268, 02269, 02375, 03503, 03508, and 03509. There have been no additional studies conducted within a one-half mile radius. See the enclosed map for study locations and report designations.

(RS# 11-057)

KNOWN/RECORDED CULTURAL RESOURCES WITHIN THE PROJECT AREA AND A ONE-HALF MILE RADIUS

There is one (1) recorded cultural resource within the project area, P-15-000124. There are twenty-two (22) recorded cultural resources within a one-half mile radius, P-15-000125, 002329, 003140, 003213, 003241, 003242, 003246, 003247, 003248, 003252, 003253, 003254, 003255, 003861, 006734, 006735, 006770, 006771, 006774, 006776, 009319, and 009320. See the enclosed project map for resource locations.

There are no known cultural resources within the project area or radius that are listed in the National Register of Historic Places, California Register, California Inventory of Historic Resources, California Points of Historical Interest, or the California State Historic Landmarks.

COMMENTS

Requested copies are enclosed. If you have any questions, comments, or need additional information, please don't hesitate to contact our office at (661) 654-2289.

By

for

Brian E. Hemphill, Ph.D.
Coordinator

Date: February 21, 2011

Fee: $225.00/hr. (Priority Service)

Please note that invoices for Information Center services will be sent under separate cover from the California State University, Bakersfield Accounting Office.

APPENDIX B

TRIBAL CONSULTATION

Tribal consultations have not yet been completed

ATTACHMENT C

AN ANALYSIS OF NOISE IMPACTS FOR MODIFIED ALIGNMENT OF CO2 SUPPLY LINE

An Analysis of Noise Impacts for Modified Alignment of CO2 Supply Line

CO2 supply line alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility
Tupman, Kern County, CA

March 1, 2011

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Appendix A – Construction Noise Models

1.0 INTRODUCTION

Potential noise impacts from installation of the CO2 supply line in HECA's 2009 CEC AFC filing, focused on the distance away from sensitive receptors. HECA specifically evaluated construction noise impacts from construction of the main HECA Facility. As the main HECA Facility was located closer to sensitive receptors than the CO2 supply line and potential noise impacts from construction were determined to not be significant, construction impacts resulting from pipeline installation were also determined not to be significant. However, the modification of the CO2 supply pipeline alignment results in the pipeline being located closer to the (sensitive receptors) Tule Elk Reserve State Park and the community of Tupman. As a result of the decrease in distance, a substantial noise data gap has been identified and this noise analysis re-evaluates potential noise impacts from the alignment modification.

Installation of the CO2 supply line will be performed by utilizing a combination of horizontal direction drilling (HDD) and conventional trenching techniques. Specifically, the CO2 supply line will be installed under the farm irrigation canal (Bore #1), located immediately south of the HECA Project, and the West Side Canal and California Aqueduct (Bore #2) using HDD techniques and conventional trenching for the remainder of the alignment. As a result of the proposed installation methods, Stantec has evaluated the construction noise anticipated to result in the community of Tupman from pipeline construction at their closest point to Tule Elk Reserve State Park and the community of Tupman. These points equate to a distance of 2,400 feet to Tule Elk Reserve State Park from trenching and HDD operations as well as 6,774 feet to Tupman from trenching operations and 10,500 feet to Tupman from HDD operations. This assumption further assumes that the closest HDD point to Tule Elk Reserve State Park and Tupman (south of the California Aqueduct) will be utilized as a HDD entry point which provides the most conservative approach for equipment usage and noise impacts compared to more limited equipment used in support of a HDD exit point.

2.0 TERMINOLOGY

The measurement of any sound level requires language used specifically for the measurement of acoustical conditions. Definitions of acoustical l terms used in this noise evaluation are included in ***Table 1.***

TABLE 1: DEFINITION OF ACOUSTICAL TERMS	
Term	Definition
dB, Decibel	Unit of measurement of sound level
dBA, decibel A-Weighted	A unit of measurement of sound level corrected to the A–weighted scale, as defined in ANSI S1.4–1971 (R1976), using a reference level of 20 micropascals (0.00002 Newtons per square meter).
A – Weighted Scale	A sound measurement scale, which corrects the pressures of individual frequencies according to human sensitivities. The scale is based upon the fact that the region of highest sensitivity for the average ear is between 2,000 and 4,000 Hz. Sound levels are measured on a logarithmic scale in decibels, dB. The universal measure for environmental sound is the A–weighted sound level, dBA.
Leq, Equivalent Noise Level	Also called the equivalent continuous noise level. It is the continuous sound level that is equivalent, in terms of noise energy content, to the actual fluctuating noise existing at the location over a given period, usually one hour. Leq is usually measured in hourly intervals over long periods in order to develop 24–hour noise levels.
CNEL, Community Noise Equivalent Level	The CNEL is a measure of the cumulative noise exposure in the community, with greater weights applied to evening and night time periods. This noise descriptor is the equivalent noise level over a 24–hour period mathematically weighted during the evening and night when residents are more sensitive to intrusive noise. The daytime period is from 7:00 a.m. to 7:00 p.m.; evening from 7:00 p.m. to 10:00 p.m.; and nighttime from 10:00 p.m. to 7:00 a.m. A weighting factor of 1 dB is added to the measured day levels defined as 7 a.m. to 7 p.m., evening levels (7 p.m. to 10 p.m.) have a weighting factor of three and 10 dB to the night time levels (10 p.m. to 7 a.m.). The weighted levels over a 24–hour period are then averaged to produce the single number CNEL rating.
Ldn, Day/Night Noise Level	The same as CNEL except that the evening time period is not considered separately, but instead it is included as part of the daytime period. Measurements of both CNEL and Ldn in the same residential environments reveal that CNEL is usually slightly higher (by less than 1 dB) than Ldn due to the evening factor weighting.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

The decibel (dB) is the preferred unit to measure sound levels utilizing a logarithmic scale to account for large a large range in audible sound intensities. A general rule for the decibel scale is that a 10 dB increase in sound is perceived as a doubling of loudness by the human ear.

3.0 ENVIRONMENTAL SETTING

3.1 AFFECTED NOISE ENVIRONMENT

The proposed alignment of the CO2 supply line is located primarily within an area used for agriculture north of the California Aqueduct and West Side Canal and petroleum extraction within the EHOF to the south. The nearest sensitive receptors to the CO2 supply line are the Tule Elk Reserve State Park located approximately 0.45 miles to the east of the HDD entry point, and the community of Tupman, which is located approximately 1.25 miles east of the eastern most point located along the CO2 supply line.

3.2 PROJECT VICINITY NOISE SETTING

Existing sources of noise in the Project vicinity include agricultural activities to the north of the California Aqueduct, vehicular traffic on Tupman Road to the east, and oilfield activities to the south of the proposed CO2 supply line alignment.

3.3 SENSITIVE RECEPTORS AND AMBIENT NOISE LEVELS

The nearest sensitive receptor to the proposed pipeline alignment is the Tule Elk Reserve State Park located approximately 0.45 miles to the east of the HDD entry point. The next closest sensitive receptor is the community of Tupman (Elk Hills Elementary School), which is located approximately 1.25 miles east of the eastern most point located along the alignment of the CO2 supply line. The sensitive receptors, proximity to the pipeline alignment, and the ambient noise levels are presented in ***Table 2***.

TABLE 2: SENSITIVE RECEPTORS IN CLOSE PROXIMITY TO PIPELINE ALIGNMENT AND AMBIENT NOISE LEVEL

Receptor Identification	Receptor Description	Receptor Location	Daytime Ambient Noise Level (Leq)
Tule Elk Reserve State Park	North of California Aqueduct and east-northeast of Tupman Road	0.45 miles east of pipeline alignment	Assumed 65 dBA
Community of Tupman	Intersection of Grace Avenue and Kern Street	1.25 miles east of pipeline alignment	62.2 dBA*

*Data collected by Stantec Personnel on September 21, 2010 during daytime hours. However, a daytime ambient noise level of 65 dBA was used in this evaluation to provide a conservative approach.

4.0 REGULATORY SETTING

Following are local, state, and federal regulations and standards pertaining to noise that apply to installation of the CO2 supply line.

4.1 LOCAL

4.1.1 Kern County General Plan

The goals and policies set forth by the Kern County General Plan Noise Element have been established in order to protect the acoustical environment for Kern County and to assure a comfortable and calming quality of life for residents. The Kern County General Plan Noise Element requires indoor noise levels in habitable rooms be limited to 45 dBA day/night noise level (Ldn). The typical attenuation factor for structures with closable windows is 20 dBA. The maximum noise level in outside living areas, such as yards, is required to be less than 65 dBA Ldn. A noise level of 65 dBA Ldn is considered the upper limit for noise-sensitive land uses such as residential areas, schools, convalescent and acute care hospitals, parks and recreation areas and churches.

4.1.2 Kern County Code (Chapter 8.36.020)

The Kern County Code prohibits noise from construction, between the hours of nine (9:00) p.m. and six (6:00) a.m. on weekdays and nine (9:00) p.m. and eight (8:00) a.m. on weekends, which is audible to a person with average hearing faculties or capacity at a distance of one hundred fifty (150) feet from the construction site, if the construction site is within one thousand (1,000) feet of an occupied residential dwelling.

4.2 STATE

Two state laws address occupational noise exposure for construction workers and vehicle noise. The Cal-Occupational Safety & Health Administration (OSHA) regulations, which are the same as the federal OSHA regulations, are described below under the Federal subheading. The regulations are contained in Section 8 of the California Code of Regulations (CCR), General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq. 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 (CHP) and the Kern County Sheriff's Office. The California State Government Code, Section 65302, requires local governments (Counties and Cities) to prepare plans that contain noise provisions and standards. Kern County conforms to the Government Code requirements with the Kern County General Plan Noise Element outlined above.

4.2.1 California Energy Commission (CEC)

The CEC guidelines state that the area of impact to be studied should include areas where the noise of the project plus the background exceeds the existing background levels by 5 dBA or more at the sensitive receptor, including those receptors that are considered a minority population. The CEC has considered it reasonable to assume that an increase in background noise levels up to 5 dBA in a residential setting is considered insignificant, while an increase of more than 10 dBA in a residential setting is considered significant. For projects where the increase is between 5 and 10 dBA, the level of an impact depends on the particular circumstances of a case. Factors to be considered in determining the significance of an impact for this plus 5 to plus10 dB situation include:

- Resulting noise level;
- Duration and frequency of the noise;
- Number of people affected;
- Land use designation of the affected receptor sites; and
- Public concern or controversy as demonstrated at workshops or hearings, or by correspondence.

4.3 FEDERAL

The federal government has no standards or regulations applicable to off-site noise levels from the Project. However, guidelines are available from the United States Environmental Protection Agency (EPA; 1974) to assist state and local government entities in development of state and local laws, ordinances regulations, and standards (LORS) for noise.

On-site noise levels are regulated, in a sense, through the Occupational Safety and Health Act of 1970 and through the OSHA. The noise exposure level of workers is regulated at 90 dBA over an eight (8)-hour work shift to protect hearing (29 CFR 1910.95).

5.0 IMPACT EVALUATION

The only sensitive receptors that could be adversely impacted by installation of the CO2 supply line are the Tule Elk Reserve State Park and the community of Tupman. Projected sound levels from construction equipment anticipated to be used for trenching and HDD installation methods were estimated using a point source attenuation model. Noise from the source was assumed to attenuate at a rate of 6 dB for each doubling of distance. To determine potential noise impacts, the noise levels of these activities were estimated at the distance to the sensitive receptors and compared to the Kern County exterior standard noise level of 65 dBA Ldn and the CEC threshold of a 5 dBA noise level increase. The point source attenuation models for each of the following modeled scenarios are attached as ***Appendix A***.

- HDD operations (entry point) within 2,400 feet of Tule Elk Reserve State Park;
- Trenching operations within 2,400 feet of Tule Elk Reserve State Park;
- HDD operations (entry point) within 10,500 feet of Elk Hills Elementary School; and,
- Trenching operations within 6,774 feet of Elk Hills Elementary School.

The noise model assumed eight of hours of construction during daytime hours and no construction activities during nighttime hours for the trenching installation scenario. The model assumed continuous 24 hours of construction per day for the HDD installation scenario (12 hours daytime, 3 hours evening, and 9 hours nighttime). The model further assumes that all equipment would operate at the same time within the same closest distance to the sensitive receptor, which although unlikely to occur, provides a conservative estimate of resulting sound levels for purposes of this analysis. Ambient noise levels of 65 dBA daytime and 50 dBA nighttime were also used to predict the dBA Ldn at sensitive receptors with construction noise. Table 3 provides a summary of the modeling results for each of the above-identified scenarios.

TABLE 3: ESTIMATED SOUND LEVELS FROM CO2 SUPPLY LINE INSTALLATION AT SENSITIVE RECEPTORS				
Installation Scenario	Receptor Modeled	Distance to Receptor (feet)	Estimated Resulting Noise Level (dBA Ldn)	Resulting Increase Over Ambient (dBA Ldn)
HDD	Tule Elk Reserve State Park	2,400	65.4	1.7 dBA
Trenching	Tule Elk Reserve State Park	2,400	63.8	0.1 dBA
HDD	Elk Hills Elementary School	10,500	63.8	0.1 dBA
Trenching	Elk Hills Elementary School	6,774	63.7	No increase

NOTE: Resulting increase over ambient noise levels based on assumed 65 dBA daytime and 50 dBA nighttime ambient noise levels.

As shown in ***Table 3***, the results of the noise model indicates that noise levels are predicted to be below the exterior 65 dBA Ldn Kern County standard for trenching and HDD methods measured at Elk Hills Elementary School (Community of Tupman), as well as for trenching installation methods measured at Tule Elk Reserve State Park. The noise level for HDD methods predicted at Tule Elk Reserve State Park was estimated to exceed the exterior 65 dBA Ldn Kern County standard by 0.4 dBA. However, the Kern County standard is typically applied to outside living areas. It should also be noted that the HDD noise level model assumed all equipment typically required for HDD installation will all operate at the same time, continuous 24 hours a day operation, and at the same distance to the Tule Elk Reserve State Park. As such, it is likely that the estimated noise levels from HDD operations at the Tule Elk Reserve State Park have been overestimated. Furthermore, the HDD installation activities at this location will be limited to a short-term duration and will not result in a permanent noise level increase at this sensitive receptor. In addition, there is not an occupied residential dwelling located within 1,000 feet of the HDD location (or any other proposed CO2 supply line installation location). Therefore, construction activities are not expected to violate the Kern County Code or Noise Ordinance.

As shown in ***Table 3***, the predicted increase in ambient noise levels at sensitive receptors will be below the 5 dBA threshold considered by the CEC for noise level increases for residential settings. Even when applied to all potentially affected sensitive receptors (school and park), no increases in ambient levels will approach the 5 dBA CEC threshold. Considering the above, noise impacts from installation of the modified CO2 supply line alignment will not result in a significant noise impact or violate any applicable standard.

Operation of the CO2 supply line is not expected to generate substantial noise. Some noise may occur during operation of the CO2 supply line as a result of vehicles and other equipment used in support of routine right-of-way (ROW) inspections, response to underground service alert requests, and other supply line maintenance activities. However, the level of activity and

noise sources associated with operational activities are expected to be below noise levels associated with installation of the CO2 supply line. As noise levels form pipeline installation have been shown not to be significant or violate any applicable standard through this evaluation, operational noise sources are also not expected be significant or violate any applicable standard.

APPENDIX A

CONSTRUCTION NOISE MODELS

CONSTRUCTION NOISE ANALYSIS
MODIFIED CO2 SUPPLY LINE ALIGNMENT

Noise Scenario: Pipeline Installation via Conventional Trenching Techniques
Receptor: Tupman (Elk Hills Elementary School)

Construction Noise Source (Point Source)	Number of Units	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)	Noise Level Below Loudest	Additive Noise Level (dBA)
Crane	1	0.16	83	6774	37.8	4.8	33.1	3.7	1.5
Backhoe or Excavator	1	0.73	85	6774	41.6	4.8	36.8	0.0	3
Welding Machine	1	0.73	73	6774	29.6	4.8	24.8	12.0	0.26
Supply Truck	1	0.73	82	6774	38.6	4.8	33.8	3.0	1.68
Water Truck	1	0.73	83	6774	39.6	4.8	34.8	2.0	2.12

Total Leq (dBA) at Receptors During Scenario	**42.3**
Assumed Daytime Ambient Noise Level:	65.0
Assumed Nighttime Ambient Noise Level:	50.0
Number of Daytime Hours Operating	8.0
Number of Evening Hours Operating	0.0
Number of Nighttime Hours Operating	0.0
Assumed Ambient Ldn	63.7
Estimated Ldn	**63.7**

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground
Data Source: EPA (1971), Noise From Construction Equipment and Operations

CONSTRUCTION NOISE ANALYSIS
MODIFIED CO2 SUPPLY LINE ALIGNMENT

Noise Scenario: Pipeline Installation via Horizontal Directional Drilling (Bore 2 - entry south of California Aqueduct)
Receptor: Tupman (Elk Hills Elementary School)

Construction Noise Source (Point Source)	Number of Units	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)	Noise Level Below Loudest	Additive Noise Level (dBA)
Crane	1	0.16	83	10500	34.0	4.8	29.3	3.7	1.5
Backhoe or Excavator	1	0.73	85	10500	37.7	4.8	33.0	0.0	3
Drill Rig	1	0.73	85	10500	37.7	4.8	33.0	0.0	3
Generator	1	0.73	78	10500	30.7	4.8	26.0	7.0	0.79
Supply Truck	1	0.73	82	10500	34.7	4.8	30.0	3.0	1.68
Pump	3	0.73	76	10500	33.1	4.8	28.3	4.6	1.23

Total Leq (dBA) at Receptors During Scenario	**41.2**
Assumed Daytime Ambient Noise Level:	65.0
Assumed Nighttime Ambient Noise Level:	50.0
Number of Daytime Hours Operating	12.0
Number of Evening Hours Operating	3.0
Number of Nighttime Hours Operating	9.0
Assumed Ambient Ldn	63.7
Estimated Ldn	**63.8**

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground
Data Source: EPA (1971), Noise From Construction Equipment and Operations

CONSTRUCTION NOISE ANALYSIS
MODIFIED CO2 SUPPLY LINE ALIGNMENT

Noise Scenario: Pipeline Installation via Conventional Trenching Techniques
Receptor: Tule Elk Reserve State Park

Construction Noise Source (Point Source)	Number of Units	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)	Noise Level Below Loudest	Additive Noise Level (dBA)
Crane	1	0.16	83	2400	46.9	4.7	42.2	3.7	1.5
Backhoe or Excavator	1	0.73	85	2400	50.6	4.7	45.9	0.0	3
Welding Machine	1	0.73	73	2400	38.6	4.7	33.9	12.0	0.26
Supply Truck	1	0.73	82	2400	47.6	4.7	42.9	3.0	1.68
Water Truck	1	0.73	83	2400	48.6	4.7	43.9	2.0	2.12

Total Leq (dBA) at Receptors During Scenario	**51.4**
Assumed Daytime Ambient Noise Level:	65.0
Assumed Nighttime Ambient Noise Level:	50.0
Number of Daytime Hours Operating	8.0
Number of Evening Hours Operating	0.0
Number of Nighttime Hours Operating	0.0
Assumed Ambient Ldn	63.7
Estimated Ldn	**63.8**

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground
Data Source: EPA (1971), Noise From Construction Equipment and Operations

CONSTRUCTION NOISE ANALYSIS
MODIFIED CO2 SUPPLY LINE ALIGNMENT

Noise Scenario: Pipeline Installation via Horizontal Directional Drilling (Bore 2 - entry south of California Aqueduct)
Receptor: Tule Elk Reserve State Park

Construction Noise Source (Point Source)	Number of Units	Assumed Equipment Use Factor	Maximum Sound Pressure @50 feet (dBA)	Distance to Receptor (Feet)	Point Source Noise Level Attenuation with Distance (dBA)	Ground Attenuation with Distance (dBA)	Total Noise Level Attenuation (dBA)	Noise Level Below Loudest	Additive Noise Level (dBA)
Crane	1	0.16	83	2400	46.9	4.7	42.2	3.7	1.5
Backhoe or Excavator	1	0.73	85	2400	50.6	4.7	45.9	0.0	3
Drill Rig	1	0.73	85	2400	50.6	4.7	45.9	0.0	3
Generator	1	0.73	78	2400	43.6	4.7	38.9	7.0	0.79
Supply Truck	1	0.73	82	2400	47.6	4.7	42.9	3.0	1.68
Pump	3	0.73	76	2400	45.9	4.7	41.2	4.6	1.23

Total Leq (dBA) at Receptors During Scenario	**54.1**
Assumed Daytime Ambient Noise Level:	65.0
Assumed Nighttime Ambient Noise Level:	50.0
Number of Daytime Hours Operating	12.0
Number of Evening Hours Operating	3.0
Number of Nighttime Hours Operating	9.0
Assumed Ambient Ldn	63.7
Estimated Ldn	**65.4**

Ground attenuation estimates assume soft sites, average transmission path of 2 meters above the ground
Data Source: EPA (1971), Noise From Construction Equipment and Operations

ATTACHMENT D

HAZARDS ASSESSMENT FOR MODIFIED ALIGNMENT OF CO2 SUPPLY LINE

Hazards Assessment for Modified Alignment of CO2 Supply Line

CO2 supply line alignment from the HECA Facility to the OEHI CO2 EOR Processing Facility
Tupman, Kern County, CA

April 12, 2011

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1.0 RISK ASSESSMENT

This Risk Assessment was conducted as an update for the accidental worst-case release scenario from the carbon dioxide (CO2) Supply Line from the Hydrogen Energy California (HECA) Facility to the Occidental of Elk Hills, Inc (OEHI) CO2 Enhanced Oil Recovery (EOR) Processing Facility located in Section 27S. This Risk Assessment addresses the worst-case release scenario of a modified alignment of the CO2 supply line from what was originally considered in HECA's 2009 Application for Certification (AFC) with the California Energy Commission (CEC). This risk assessment specifically addresses a worst-case scenario by dispersion of CO2 and hydrogen sulfide (H2S). The risk assessment methodology for CO2 is based on the evaluation performed on the original pipeline alignment contained in HECA's 2009 CEC AFC filing (URS, 2009, Appendix E).

The chemical compound CO2 does not manifest hazardous properties (i.e., toxicity, reactivity, flammability, or explosivity) that would result in regulatory classification as a hazardous material. However, the current U.S. Department of Transportation (DOT) requirement for pipelines transporting CO2 (49 Code of Federal Regulations [CFR] 195) directs the operator to perform a risk assessment.

Hydrogen sulfide (H2S) does manifest hazardous properties (i.e., primarily toxicity and flammability). By relative volume compared to the quantity of CO2, the H2S volume is much lower, but National Institute for Occupational Safety and Health (NIOSH) regulated permissible exposure limits (PELs) are also much lower.

The CO2 captured in the gasification processes at the HECA Facility will be compressed and transported in a semi-aqueous state to the custody transfer point and ultimately injected into the Stevens reservoirs for CO2 EOR and sequestration. The 12-inch diameter CO2 supply line will convey the CO2 from the HECA Facility to the OEHI CO2 EOR Processing Facility. It is anticipated that the pressure of the CO2 from the compressor will be approximately 2,500 pound-force per square inch gauge *(psig)*. The modified alignment of the CO2 supply line is 3.36 miles (see Figure 2 of the Data Gap Analysis).

For the majority of the modified alignment, the CO2 supply line will be buried approximately 5 feet below grade in a trench. The CO2 supply line will be buried as deep as 50 to 100 feet below grade using horizontal directional drilling (HDD) methodology when crossing the California Aqueduct and the Buena Vista Slough. The length of the surface pipeline which connects the compressor and underground pipeline will be approximately 200 feet long and entirely within the HECA Facility.

The CO2 supply line will be equipped with four emergency block valves that will isolate various segments of the supply line. The first block valve will be located at the end of the 200-foot aboveground supply line segment from the HECA compressor discharge, before the pipeline transitions below ground. There will be additional block valves placed along the CO2 supply line on the north side of the aqueduct and on the south side of the aqueduct. The last block valve will be placed at the pipeline terminus at OEHI's CO2 EOR Processing Facility. Although the block valves located near the boundary of the HECA facility and the pipeline termination at the EOR Processing Facility will be automated emergency block valves, the block valves located adjacent to the north and south sides of the California Aqueduct will be manual block

valves. As such, the evaluation of the potential consequences associated with a worst-case release from the CO2 supply line includes a release from the entire 3.36 mile-long pipeline rather than individual pipeline segments located between block valves.

.

2.0 QUANTITATIVE FAILURE ANALYSIS

The HECA project analyzed the risk of upset assessment for the proposed CO2 supply line and estimated the probability of failure and adverse consequences based on historical accident records of CO2 pipelines.

Accident/spill records of CO2 pipelines were obtained from the data provided by the Office of Pipeline Safety at the DOT. Incident failure rate was also obtained from the European Gas Pipeline Incident Data Group and analysis in the Oil and Gas Journal. Based on these data, the failure and accident frequency of CO2 pipelines could be calculated.

A total of 13 accidents regarding CO2 pipelines occurred in the United States between 1986 and 2008. Of these 13 accidents, none had reported human injuries or fatalities, compared to the more than 5,000 accidents and 107 fatalities in the same period caused by natural gas and hazardous liquid pipelines. This information on CO2 pipeline incidents was used to estimate the failure rate (i.e., 13 accidents in 22 years in 3,500 miles of pipelines).

The HECA project evaluation concluded that 46 percent of the accidents were caused by equipment failure. Close examination of these accidents revealed that the majority were caused by failure of a subcomponent (such as valve or gasket). The second most common cause was “Unknown,” accounting for approximately 23 percent of all accidents. The average failure rate for this period of time was 0.000169 failure per mile of CO2 pipeline per year.

Based on these data, the upper bound of the projected failure rate for the approximately 3.36 miles of CO2 supply line is 0.0006 failure per year.

Due to the adverse consequences that may occur from a possible CO2 pipeline failure, the industry has developed standard means to control the integrity and safe operation of pipelines. These practices include routine inspections of the pipeline rights-of-way (ROWs) for third party actions, internal pipe inspections performed by in-line inspection tools (e.g., pigs), and cathodic protection programs.

3.0 POTENTIAL HAZARD IMPACTS AND CONSEQUENCE MODELING

This section presents an evaluation of a hypothetical worst-case release scenario to assess the maximum potential consequence from the CO2 supply line.

Dispersion modeling provides an examination of the dispersion of CO2 in the form of a vapor cloud. The modeling assumptions for a worst-case release scenario are that the total contents from the largest inventory are accidentally released into the atmosphere. The extent of potential impact from the hypothetical accidental release was computed by using the Areal Locations of Hazardous Atmospheres (ALOHA) 5.4.1 air dispersion modeling program. ALOHA is a Gaussian plume model that incorporates continuous source and meteorological parameters.

The ALOHA model was selected to model the release, as it is suitable for modeling the release of a heavy gas (i.e., gas that is heavier than air) such as CO2. This model also takes into consideration the specific atmospheric conditions that may affect a potential release.

The modeling assumed worst-case atmospheric conditions during such a release. These conditions provide conservative results because these extreme and unlikely climatic conditions maximize the vaporization to create the vapor cloud and minimize its dispersion. For purposes of this analysis, the worst-case climate condition consists of:

- an ambient temperature of 115 degrees Fahrenheit (ºF) (the highest average temperature in the Project area),
- 50 percent average humidity,
- wind speed of 1.5 meters per second, and
- level F atmospheric stability.

Level F atmospheric stability provides the most stable atmospheric environment where the tendency of the atmosphere is to resist or enhance vertical motion and/or turbulence—this also contributes to minimum dissipation of the vapor cloud.

3.1 CARBON DIOXIDE EXPOSURE LIMITS

The modeling conducted to evaluate the potential impact area associated from a worst-case CO2 supply line release used exposure limit concentrations levels of CO2 as established by the U.S. Occupational Safety & Health Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), and NIOSH. The concentrations were examined to determine which concentration levels would present the greatest hazard during a worst-case release scenario.

These concentrations are stated in terms of:

(1) Permissible Exposure Limit PEL;

(2) Threshold Limit Value (TLV);

(3) Short Term Exposure Limit (STEL); and

(4) Immediately Dangerous to Life or Health (IDLH).

Both the PEL and TLV specify airborne concentration levels under which nearly all workers may be repeatedly exposed without potential adverse effects. The STEL represents the concentration to which workers can be exposed continuously for a short period of time without suffering from irritation, chronic or irreversible tissue damage, or narcosis of sufficient degree to increase the likelihood of accidental injury, impaired judgment, or materially reduction in work efficiency.

TABLE 1: Concentrations of Concern for Carbon Dioxide

Exposure Limit for Carbon Dioxide	Concentration	Exposure Period
OSHA PEL	5,000 ppm	Time weighted average concentration for 8-hour work day
ACGIH TLV	5,000 ppm	Time weighted average concentration for normal 8-hour work day or 40-hour work week
OSHA STEL	30,000 ppm	Maximum concentration for 15-minute period (maximum of 4 periods per day with at least 60 minutes between exposure periods)
NIOSH IDLH	40,000 ppm	The maximum level to which a healthy individual can be exposed to a chemical for 30 minutes and escape without suffering irreversible health effects or impairing symptoms

Notes:

ACGIH = American Conference of Governmental Industrial Hygienists
IDLH = Immediately Dangerous to Life or Health
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety & Health Administration
PEL = Permissible Exposure Limit
ppm = parts per million
STEL = Short Term Exposure Limit
TLV = Threshold Limit Value

3.2 HYDROGEN SULFIDE EXPOSURE LIMITS

The CO2 contained in the CO2 supply pipeline is expected to have a relatively small percentage of H2S in the stream. A peak concentration of 100 ppm with an average of 20 ppm is anticipated, so exposure limit concentrations were also reviewed the worst-case release scenario.

These concentrations are stated in terms of:

(1) PEL;

(2) TLV;

(3) STEL; and

(4) IDLH.

TABLE 2: Concentrations of Concern for Hydrogen Sulfide		
Exposure Limit for Carbon Dioxide	**Concentration**	**Exposure Period**
OSHA PEL	20 ppm	Time weighted average concentration for 8-hour work day
ACGIH TLV	10 ppm	Time weighted average concentration for normal 8-hour work day or 40-hour work week
OSHA STEL	50 ppm (10-minute max peak)	Maximum concentration for 10-minute period (maximum of one time per day)
NIOSH IDLH	100 ppm	The maximum level to which a healthy individual can be exposed to a chemical for 30 minutes and escape without suffering irreversible health effects or impairing symptoms

Notes:

ACGIH = American Conference of Governmental Industrial Hygienists
IDLH = Immediately Dangerous to Life or Health
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety & Health Administration
PEL = Permissible Exposure Limit
ppm = parts per million
STEL = Short Term Exposure Limit
TLV = Threshold Limit Value

3.3 CONSEQUENCE MODEL AND METHODOLOGY

Carbon Dioxide Worst-Case Release Scenario

In order to provide conservative results as to the extent of impact of a CO2 release from the CO2 supply line, the worst-case scenario modeling examined an instantaneous release from a complete lateral shear and de-pressurization of the CO2 supply line sections isolated by automated emergency block valves (assumed to be the entire 3.36 mile-long pipeline for purposes of this evaluation).

This Risk Assessment uses the same following assumptions for a CO2 release as those considered in HECA's 2009 CEC AFC filing (URS 2009, Appendix E):

> The CO2 will be transported as a supercritical fluid under highly pressurized conditions. Due to the highly pressurized conditions, a complete shear or rupture of the pipeline may displace the soil above the pipeline. Upon release and adiabatic expansion, it is estimated that approximately 75 percent of the CO2 volume within the affected pipeline segment will be discharged as a gas. The remaining 25 percent of the CO2 volume will solidify and then vaporize slowly, resulting in a gaseous release into the atmosphere.
>
> Since the weight of the soil above the pipeline would decrease the release rate, the worst-case scenario of CO2 release at each pipeline section was assumed to occur at the piping connecting to the valve boxes, which are located near the ground surface level, resulting in a release to the atmosphere.
>
> The evaluation of the worst-case release scenario focused on the estimated gas volume of the supercritical CO2 released, because the CO2 gas volume presents the greatest

potential for dispersion upon release into the atmosphere. Based on these assumptions, this assessment analyzed the potential impacts of the CO2 within the affected pipeline segment being modeled at a ground-level elevation, which is the worst-case scenario.

For the worst-case release scenario, the rupturing of the CO2 supply line was assumed to produce an 0.8-square-foot aperture (meaning a complete severing of the 12-inch-diameter pipeline) at the connection to the valve box through which CO2 would escape. The worst-case scenario assumes that the total CO2 volume of each section will release through the rupture within 1 minute (the minimum duration used by the ALOHA model for immediate releases). The atmospheric conditions modeled represent the least favorable conditions for the normal dissipation of a concentrated CO2 release.

In addition to the gas volume released from each isolated pipeline segment, the analysis also accounted for the additional CO2 that would be released during the reaction time for activation of the automated emergency block valves. It would take approximately 20 seconds for the CO2 supply line emergency block valves to activate based on pressure loss conditions identified for the pipeline.

Based on the foregoing, a total of 273,423 pounds of CO2 would be released during the worst-case release scenario

3.4 MODELING RESULTS CARBON DIOXIDE

The modeling of the worst-case scenarios demonstrated the following concentrations may be reached at the following approximate distances during the hypothetical release. This information was used for the risk analysis.

TABLE 3: Approximate Distances to Carbon Dioxide Concentrations of Concern

Length of CO2 Pipeline (feet)	CO2 Released (Pounds)	Concentration of Concern (PPM)	Approximate Distance to Concentration of Concern (feet)
17,741	273,423	30,000(STEL)	1,767
		40,000 (IDLH)	1,476

The area surrounding the CO2 supply line route is mainly composed of oil field, native terrain, and agriculturally developed lands in areas that would potentially be impacted from the hypothetical worst-case scenario release. The community of Tupman is approximately 6,804 feet from the closest point along the pipeline alignment. Other individuals who may be present in potential areas of impacts include occasional agricultural workers and oil production workers and potential future workers at the projects.

3.5 MODELING RESULTS HYDROGEN SULFIDE

The CO2 provided to the Project from HECA is expected to contain H2S with an anticipated peak concentration of 100 parts per million (ppm) and an average concentration of 20 ppm. H2S is considered a toxic gas, so a release could create a hazard to the public. As a worst-case release scenario, the radius of H2S exposure at the IDLH was modeled using the Pasquill-Gifford equation. Specifically, the radius of H2S exposure was estimated using the following equation:

$$\text{Radius of } H_2S \text{ Exposure (feet)} = [(1.589)\,(\text{mole fraction } H_2S)(Q)]^{0.6258}$$

The above equation estimates the radius of exposure in feet, where: Q = maximum volume determined to be available for escape in cubic feet, and mole fraction H2S = mole fraction of hydrogen sulfide in the gaseous mixture available for escape. At 100 ppm H2S, the H2S mole fraction is 0.0001. Q is the worst-case release mass of 273,423 pounds (lbs) of CO2 which is equivalent to 2,389,990 standard cubic feet of gaseous mixture available for escape. Using the above assumptions, the IDLH for H2S (100 ppm) is estimated to extend approximately 41 feet from the release point.

4.0 CONCLUSION

The modification to the alignment of the CO2 supply line and resulting dispersion modeling of the worst-case release scenario does not substantially change the risk probability or evaluation contained in HECA's 2009 CEC AFC filing. As calculated in Section 20, the historical failure rate for the 3.36-mile CO2 supply line is estimated to be approximately 0.0006 failures per year, which will not present a significant likelihood of occurrence. The ranges of risk values previously evaluated by HECA remain unchanged as a result of the alignment modification and are acceptable based upon standard risk methodology. This demonstrates that the CO2 supply line will have a less-than significant risk.

Appendix A-3

OEHI Responses to CEC August 5, 2011 Outstanding Items Letter

OCCIDENTAL OF ELK HILLS, INC.
10800 Stockdale Highway, Bakersfield, CA 93311
Telephone 661 412-5000

April 27, 2012

Robert Worl, Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

**RE: HYDROGEN ENERGY CALIFORNIA PROJECT (08-AFC-8)
CALIFORNIA ENERGY COMMISSION DATA REQUEST, AUGUST 5, 2011(#s 13-36)**

Dear Mr Worl:

Below are responses to the certain questions from the California Energy Commission data request regarding the Hydrogen Energy California Project which pertain to Oxy's CO2 EOR Project.

13. Applicant to provide Oxy's historical wildlife data from long-term monitoring of NPR-1 and NPR-2 (several decades of data was collected during Naval Petroleum Reserve monitoring). Resource agencies have a good handle on which wildlife are present on Elk Hills. San Joaquin kit fox, San Joaquin antelope ground squirrel, giant kangaroo rat, blunt-noise leopard lizard are all threatened and endangered species and assumed present.

Section 4.4 of the SEI includes a discussion of existing biological resources and impact analysis for the CO2 EOR Project. OEHI is providing the Annual Reports from 1995 to 2011 which contains historic long-term monitoring data for NPR-1 (EHOF).

14. Applicant to map giant kangaroo rat precincts (individual territories) on direct impact areas of Elk Hills. Giant kangaroo rat are assumed present by resource agencies, but a current mapping would be useful. The resource agencies asked for current giant kangaroo rat precinct data for the carbon dioxide pipeline so the same request would likely be made here.

Section 4.4 of the SEI includes a discussion of existing biological resources and impact analysis for the CO2 EOR Project.

15. Applicant to perform focused surveys for Swainson's hawk nests. General survey timing: March-August.

As required by the EHOF HCP, biological pre-activity surveys are conducted by qualified biologist's prior to ground disturbance activities. Biological data associated with Swainson's hawk and nests are provided in the EHOF HCP semi-annual and annual reports provided to the wildlife agencies.

16. **Applicant to provide golden eagle nest data for Elk Hills and surrounding areas. Provide the results of a literature review, museum records search, database search, and check with local raptor groups for golden eagle nests and territories. Depending on this data, USFWS's Migratory Bird Office may request more detailed field surveys and/or helicopter surveys.**

Biological pre-activity surveys are conducted by qualified biologist's prior to ground disturbance activities. Biological data associated with golden eagle and nests are provided, if observed in the annual reports provided to the wildlife agencies; and included herewith.

17. **Applicant to conduct focused burrowing owl surveys (Phase I habitat assessment, Phase II burrow surveys, Phase III owl surveys) on Oxy's direct impact areas. Timing: Phase I and II can be conducted any time of the year, Phase III peak nesting season April 15 to July 15.**

Biological pre-activity surveys are conducted by qualified biologist's prior to ground disturbance activities. Biological data associated with burrowing owl and nests are provided, if observed in the annual reports provided to the wildlife agencies; and included herewith.

18. **Applicant to conduct focused botanical surveys following CDFG 2009 survey guidelines over the direct impact area of Elk Hills. Staff is not sure how current the plant survey data is for Elk Hills although rare plants have been long-studied here. Survey timing is species-specific in the southern San Joaquin Valley, but generally, surveys should be spaced out between February through March/April for annuals. Perennials can be surveyed for later in the season. Consult with DFG on species-specific survey timing.**

Plant species are listed in the Data Gap Analysis Biological Assessment (Feb 2011), and survey data are included herewith.

19. **Applicant to provide mapping of potentially state jurisdictional waters following Section 1600 Fish and Game Codes on Elk Hills direct impact area.**

OEHI holds a 12 year site-wide streambed alteration maintenance permit as required by 14 CCR Sections 1601 and 1603 of the Fish and Game Code. The current permit for OEHI expires in the year 2020. If it is determined that the activity may substantially adversely affect fish and wildlife resources within state jurisdictional waters, a Lake or Streambed Alteration Agreement will be prepared.

20. **Applicant to add Elk Hills direct impact area to Section 404 Waters of the U.S. study area map and re-submit to Corps for verification.**

EHOF contains no U.S. Army Corps of Engineers jurisdictional waters.

21. Applicant to assess whether Elk Hills direct impact area overlaps with any existing or proposed conservation lands owned by CDFG per the draft Occidental of Elk Hills Habitat Conservation Plan (HCP).

The Elk Hills direct impact area does not overlap with any existing or proposed conservation lands owned by CDFG.

22. Determine the nature of impacts to ethnographic resources through with local Native American groups. Staff has found that letters and emails to be ineffective in determining ethnographic impacts. Therefore, face to face consultation and site tours are strongly recommended.

Face to face consultation with Native American groups has not been conducted for the CO2 EOR Project. Impacts to ethnographic resources have been addressed in the SEI and C02 EOR Supply Line Data Gap Analysis.

23. Provide copies of formal government-to-government Section 106 consultation letters written by the DOE to local Native American groups.

A copy of the consultation letter has been provided to HECA.

24. Revisit site CA-Ker-5392, identify and map its full extent, and submit either a detailed site specific avoidance plan or data recovery plan to address impacts of the proposed CO2 line.

Site CA-Ker-5392 is approximately a mile away from the OEHI proposed CO2 line route. No further survey, mapping, avoidance plan, or data recovery plan is needed since it will not be impacted by this project.

25. Revisit historic archaeological sites P-15-9738 and HECA 2010-2, update the site maps and site forms to include all of the structures and features shown on aerial photographs or described in previous site forms. Conduct archival research equivalent to that conducted for the build-environment resources by JRP.

OEHI is not familiar with these historic archaeological sites. Please provide further details.

26. Complete the pedestrian survey for all of the HECA linear alignments.

A pedestrian survey was conducted for the OEHI preferred CO2 supply line alignment (see Data Gap Analysis). Remaining HECA linear alignments are the responsibility of HECA.

27. Conduct test excavations and evaluations of CRHR eligibility for all archaeological sites which staff has identified as having the potential to be directly impacted by HECA.

OEHI will evaluate the sites within the CO2 supply pipeline ROW alignment. Remaining sites with the HECA linear alignments are the responsibility of HECA.

28. Conduct geoarchaeological field sampling as requested in Data Requests 78-79, 143 and 172-173 (CEC 2009o, CEC 2010b, 2010w). Staff requests that the sampling be conducted prior to the completion of the FSA, otherwise staff may not be able to complete their analysis.

This DR is the responsibility of HECA.

29. Provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the project, the measures proposed to mitigate adverse environmental impacts of the project, the effectiveness of the proposed measures, and any monitoring plan proposed to verify the effectiveness of the mitigation.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

30. A summary of the ethnology, prehistory, and history of the region with emphasis on the area within no more than a 5-mile radius of the project location.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

31. The results of a literature search to identify cultural resources within an area not less than a 1-mile radius around the project site and not less that than one-quarter (0.25) mile on each side of the linear facilities.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

32. Conduct all required pedestrian surveys of the CO2 linear route and any proposed facilities, staging areas or injection points and provide the results in a technical report.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

33. Copies of all technical reports whose survey coverage is wholly or partly within .25 mile of the area surveyed for the project.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

34. Copies of California Department of Parks and Recreation (DPR) 523 forms for all cultural resources identified in the literature search as being 45 years or older or of exceptional importance.

OEHI is not familiar with these forms. Please provide further details.

35. A copy of the USGS 7.5' quadrangle map of the literature search area delineating the areas of all past surveys.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

36. A map at a scale of 1:24,000 U.S. Geological Survey quadrangle depicting the locations of all previously known and newly identified cultural resources compiled through the research required by Appendix B.

See section 4.5 (Cultural Resources) of the SEI and Data Gap Analysis.

Sincerely,

William H. Barrett
EOR Business Manager
Occidental of Elk Hills, Inc.