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Description:	*** These documents supersedes TN 65049 which was just the cover letter due to the fact the Amended AFC was too large to docket at the time. *** - Document was on proceeding webpage and is now moved over to the docket log.
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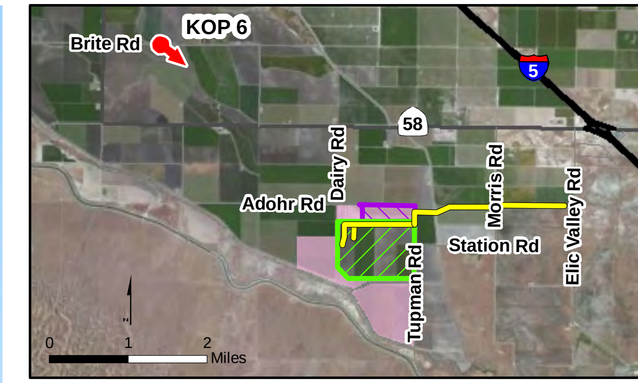
Photograph is intended to be viewed 10 inches from viewer's eyes when printed on 11x17 paper. The photograph below has been cropped top and bottom to show a wide angle of view with the above photograph's area shown in yellow.



Key Observation Point
Transmission
Project Site
Construction Staging Area
Controlled Area

Photograph Information

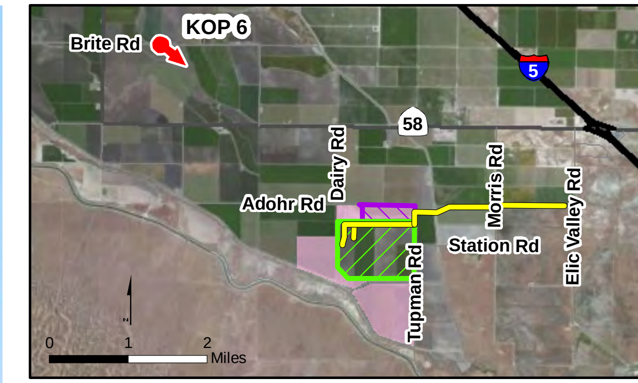
Time of photograph:	4:07 PM
Date of photograph:	March 5, 2009
Distance to project:	.31 mile
Weather condition:	Partly Cloudy
Viewing direction:	Southeast
Latitude:	35°22'9.23"N
Longitude:	119°26'4.83"W

KOP 6: VIEW FROM EASTBOUND BRITE ROAD
EXISTING CONDITIONS

April 2012 — Hydrogen Energy California (HECA)
28067571 — Kern County, California

URS

FIGURE 5.11-25



Key Observation Point

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KOP 6: VIEW FROM EASTBOUND BRITE ROAD
SIMULATED CONDITIONS

April 2012
28067571

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.11-26

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5.12 HAZARDOUS MATERIALS HANDLING

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.
- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.
- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.
- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration**.**
- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  - **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  - **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

This section presents a discussion of the potential impacts from storage and use of hazardous materials during construction and operational phases of the Project. Design features have been incorporated into the Project regarding the use of hazardous materials— specifically storage procedures—in order to keep maximum potential impacts below defined thresholds of significance. Hazardous waste generation and waste management practices for the Project are further discussed in Section 5.13, Waste Management.

The discussion below includes the existing conditions; the environmental consequences associated with hazardous materials use during construction and operation of the Project; cumulative impacts; mitigation measures; and applicable laws, ordinances, regulations, and standards (LORS). Appendix K, Hazardous Materials Technical Analysis, provides additional data supporting this analysis.

Information related specifically to the OEHI Project is contained in Appendix A-1 of this AFC Amendment, Section 4.7, Hazards and Hazardous Materials and Appendix A-2, Section 2.12, Hazards and Hazardous Material.

5.12.1 Affected Environment

The Project Site is currently used for farming purposes, including cultivation of cotton, alfalfa, and onions. Adjacent land uses consist of Adohr Road and agricultural uses to the north; Tupman Road and agricultural uses to the east; agricultural uses and an irrigation canal to the south; and agricultural uses and the Dairy Road right-of-way to the west.

The West Side Canal, Kern River Flood Control Channel, and California Aqueduct are located approximately 500 feet, 700 feet, and 1,900 feet, respectively, to the south of the Project Site. The land southwest of the California Aqueduct is used for mineral and petroleum purposes. The Elk Hills Field is approximately 1 mile south of the Project Site.

There are no sensitive receptors (e.g., schools, hospitals, playgrounds, daycare centers, residences, etc.), as defined by California Accidental Release Prevention (CalARP) 19 Code of California Regulations (CCR) §2735.3, within the Project Site. One residence was found approximately 1,400 feet east of the Project Site along Station Road. See Section 5.6, Public Health, for additional information on sensitive receptors. For a detailed description of the Project features, see Section 2.0, Project Description.

5.12.2 Environmental Consequences

The criteria used at the Project were evaluated based on the Environmental Checklist Form of the California Environmental Quality Act (CEQA) guidelines, and on standards and thresholds adopted by the relevant agencies involved with this AFC Amendment. Accordingly, the Project may result in a significant impact if it will:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school.
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code §65962.5, and as a result, create a significant hazard to the public or environment.

- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

5.12.2.1 Construction Phase

Hazardous materials to be used during construction include gasoline, diesel fuel, oil, and lubricants, as well as minimal amounts of cleaners, solvents, adhesives, and paint materials. No Acutely Hazardous Materials (AHMs) will be used or stored on site during construction, and no storage of hazardous materials will occur outside of the Project Site. A summary of hazardous materials to be used and stored for construction is provided in Table 5.12-1, Hazardous Materials Usage and Storage During Construction Based on Title 22 Hazardous Characterization; and Table 5.12-2, Hazardous Materials Usage and Storage During Construction Based on Material Properties. These tables identify hazardous materials that will be used during construction, based on Title 22 characteristic criteria, and based on the properties of the substance itself.

A Hazardous Materials Business Plan (HMBP) will be prepared prior to construction activities, and will outline hazardous materials handling, storage spill response, and reporting procedures. In accordance with the HMBP, construction contractors will be responsible for demonstrating that the use, storage, and handling of these materials are in compliance with applicable LORS, including licensing, personnel training, accumulation limits, reporting requirements, and recordkeeping. Each construction contractor will also be responsible for maintaining a set of Material Safety Data Sheets (MSDSs) for each on-site chemical they use, and construction workers will be made aware of their location and contents.

A Spill Prevention Control and Countermeasure (SPCC) Plan will be prepared in accordance with 40 Code of Federal Regulations (CFR) Part 112, Oil Pollution Prevention. The purpose of the SPCC Plan is to prevent a discharge of oil into navigable waters. A facility is covered by the SPCC rule if it has an aggregate aboveground oil capacity greater than 1,320 gallons. Because maximum stored quantities of diesel fuel and gasoline exceed the threshold, the SPCC rule applies to the Project construction phase. The SPCC Plan requires that the owner or operator of the facility develop procedures that describe oil-handling operations, spill prevention practices, discharge or drainage controls, and the personnel, equipment, and resources at the facility that are used to prevent oil spills from reaching navigable waters. Secondary containment to catch oil spills, such as berms or curbing, will have to be provided.

The following services will be provided at the Project Site during construction:

- Environmental health and safety training;
- Site security;
- Site first aid;
- Construction testing (e.g., soil, concrete);
- Furnishing and servicing of sanitary facilities;
- Trash collection and disposal;
- Disposal of hazardous materials and waste; and
- An SPCC Plan that details temporary secondary containment.

Contractors will be expected to implement best management practices (BMP) consistent with hazardous materials storage, handling, emergency spill response, and reporting specified in the HMBP. These BMPs will include provisions for spill protection for non-hazardous materials (such as lube oils), which will also be handled and stored on site during construction. The most probable accidents involving hazardous materials during construction might occur from small-scale spills during cleaning, or use of other materials in the storage areas, or during refueling of equipment. Such materials generally have a low relative risk to human health and the environment. Such spills will be immediately cleaned up, and materials containing hazardous substances will be properly disposed in accordance with the HMBP and BMPs.

If a large spill occurs, the spill area will be bermed or controlled as quickly as practical to minimize the footprint of the spill, in accordance with the HMBP and BMPs. Contaminated soil materials produced during cleanup of a spill will be stored, transported, and disposed. If a spill or leak into the environment involves hazardous materials equal to or greater than the specific reportable quantity, federal, state, and local reporting requirements will be adhered to. In particular, the Kern County Environmental Health Services Department (EHSD) will be notified. The Kern County Fire Department (KCFD) will also be notified in the event of a fire or injury.

Impacts associated with the use of hazardous materials during construction would be less than significant as a result of the Applicant implementing the above procedures, and Mitigation Measures HAZMAT-1 through HAZMAT-4, as discussed in Section 5.12.5, Mitigation Measures.

According to the analysis contained in Appendix A-1, Section 4.7, Hazards and Hazardous Materials; and Appendix A-2, Section 2.12, Hazards and Hazardous Materials, impacts associated with the use of hazardous materials during the construction of the OEHI Project would not result in significant adverse impacts.

5.12.2.2 Operations Phase

A summary of hazardous materials to be used and stored on site for operation of the Project is provided in Table 5.12-3, Hazardous Materials Usage and Storage During Operations Based on Title 22 Hazardous Characterization, and Table 5.12-4, Hazardous Materials Usage and Storage During Operations Based on Material Properties. These tables present materials that will be used during regular plant operations that may be characterized as hazardous, based on Title 22 criteria or on the materials' properties.

Fire and Explosion Risks

Natural Gas

Natural gas, which will be used for start-up, shut-down, and back-up fuel for the Project, poses a fire and/or explosion risk as a result of its flammability. U.S. Department of Transportation (DOT) rules govern gas pipeline operations to reduce the fire and explosion risk.

For the Project, natural gas will be used to start up and load the combustion turbine to the point where hydrogen-rich fuel can be used. Natural gas will also serve as a backup fuel to allow electric power generation to continue when hydrogen-rich fuel is not available. Natural gas is to be used for flare pilots, startup of the sulfur recovery unit (SRU), pilot gas, auxiliary boiler, and support fuel for the SRU tail-gas thermal oxidizer. Natural gas will also be used to preheat the gasifier, and as start-up fuel for the gasifier. Natural gas will not be stored on site.

The risk of a fire and/or explosion will be minimized through adherence to applicable codes and design features, including isolation valves and the continued implementation of effective safety management practices. With the implementation of standard operating procedures (SOPs) and BMPs, based on Occupational Safety and Health Administration (OSHA) and DOT regulatory requirements, the potential impacts from the use of natural gas would be less than significant.

Syngas and Hydrogen

The Project will generate (but not store) syngas consisting mainly of hydrogen and carbon monoxide, with varying amounts of water vapor and substantially smaller amounts of CO_2, nitrogen, argon, and hydrogen sulfide. The Project will use a hydrogen-cooled generator and store 30,000 standard cubic feet (scf) of compressed hydrogen gas in a pressurized multi-tube trailer.

Hydrogen, carbon monoxide, and hydrogen sulfide may pose a fire and/or explosion risk as a result of flammability. Section 5.12.2.3, Off-Site Consequence Analysis (OCA), provides a worst-case release scenario analysis for the hazardous components of syngas. As discussed in Section 5.12.2.3 and Appendix K, the potential off-site impacts related to accidental worst-case hydrogen and syngas release would be less than significant. Furthermore, the risk of a fire and/or explosion will be minimized through adherence to applicable LORS and codes, design features, and safety management practices specified in the HMBP.

Oxygen

The gasification process selected requires high-pressure, high-purity oxygen (99.5 percent by volume). The oxygen is supplied from the ASU, which separates and purifies oxygen from the ambient air. The air is filtered, compressed, dried, cooled to cryogenic temperatures, and separated into nitrogen and oxygen products. The oxygen is sent to the gasifier and the SRU as one of the feeds. The potential impacts presented by the use of oxygen will be less than significant through the adherence to applicable LORS and codes, design features, and safety management practices specified in the HMBP.

Ammonia

The Project will store a maximum of 3.8 million gallons—or approximately 10,733 short tons—of anhydrous ammonia (a 7-day supply for the Manufacturing Complex). There will be two vertical cylindrical steel tanks, each housed in their own unique double-integrity vessel, elevated above ground on a concrete pedestal, and surrounded on all sides by a 4-foot-high reinforced-concrete barrier wall. The tank-within-a-tank design provides maximum safety against the release of ammonia. The outer tank will contain any spill from the inner storage tank if a breach were to develop. There is sufficient space in the outer tank to accommodate release from the inner storage tank. As described in Appendix K, a release can only occur through the pressure-relief valve on the outer tank. This type of tank-within-a-tank design is designed specifically to prevent any major release of ammonia.

Ammonia will be used as a component in the manufacturing of urea, may also be sold off site, and will be used as a reducing agent for control of nitrogen dioxide (NO_2) emissions from the combustion turbine generators (CTGs). Ammonia is a potentially toxic chemical that will vaporize upon release into a vapor cloud. Ammonia is listed in the following federal and state regulations:

- 40 CFR Part 68 Chemical Accident Prevention Provisions (U.S. Environmental Protection Agency [USEPA])
- 29 CFR §1910.119 Process Safety Management of Highly Hazardous Chemicals
- California Health and Safety Code, §§ 25531 to 25543.3
- CCR Title 19, §§ 2735.1 to 2785.1

The anhydrous ammonia stored at the Project Site exceeds the imposed threshold amounts in the above regulations. The Project is required to develop a Risk Management Plan (RMP) that will be submitted to the EPA. A CalARP RMP is required and will be submitted to the Kern County Environmental Health and Safety Department. An OCA for the worst-case release scenario was performed for anhydrous ammonia stored at the Project and is discussed in Section 5.12.2.3. A Process Safety Management (PSM) Plan is required and must be kept on site for federal and Cal/ OSHA (Division of Occupational Safety and Health) inspection.

The worst-case release scenario assumed that one of the inner steel tanks develops a leak and liquid ammonia is instantaneously released into the interstitial space between the tank and the outer tank. Since the outer tank sidewall is exposed to the environment, it will be nearer to ambient temperature. Due to the temperature gradient between the liquid ammonia and outer sidewall, heat will transfer to the ammonia and the liquid ammonia will begin to vaporize until temperature differences approach thermal equilibrium. The vaporization of ammonia will cause an increase in pressure which will be released through a relief valve at the top of the tank. In a worse-case release scenario, the released ammonia will remain in the outer tank at the refrigeration temperature until heat from the surrounding areas causes the ammonia to vaporize and put a slightly elevated pressure on the tank. If the vapor exceeds the set pressure of the relief valve system, a release will occur. The maximum rate that ammonia will be released was calculated to be 9.6 lb per minute and is detailed in Appendix K. Under a worst-case release scenario, the amount of ammonia released will not cause concentration levels of significance to be reached during the release period. Distances to toxic endpoints for ammonia concentrations of significance are shown below.

The calculated threat zones for 75 pm (CEC significance value), 150 pm (USDOT Emergency Response Program Level 2 “ERPG-2”), and 200 pm (USEPA/CalARP Toxic Endpoint).

- 75 pm (CEC significance value) – Does not occur at ground level.
- 150 pm (ERPG-2) – Does not occur at ground level.
- 200 pm (USEPA/CalARP Toxic Endpoint) – Does not occur at ground level.

Ground-level concentrations of ammonia do not exceed any levels of concern at any time during a worst-case release scenario. The calculated threat zones do not extend offsite and no sensitive receptors will be affected. Therefore, the potential impact from the use and storage of anhydrous ammonia by the Project would be less than significant.

Methanol

The Project will use methanol in the Rectisol® unit, which will be stored in a single 300,000-gallon above-ground storage tank (AST) with secondary containment. The methanol is used as a purification solvent that is regenerated in the process. An additional 250,000 gallons of methanol will also be contained within process vessels, equipment, and piping of the Rectisol® unit. The AST is located away from the process unit to reduce hazards. A pump and isolation valve are placed on the piping between the storage tank and the acid gas removal (AGR) unit, physically isolating the AST and AGR unit. Methanol is considered to be a hazardous substance due to its flammable and moderately toxic chemical properties. Methanol is listed in the following federal regulations:

- 29 CFR §1910.1200 (OSHA)
- 40 CFR Part 116 and 40 CFR Part 117 (USEPA)
- 40 CFR Part 355, Appendices A and B (USEPA)
- 40 CFR Part 372 (Superfund Amendments and Reauthorization Act [SARA] Title III)
- 40 CFR Part 302 (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA])

Although it is a listed substance, neither federal nor state regulations require an OCA for the use of methanol. However, because of the flammable and explosive characteristic of the substance, the Project performed an OCA for the worst-case release scenario to assess the potential consequences of such an event, and to assess the need for appropriate controls and mitigation measures for the Project. Because methanol is a flammable substance, the most severe hazardous consequence that could be derived from an accidental release would consist of a vapor cloud explosion. The analysis is included in Section 5.12.2.3, Off-Site Consequence Analysis, and in Appendix K.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use and storage of methanol by the Project would be less than significant.

Sulfur

The Project Site will store 100,000 gallons of degassed liquid sulfur in an above-ground sulfur storage pit and one above-ground tank, as further described in Section 2.0, Project Description. The potential impact from the use and storage of sulfur on site by the Project is expected to be less than significant.

Other Gases

Other gases expected to be stored and used at the site include gases typically used for maintenance activities such as shop welding and emissions monitoring. These gases include small amounts of acetylene, carbon monoxide, and oxygen. The potential impacts presented by the use of these gases are not considered to be significant, based on the following:

- A limited quantity of each gas will be stored at the facility.
- The gases will be stored in DOT-approved safety cylinders, secured to prevent upset and physical damage.
- Incompatible gases (e.g., flammable gases and oxidizers) will be stored separately.
- The gases will be stored in multiple, standard-sized portable cylinders, in contrast to larger cylinders, generally limiting the quantity that may be released from an individual cylinder failure.

For these reasons, the potential impact from use of these gases would be less than significant.

Risk Analysis of Hazardous Materials

In September 1996, Senate Bill (SB) 1889 was enacted to change the California Health and Safety Code (CHSC) §25531 et seq., replacing the Risk Management and Prevention Program requirements with the Risk Management Plan (RMP) requirements established pursuant to Section 112(r) of the federal Clean Air Act (CAA) (42 United States Code [USC] Section 7412). Pursuant to SB 1889, the California Office of Emergency Services (OES) is required to adopt implementing regulations, initially as emergency regulations, and to seek and maintain delegation of the federal program. The CalARP program merges federal and state programs for the prevention of accidental releases of regulated toxic and flammable substances. The goal was to eliminate the need for two separate and distinct chemical risk management programs. The CalARP Phase I Final Regulations were approved on 16 November 1998.

The CalARP Phase I Final Regulations (CCR Title 19, Division 2, and Chapter 4.5) provide two sets of lists of Regulated Substances: (1) Federal Regulated Substances; and (2) State Regulated Substances.

- Section 2770.5 – Tables 1 and 2 of §2770.5 list Federal Regulated Substances and threshold quantities for accidental release prevention, including flammable substances. Anhydrous ammonia, sulfuric acid, and flammable/hazardous compressed gases (such as hydrogen) are on the list. The quantities of sulfuric acid and flammable/hazardous compressed gases proposed for use by the Project from construction through operation do not exceed the threshold quantity limits and therefore are not regulated under the federal program. However, the quantity of ammonia (10,733 short tons) exceeds the threshold quantity for anhydrous ammonia in for both state and federal programs.
- Section 2770.5 – Table 3 of §2770.5 lists State Regulated Substances and threshold quantities for accidental release prevention. Anhydrous ammonia, sulfuric acid, and flammable/hazardous compressed gases (such as hydrogen) are on the list. The quantities of sulfuric acid and flammable/hazardous compressed gases proposed for use by the Project from construction through operation do not exceed the threshold quantity limits, with the

exception of ammonia. Therefore, these chemicals as used by the Project are not regulated under the state program, except for anhydrous ammonia.

Ammonia

Tables 1 and 3 of CalARP §2770.5 identify the threshold quantities for anhydrous ammonia to be 10,000 pounds and 500 pounds, respectively. Appendix A of 29 CFR 1910.119 identifies the threshold quantity of anhydrous ammonia to be 10,000 lbs. Since the quantity of ammonia (10,733 short tons) at the Project will exceed the 10,000 lb federal requirement and 500 lb state requirement, federal and state RMP regulations will apply. Since the quantity of ammonia also exceeds the 10,000 lb federal PSM threshold, federal PSM regulations will also apply. The Project will comply with USEPA and CalARP regulatory requirements to develop a federal RMP and a CalARP and federal PSM, which will be submitted to the USEPA and Kern County EHSD.

An OCA was conducted for the Project to determine the extent of impact that may be caused from a worst-case release of ammonia, and to determine the appropriate program classification for the Project under CalARP (19 CCR §2735.4). See Section 5.12.2.3, Off-Site Consequence Analysis, for the specific modeling parameters, results, and program determination of the OCA.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use and storage of ammonia by the Project would be less than significant.

Sulfuric Acid

Table 3 of CalARP §2770.5 provides a threshold quantity requirement of 1,000 pounds for sulfuric acid. Even though sulfuric acid exceeds the threshold quantity pursuant to §25532(g) (2) of the HSC, it does not satisfy the other criteria required under the regulations to be considered a CalARP-regulated chemical, because it is not concentrated with greater than 100 pounds of sulfur trioxide to meet the definition of oleum, and/or it is not in a container with flammable hydrocarbons (flash point <730 degrees Fahrenheit [°F]). In summary, the Project will store 14,000 gallons of sulfuric acid within an AST, at ambient temperature, but will not be subject to CalARP requirements because it will not meet the definition of oleum, and will not be stored in a container with flammable hydrocarbons.

While not mandated by the applicable regulations, the hazardous nature of sulfuric acid was evaluated when developing safety measures and procedures for the Project. The sulfuric acid AST will be made of compatible material, which will not corrode, and the groundcover surrounding the location of the tank will be coated to prevent deterioration of the ground surface in the event of a spill. To prevent any possible spill from entering a wastewater or stormwater drainage system, this area will not contain any drains or drainage. All combustible material will be removed from the location of the tank to prevent any potential combustion.

Based upon the foregoing, the potential impact from the use and storage of sulfuric acid by the Project would be less than significant.

Hydrogen

Table 2 of CalARP §2770.5 identifies the threshold quantity for hydrogen to be 10,000 pounds. The Project will store 30,000 scf of hydrogen (about 150.8 pounds) on site in a pressurized multi-tube trailer. Because the amount of hydrogen stored on site is below the regulatory threshold, there is no requirement to satisfy CalARP or CAA RMP regulatory requirements. However, even though the storage amount of hydrogen at the Project Site is far below the federal or state regulatory threshold, an OCA evaluation was performed in order to assess the potential consequences of a worst-case release scenario, and the need to design appropriate controls and mitigation measures to operate in a safe environment. In accordance with California Energy Commission (CEC) requirements, the U.S. Environmental Protection Agency (USEPA) RMP OCA Guidance (April 1999) document was applied to generate the OCA for hydrogen. The analysis is included in Section 5.12.2.3, Off-Site Consequence Analysis, and in Appendix K.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use and storage of hydrogen by the Project would be less than significant.

Acid Gas

Acid gas for the Project will typically consist of about 45 percent hydrogen sulfide and about 55 percent CO_2. Hydrogen sulfide is a regulated material. It is produced by the gasification process, separated from the syngas by the AGR unit, and converted to elemental sulfur in the SRU. The regulatory threshold for hydrogen sulfide is 10,000 pounds under CAA RMP, and 500 pounds under CalARP. The toxicity concentration level set by CAA RMP/CalARP for hydrogen sulfide is 32.3 parts per million (ppm) (0.042 milligrams per liter [mg/L]). The on-site quantities of hydrogen sulfide to be generated by the Project are below regulatory thresholds, and do not trigger application of CalARP or CAA RMP requirements. However, because of its characteristic of explosivity and toxicity, the Project performed an OCA to assess the potential consequences of a worst-case release scenario and the need for appropriate controls and mitigation measures to operate in a safe environment. The analysis is included in Section 5.12.2.3, Off-Site Consequence Analysis, and in Appendix K.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use of hydrogen sulfide by the Project would be less than significant.

Syngas

The feedstock will be gasified to produce a syngas. The syngas will be processed and purified to produce a hydrogen-rich gas, which will be used to fuel the combustion turbine for low-carbon power generation and to produce high-purity hydrogen for nitrogen-based products. Syngas consists of water vapor, carbon monoxide, CO_2, hydrogen, nitrogen, and hydrogen sulfide, with trace amounts of argon, ammonia, and methane. Of these substances, only hydrogen, carbon monoxide, hydrogen sulfide, ammonia and methane are regulated chemicals under applicable federal and state regulations. Hydrogen and methane are regulated as flammable substances, while hydrogen sulfide and ammonia are regulated as a toxic substance (see 40 CFR 68.130 and 19 CCR 2770.5). The quantities of these constituents in the syngas do not trigger regulatory requirements under CalARP or CAA RMP. However, because of its characteristic of flammability and toxicity, the Project performed an OCA for the worst-case release scenario to assess the potential consequences of a worst-case release scenario, and the need for appropriate controls and mitigation to operate in a safe environment. The analysis is included in Section 5.12.2.3, Off-Site Consequence Analysis, and in Appendix K.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use of syngas by the Project would be less than significant.

Methanol

The Project will use methanol in the Rectisol® unit, which will be stored in a single 300,000-gallon above-ground storage tank (AST) with secondary containment. The methanol is used as a purification solvent that is regenerated in the process. An additional 250,000 gallons of methanol will also be contained within the process vessels, equipment, and piping of the Rectisol® unit. The AST is located away from the process unit to reduce hazards. A pump and isolation valve are placed on the piping between the storage tank and the AGR unit, physically isolating the AST and AGR unit. Methanol is considered to be a hazardous substance due to its flammable and moderately toxic chemical properties. Methanol is listed in the following federal regulations:

- 29 CFR §1910.1200 (OSHA)
- 40 CFR Part 116 and 40 CFR Part 117 (USEPA)
- 40 CFR Part 355, Appendices A and B (USEPA)
- 40 CFR Part 372 (Superfund Amendments and Reauthorization Act [SARA] Title III)
- 40 CFR Part 302 (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA])

Although it is a listed substance, federal regulations do not require an OCA for the use of methanol. Additionally, methanol is not regulated under applicable state regulations. However, because of its characteristic of flammability and explosivity, the Project performed an OCA for the worst-case release scenario to assess the potential consequences of a worst-case release scenario, and the need for appropriate controls and mitigation to operate in a safe environment. Because methanol is a flammable substance, the most severe hazardous consequence that could be derived from an accidental release would consist of a vapor cloud explosion and a pool fire. The analysis is included in Section 5.12.2.3, Off-Site Consequence Analysis, and in Appendix K.

Based upon the foregoing, and as further described in Section 5.12.2.3, the potential impact from the use and storage of methanol by the Project would be less than significant.

Other Hazardous Materials

No adverse environmental impacts related to other hazardous materials used at the Project Site are anticipated. Only minimal quantities of paints, oils, solvents, pesticides, and cleaners, typical of those packaged for retail consumer use will be present during operation of the Project. Small volumes of petroleum products associated with construction equipment will be on site during construction. As described in Section 5.12.2.2, Operations Phase, and Section 5.12.5, Cumulative Impact Analyses, long-term or cumulative impacts will be avoided by cleaning up any accidental leaks or spills of these materials. As a result, no adverse environmental impacts related to other hazardous materials used at the Project Site are anticipated.

Carbon Dioxide

CO_2 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 DOT requirement for pipelines transporting CO_2 (49 CFR 195) directs the operator to perform a risk assessment. Pursuant to this DOT requirement and industry practice, the Project conducted a risk analysis for the CO_2 pipeline. Section 5.12.2.4 below sets forth the Risk Evaluation conducted for an accidental worst-case release scenario from the CO_2 pipeline.

CO_2 captured in the gasification process will be compressed and used in the Manufacturing Complex as well as transported to EHOF for use in EOR. A compressor will pressurize the CO_2 for off-site delivery.

Based upon the foregoing, and as further described in Section 5.12.2.4, the potential impact from the use and storage of CO_2 by the Project would be less than significant.

Hazardous Materials Business Plan

The Project will maintain and implement an HMBP. The Project will also implement BMPs consistent with the hazardous materials handling, emergency spill response, and reporting as specified in the HMBP.

If there is a spill or release of hazardous materials during operations, the spill area will be bermed or otherwise controlled as quickly as practical to minimize the footprint of the spill in accordance with the HMBP and BMPs. Specifically, the following procedures will be followed:

- Contaminated soil materials produced during cleanup of a spill will be stored, transported, and disposed of in accordance with local, state, and federal regulations

- If a spill or leak into the environment involves hazardous materials equal to or greater than the specific reportable quantity, the Project will follow federal, state, and local reporting requirements. In particular, the Kern County EHSD will be notified. The Emergency Management System will also be notified by calling 911 in the event of a fire or serious injury.

With the implementation of the HMBPs and BMPs, long-term or cumulative impacts associated with spills or releases of hazardous materials will be avoided. Impacts would be less than significant.

Fire Prevention and Protection

Several combustible materials will be stored and used on the Project Site during the construction and operation phases. A listing of these materials is found in Tables 5.12-1, 5.12-2, 5.12-3, and 5.12-4. Potential hazards from the storage and use of these materials consist of fires and explosions. The Applicant will implement a variety of prevention and mitigation measures to prevent and control potential fires and/or explosions.

The Fire Prevention and Protection Program includes both fire prevention and protection measures. Employment of conservative equipment layouts, segregation of critical components, and the remote location of non-essential resources are some of the important components of the fire mitigation/suppression measures employed.

Conservative equipment spacing and segregation of potentially hazardous activities from the balance of plant (BOP) facilities are the guiding principles used to protect personnel and property. Flammable gas (i.e., carbon monoxide and natural gas) and toxic fume (i.e., ammonia and hydrogen sulfide) monitors will be strategically located in the process areas to detect and alarm at specified concentration levels. Oil containment sumps and fire walls will be erected to isolate large transformers from adjacent facilities. Hydrogen distribution lines are routed to avoid hazardous locations and areas containing critical equipment. Structural steel will be protected with fire-proofing materials in strategic areas. Process liquid drains will be configured to contain liquid spills within the unit of origin. Grading and paving plans will be prepared to complement this objective. An extensive plant grounding system will be installed to dissipate static electrical charges. Emergency lighting is provided to illuminate egress lanes. The administration building, general warehousing, and other components not essential to support daily operations will be located away from the main process facilities.

Fire suppression will be provided by various means. A dedicated fire-water storage and site-wide loop distribution system, including automatic fire suppression (deluge/mist), and manual fire-water fighting equipment (monitors and hydrants) will be provided. Inert gas suppression systems will be installed in areas where water systems would otherwise cause damage to site equipment. CO_2 fire suppression systems will be provided in the combustion turbine enclosures. Provisions for the deployment of Aqueous Fire-Fighting Foam (AFFF) will be included with the methanol storage tank. Steam is used to smother fires originating in hot equipment, which may otherwise be further damaged by the application of relatively “cold” fire water.

The Project Site fire protection areas consist of the following:

- Material handling
- Gasification
- Acid gas removal
- Sulfur recovery unit/tail gas treating unit
- Syngas blending and distribution
- Ammonia production and storage
- Natural gas distribution
- Air separation unit
- Cooling towers
- Power generation and high voltage transmission.

An evaluation of the potential areas that may be impacted from the worst-case scenario combustion of ignitable hazardous materials can be found in Appendix K, Hazardous Materials Technical Analysis. The analyses performed show that the potential impact derived from these worst-case scenarios will not be significant. The application of the aforementioned prevention and mitigation measures will further reduce the predicted area of impact established through the OCA analyses, as described in Appendix K.

OEHI Project

According to the analysis contained in Appendix A-1, Section 4.7, Hazards and Hazardous Materials; and Appendix A-2, Section 2.12, Hazards and Hazardous Materials, impacts associated with the use of hazardous materials during the operation of the OEHI Project would not result in significant adverse impacts.

5.12.2.3 Off-Site Consequence Analysis

An OCA was conducted for ammonia, hydrogen, and other chemicals that will be used or produced at the Project Site. The following section and Appendix K, Hazardous Materials Technical Analysis, present the parameters and results of the OCA conducted for chemicals at the Project Site.

Ammonia

The Project will store approximately 3.8 million gallons (approximately 10,733 short tons) of anhydrous ammonia. The storage system uses two vertical cylindrical steel tanks, each housed in its own unique double-integrity vessel, elevated above ground on a concrete pedestal, and each having a storage capacity of 5,367 tons, which is equivalent to 1.9 million gallons. The storage system incorporates an inner storage tank approximately 84 feet in diameter, containing refrigerated liquid ammonia and an outer secondary tank. There will be a 3-foot interstitial space between the inner storage tank and outer tank. The inner storage tank will be constructed out of steel, in accordance with API 620 Appendix R. The outer tank will also be constructed of steel, and will contain insulation and aluminum cladding. Sensors will be installed in the interstitial space to detect liquid ammonia leaks. The top of the inner tank will be a dome with a suspended deck insulated by mineral wool. Between the suspended deck and the top roof, the presence of ammonia vapor acts as an insulating media. Siporex (light-weight concrete with high thermal insulation) blocks, foam glass, and layers of sand will serve as insulating layers between the pedestal and the vessel. The concrete pedestal prevents ice formation in the ground under the foundation. The ammonia storage system will be surrounded on all sides by a 4-foot-high reinforced-concrete barrier wall.

Following the regulatory guidance for OCAs, an OCA was conducted for an accidental worst-case release scenario under worst-case atmospheric conditions for the Project Site, where the entire content of one ammonia tank is released. Under the scenario, the inner steel storage tank develops a leak, and liquid ammonia is released into the interstitial space between the tank and the outer tank. Because the outer tank sidewall is exposed to the environment, it will be nearer to ambient temperature. The liquid ammonia is stored at minus 28 degrees Fahrenheit (°F). Due to the temperature gradient between the liquid ammonia and outer sidewall, heat will transfer to the ammonia, and the liquid ammonia will begin to vaporize until temperature differences approach thermal equilibrium. The vaporization of ammonia will cause an increase in pressure, which will be released through a relief valve. The vaporization rate calculation is explained in Appendix K.

The model examines the results of a release of ammonia over 1 hour, and the subsequent dispersion over a 1-hour period. The OCA considered the spill during worst-case conditions. In the worst case, the atmospheric or environmental conditions are assumed that would significantly enhance the vaporization of the ammonia, and at the same time prevent the quick dissipation of a vapor cloud generated from such an assumed release.

Ammonia Modeling Results are presented in Appendix K, Hazardous Materials Technical Analysis. In summary, the concentration levels of significance do not extend outside of the Project Site boundary. No off-site impact is expected to occur from a worst-case release scenario. Consequently, the potential impacts would be less than significant.

Hydrogen

The unique properties of hydrogen—low density, high specific heat, and thermal conductivity—make it an ideal coolant for electricity generators, and it is now being widely used as a coolant for power plants. The Project will use a hydrogen-cooled generator and store 30,000 scf of compressed hydrogen gas in a pressurized multi-tube trailer as make-up for the loss within the generator. To determine the behavior of hydrogen under a worst-case release scenario, we have examined its properties, along with the historical data, to evaluate the potential impacts in this section. The worst-case release scenario assumed that the contents of the whole hydrogen tube trailer (30,000 scf) are instantaneously released.

The OCA analysis result shows that even for the worst-case hydrogen explosion scenario, the impact of the incident will be restricted within a 317-foot-radius (0.06 mile) from the center of the storage tube trailer, and it does not extend outside the Project Site boundary. Any explosion or combustion of a hydrogen-gas release at the Project Site will not have any negative impacts on the surrounding area or the public, and will be contained within the Project Site boundaries. Consequently, the potential impacts would be less than significant.

Acid Gas

The Rectisol® process will remove acid gas to significantly reduce sulfur dioxide emissions. Acid gas is removed from shifted syngas to produce low-sulfur hydrogen-rich fuel for low-carbon baseload electrical generation, and to produce high-purity hydrogen for the Manufacturing Complex. The Project acid gas will consist of a mixture of approximately 45 percent hydrogen sulfide and 55 percent CO_2. The worst-case release scenario for the acid gas consists of a total release of the piping volume equivalent to 50 pounds of hydrogen sulfide.

As shown by the modeling that is summarized in Appendix K, Hazardous Materials Technical Analysis, potential impacts from a worst-case scenario vapor cloud explosion will be limited to less than 0.1 mile. The potential impact from a worst-case explosion will be limited to inside the Project Site boundaries. Results from the toxicity modeling presented a distance to toxic endpoint of 1,974 feet (0.37 mile). The potential impact generated from the worst-case release scenario would not extend outside of the Project Site boundary. Consequently, the potential impacts would be less than significant.

Syngas

Coal and petcoke will be gasified to produce syngas, which will be processed and purified to produce a hydrogen-rich fuel. This hydrogen-rich fuel will be used to fuel the combustion turbine for low-carbon baseload power generation, and to produce high-purity hydrogen for the Manufacturing Complex. Syngas consists of hydrogen, carbon monoxide, water vapor, CO_2, nitrogen, argon, methane, and hydrogen sulfide. The purpose of the modeling was to estimate the consequences from a hypothetical worst-case release of syngas at the Project Site. The scenario analyzed consisted of a worst-case release of approximately 15,000 pounds of wet-syngas from equipment and process piping at the facility.

The modeling of the worst-case release scenario demonstrates that such a release of syngas contained with the process equipment and piping may produce a vapor cloud explosion that may reach a distance of 491 feet (0.09 mile) from the point of release. Consequently, the potential impact of an explosion will not extend outside of the Project Site boundary. Therefore, the potential impact from the use of syngas at the Project Site would be less than significant.

One of the primary components of syngas is carbon monoxide. Carbon monoxide is a hazardous material with toxic and ignitable characteristics. Due to its toxic characteristics, a worst-case scenario release was modeled for carbon monoxide. The modeling scenario consisted of a worst-case release of syngas containing approximately 4,000 pounds of carbon monoxide. The modeling considered a height of 70 feet for the release (the lowest connection point in the process vessel). Due to the height of the release, calculations from the ALOHA modeling program indicated that concentrations of concern (i.e., immediately dangerous to life and health [IDLH] or OSHA short-term exposure limit [STEL)] were not detected at ground level. The worst-case scenario release would dilute with the air in such a manner that only a concentration of carbon monoxide less than the concentration of concern would potentially impact ground-level receptors.

Similarly, worst-case scenario release modeling was conducted for the hydrogen sulfide component of the syngas. An approximate amount of 180 pounds of hydrogen sulfide was modeled to be release from a height of 70 feet. Once more, the concentration of concern (0.042 milligrams per liter [mg/L]) did not reach ground-level elevations.

Lastly, modeling was performed for the ammonia portion of the syngas. A total of 15 pounds of ammonia was modeled to be released from the gasifier/scrubber and adjoining piping. The release was also considered to take place at an elevation of 70 feet. The regulated 0.14 mg/L concentration was never reached at ground level.

Based on the results of the modeling for syngas and its components discussed above, the potential impacts from the use of syngas at the Project Site would be less than significant.

Methanol

The worst-case scenario releases modeled for methanol were potential impacts of a vapor cloud explosion and a pool fire.

The worst-case scenario modeled for the vapor cloud assumed a methanol release where the entire contents of the methanol AST (300,000 gallons) are released instantaneously.

The modeling of the worst-case 1-pound-per-square-inch (psi) pressure-wave scenario showed that the potential impact distance from a worst-case methanol vapor cloud explosion after the complete release of the tank may reach a distance of 4,224 feet (0.8 mile) from the location of the tank. The impact distance of explosion may extend past the Controlled Area. The immediate vicinity surrounding the Controlled Area is rural, and there are no residences within the pressure-wave impact distance. Therefore, even such an unlikely event will not impact sensitive receptors. The off-site impact from the use and storage of methanol at the Project Site would be less than significant.

The second worst-case scenario analyzed was a methanol pool fire in accordance with the appropriate regulatory guidance, and assumed the entire contents of the methanol AST (300,000 gallons) is released, forming a pool of fire. The modeling results showed that for a potential methanol pool fire, the potential impact distance may reach a distance of 1,215 feet (0.23 mile) from the center of the methanol pool, and will not extend outside of the Controlled Area. The implementation of appropriate safety measures will significantly reduce the likelihood of an accidental methanol release. The potential impact from the use and storage of methanol at the Project Site will be less than significant.

5.12.2.4 CO_2 Pipeline Risk Evaluation

CO_2 captured from the syngas will be compressed and transported by pipeline to EHOF for CO_2 EOR and sequestration.

OEHI has evaluated the risk associated with the CO2 pipeline in their Data Gaps Analysis (presented in Appendix A of this AFC Amendment).

5.12.2.5 Abandonment/Closure

Premature closure or unexpected cessation of operations will be outlined in the Project closure plan, as discussed in Section 3.0, Facility Closure. The plan will outline steps to secure hazardous and non-hazardous materials and wastes. Such steps will be consistent with BMPs and the HMBP. The plan will include monitoring vessels and receptacles of hazardous material and wastes, safe cessation of processes using hazardous materials or hazardous wastes, and inspection of secondary containment structures.

Planned permanent closure impacts will be incorporated into the Project closure plan, and evaluated at the end of the economic operation of the Project. The Project closure plan will document non-hazardous and hazardous waste management practices, including inventory, management, and disposal of hazardous materials and wastes; and permanent closure of permitted hazardous materials and waste storage units.

5.12.3 Hazardous Materials Delivery Route

There are two hazardous materials that will be regularly transported to the Project site during the operation phase of the Project: methanol and caustic (sodium hydroxide).

The major suppliers of project-related hazardous materials are in the city of Bakersfield, east of the Project Site. Thus, the primary transport route is planned to take Stockdale Highway, Morris Road, and Station Road, and then enter through the gate on Tupman Road (shown as a red line with arrows on Figure 5.12-1). The alternative routes will only be used if hazardous materials are transported from non-major suppliers located north or south of the Project Site (shown as blue lines with arrows on Figure 5.12-1). As a proactive measure, HECA does not plan to use State Route (SR) 119 as the primary access route during construction and operations activities, thereby minimizing Project-added traffic and environmental impacts on the unincorporated community of Tupman.

5.12.4 Hazardous Materials Transportation from the Project Site

The HECA Project will produce certain hazardous materials that will primarily be used on site to produce low-carbon nitrogen-based products. However, some of the surplus materials may be sold and transported off site via tanker trucks and/or railcars. Some of these materials include anhydrous ammonia (ammonia) and degassed liquid sulfur (sulfur).

5.12.4.1 Ammonia

It is estimated that during peak activity days, a maximum amount of 500 short tons per day (stpd) of surplus ammonia may be transported off site. If all of the surplus is transported by rail, a maximum of 234 stpd will be placed on two outbound tank railcars that meet the specifications of Department of Transportation (DOT) regulations in 49 CFR § 173.314. These railcars will travel on an industrial railroad spur (if Alternative 1 is implemented) that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. Once on the SJVRR Buttonwillow line, the railcars will travel approximately 265 miles to an ammonia distribution terminal located in Stockton, California.

If only tanker trucks are used for the surplus ammonia (under either Alternative 1 or Alternative 2), a maximum of 750 stpd will be distributed via 30 outbound portable tanks or cargo tanks (tanks) that meet the specifications of 49 CFR § 173.315. The tanks will be transported east on Station Road, north on Morris Road, and east on Stockdale Highway to either Bakersfield or Interstate 5. Potential customers located in Bakersfield that currently use anhydrous ammonia in their facilities include Crop Production Services, Britz Fertilizers, Inc., and Wm. Bolthouse Farms, Inc. Additional details about these potential customers are listed below:

- Crop Production Services, located at 9355 Copus Road, is a supplier of fertilizer and other products to farmers and uses a maximum of 450,000 pounds (225 tons) of anhydrous ammonia in their processes.[1] Tanker trucks will travel approximately 30 miles via Stockdale Highway, Interstate 5 South, and Copus Road to reach Crop Production Services.

- Britz Fertilizers, Inc., located at 19421 Creek Road in Bakersfield, is a supplier of agricultural chemicals to area farmers and uses a maximum of 260,000 pounds (130 tons) of anhydrous ammonia in their processes.[2] Tanker trucks will travel approximately 15 miles via Stockdale Highway, Enos Lane, 7th Standard Road, and Creek Road to reach Britz Fertilizers, Inc.

- Wm. Bolthouse Farms, Inc., located at 7200 East Brundage Lane in Bakersfield, operates a carrot and carrot products packaging facility and uses a maximum of 294,800 pounds (147.4 tons) of anhydrous ammonia in their processes[3]. Tanker trucks will travel approximately 31 miles via Stockdale Highway, Enos Lane, Blue Star Memorial Highway/ Rosedale Highway, SR 58 West, South Fairfax Road, and Brundage Lane to reach Wm. Bolthouse Farms, Inc.

5.12.4.2 Degassed Liquid Sulfur

It is estimated that during peak activity days a maximum amount of 700 tons per day of sulfur will be sold off site commercially. Sulfur will be transported at an elevated temperature of approximately 140 degrees Celsius. Sulfur will be placed on tank railcars that will comply with regulations set forth in 49 CFR Parts 173.247. These railcars will travel on an approximately 5-mile industrial railroad spur that will connect the Project Site to the existing SJVRR Buttonwillow railroad line, north of the Project Site.

Sulfur will be distributed via outbound tanker trucks that will comply with 49 CFR 173.247. The tanks will be transported north on Tupman Road, east on Station Road, and north on Morris Road until they reach Stockdale Highway, where they will head east towards Interstate 5.

Potential customers that use sulfur in their processes include General Chemicals LLC, Rhodia Inc., and J.R. Simplot Co.

- General Chemicals LLC operates an acid regeneration plant located at 525 Castro Street in Richmond, California. This plant produces 219,000 tons of sulfuric acid per year (600 tons per day) through the distillation of oleum. This plant is approximately 270 miles northwest of the Project.

- Rhodia Inc. operates two plants in California that use sulfur: one in Carson and the other in Martinez.

  - The Carson Plant, located at 207020 S. Wilmington Ave in Carson, produces sulfuric acid through regeneration of spent acid. This plant is approximately 138 miles southeast of the Project.

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[1] 2009 Risk Management Plan (RMP ID #55483) for Crop Production Services.
[2] 2010 Risk Management Plan (RMP ID #1000011844) for Britz Fertilizers, Inc.
[3] 2009 Risk Management Plan (RMP ID #54441) for Wm. Bolthouse Farms, Inc.

  - The Martinez Plant, located at 100 Mococo Road in Martinez, produces sulfuric acid through regeneration of spent acid. This plant produces approximately 1,834 tons of sulfuric acid per day and is approximately 261 miles northwest of the Project.

- J.R. Simplot Co. Lathrop Facility, located at 16777 Howland Road in Lathrop, produces fertilizer, industrial chemicals, and agricultural feed supplements. It uses sulfur in its production process. This plant is approximately 215 miles northwest of the Project.

The facilities identified in this section are potential customers for ammonia and sulfur produced at the Project. The final destinations of the off-site sales of ammonia and sulfur will depend on commercial sales arrangements.

5.12.5 Cumulative Impact Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines § 15130). A "cumulative impact" consists of an impact that is created as a result of the combination of the project under review, together with other projects causing related impacts (CEQA Guidelines § 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines § 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines § 15065 [a][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines § 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines § 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines § 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines § 15130[b]).

A cumulative impact analysis starts with a list of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines § 15130[b]). Factors to consider when determining whether to include a related project include the nature of the environmental resource being examined, the location of the project, and its type (CEQA Guidelines § 15130[b]). For purposes of this AFC Amendment, Kern County was contacted to obtain a list of related projects, which is contained in Appendix I. Depending on its location and type, not every project on this list is necessarily relevant to the cumulative impact analysis for each environmental topic.

Land immediately adjacent to the Project Site consists of agricultural land. Surrounding the Project Site, the land is currently used for farming. Anhydrous ammonia is frequently used by the agriculture industry as a fertilizer component, which is applied throughout agricultural fields. Because ammonia is applied throughout agricultural fields, mobile ammonia tanks can be potentially found in various locations of an agricultural field.

No cumulative impacts are anticipated from an anhydrous ammonia release at the Project Site. OCA modeling results for the anhydrous ammonia identified the extent of impact from a worst-case scenario release of anhydrous ammonia did not extend outside of the Project Site boundary. No other hazardous materials stored at the Project Site are anticipated to produce cumulative impacts with hazards derived from adjacent lands.

Consequently, it is anticipated that the potential cumulative impacts from the operation of the Project will be minimal, and less than significant.

According to the analysis contained in Appendix A-1, Section 4.7; and Appendix A-2, Section 2.12, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts as a result of hazardous materials used in connection with the OEHI Project.

5.12.6 Mitigation Measures

Implementation of the following mitigation and compliance conditions will ensure that the Project uses hazardous materials in a manner that ensures no significant environmental impacts will result related to hazardous materials.

5.12.6.1 Construction Phase

During construction, hazardous materials stored on site will be limited to fuel such as gasoline and diesel, lubricating oils, paint, coatings, adhesives, welding gases, and other cleaners. These materials will be stored in a locked utility shed or in a secured, fenced area with secondary containment. It is anticipated that fuels, lubricants, and other various fluids needed for operation of construction equipment will be transported to the construction site on an as-needed basis by equipment service trucks. During Project construction, workers will be trained in handling hazardous materials, and will be alerted to dangers associated with these materials. An on-site safety officer will be designated by the construction contractor to implement health and safety guidelines, and to contact emergency response personnel and the local hospital, if necessary.

Construction contractors for the Project will be required to develop SOPs for servicing and fueling construction equipment. These procedures will, at a minimum, include the following mitigation measures.

HAZMAT-1

The following measures will be implemented related to fueling and maintenance of vehicles and equipment:

- No smoking, open flames, or welding will be allowed in the fueling/services areas.
- Servicing and fueling of vehicles and equipment will occur only in designated areas.

- Fuel storage tanks will have secondary containment.
- Fueling service and maintenance will be conducted only by authorized personnel.
- Refueling will be conducted only with approved pumps, hoses, and nozzles.
- All disconnected hoses will be handled in a manner to prevent residual fuel and fluids from being released into the environment.
- Catch pans will be placed under equipment/hose connections to catch potential spills during fueling and servicing.
- Service trucks will be provided with fire extinguishers and spill containment equipment, such as absorbents, shovels, and containers.
- Service trucks will not remain on the job site after fueling and service are complete.

HAZMAT-2

Spills that occur during vehicle maintenance will be cleaned up immediately. Contaminated soil will be containerized and sent for subsequent evaluation and off-site disposal in accordance with applicable LORS. A log of all spills and cleanup actions will be maintained.

HAZMAT-3

Emergency telephone numbers will be available on site for the fire department, police, local hospitals, ambulance service(s), and environmental regulatory agencies.

HAZMAT-4

Containers used to store hazardous materials will be properly labeled and kept in good condition.

It is anticipated that these SOPs will minimize the potential for incidents involving hazardous materials during construction. Consequently, potential impacts from use or storage of hazardous materials during construction would be less than significant.

5.12.6.2 Operational Phase

A listing of anticipated hazardous materials to be used on site can be found in Tables 5.12-3 and 5.12-4. General mitigation measures are detailed below for containerized and bulk hazardous materials.

5.12.6.3 General Mitigation Measures

HAZMAT-5: Containerized Materials

Containerized materials will typically consist of returnable tanks (approximately 100-gallon capacity), 55-gallon drums, or 5-gallon pails of lubricants and oils, and smaller containers of paints and solvents. These materials will be managed as described below to mitigate potential releases.

- Hazardous materials will be stored in accordance with applicable LORS (i.e., the Uniform Fire Code [UFC]).

- Trucks delivering hazardous materials will be parked adjacent to the use area or storage area where the chemicals are to be stored to minimize potential unloading and transportation accidents.
- Incompatible materials will be stored separately.
- Containerized hazardous materials will be stored in original containers appropriately designed for the individual characteristics of the contained material. Containers will be labeled with contents and identification of fire hazards as required by National Fire Protection Association (NFPA) 704.
- Containers of flammable materials will be stored in inflammable storage cabinet(s) when not in use.
- Hazardous materials will be stored within secondary containment structures, typically constructed of sealed concrete. These structures will have capacity for the largest container plus an allowance for rainwater equivalent to a 24-hour, 25-year storm event, if the area is outdoors. Alternatively, containerized hazardous materials may also be stored in commercially available hazardous materials storage sheds with built-in secondary containment.
- Commercially available secondary containment pallets may also be used for containers stored in warehouse facilities to augment other spill control measures.
- Empty containers, especially portable tanks and drums, will be emptied, drained, and returned to the supplier for reuse to the maximum extent possible, or recycled off site.
- Pollution prevention efforts such as replacement of hazardous materials with less-hazardous materials, reduction of hazardous waste generation volumes, and recycling will be employed at the facility, as practical.

HAZMAT-6: Bulk Hazardous Materials

Hazardous materials will be managed as described below to mitigate the potential for releases to the environment.

Bulk chemical storage tanks will be equipped with a local level gauge and automated level instrumentation. To prevent overfilling, a high-level alarm will sound at the local common alarm panel if the storage tank reached an abnormally high level, and be interlocked to shut down the transfer pump.

Associated skid-mounted equipment includes the feed pumps, valves, interconnecting piping, controls, etc. Controls, instrumentation, and interlocks are provided for safe operation of the equipment during all modes of operation. The metering pumps will also be located within the secondary containment and will be elevated to prevent flooding during rainstorms.

Out-of-doors secondary containment will employ a valve to empty the container of rainwater, after inspection, to evaluate potential for contamination. The valve will be equipped with a lock and will remain locked shut unless rainwater is being actively emptied from the secondary containment. Contaminated water will run through the oil/water separator, or will be disposed of off site, as appropriate.

Tank trucks will be unloaded in a tank truck unloading area. This unloading area will be paved with concrete, and will have sufficient secondary containment to hold the contents of the worst-case release scenario.

Seismic loads for hazardous materials storage and containment areas will be determined by the static lateral force procedures of the Uniform Building Code (UBC), and site-specific design features will be incorporated into these storage facilities. These structures will be designed and constructed in accordance with applicable codes, regulations, and standards.

Ammonia

Anhydrous ammonia will be stored in two vertical cylindrical steel tanks (3.8 million gallons total), each housed in its own unique double integrity vessel, elevated above ground on a concrete pedestal, and surrounded on all sides by a 4-foot-high reinforced-concrete barrier wall.

Sodium Hydroxide

Sodium hydroxide will be stored on site in one large, carbon-steel AST and one waste tank (60,000 gallons total). Both tanks will be equipped with secondary containment, capable of holding 110 percent of the tank volume (100 percent of sodium hydroxide tank plus an allowance for rainwater for a 24-hour, 25-year storm event). Associated transfer pumps and piping will have secondary containment to collect any potential spills. Piping secondary containment will also be equipped with liquid detectors to identify leaks.

Sulfuric Acid and Sodium Hypochlorite

Sulfuric acid and sodium hypochlorite will be stored at the Project Site in quantities of 14,000 gallons and 7,000 gallons, respectively. Both substances will be stored in ASTs of compatible material. The storage tanks will be equipped with secondary containment, capable of storing the entire volume of the tank. The tanks will also be equipped with liquid detectors to identify the presence of any liquid substance in the secondary annular space. Additionally, the area surrounding the tanks will be constructed and coated to prevent its corrosion or deformation from an accidental chemical spill.

The sulfuric acid and sodium hypochlorite delivery systems will be equipped with flow meters and automatic shutdown capabilities. Transfer pumps and piping will have secondary containment to collect any potential spills.

Diesel Fuel

The Project Site will store a 2,000-gallon diesel AST throughout its operation. The storage tank will be equipped with secondary containment capable of holding 110 percent of the tank volume

(100 percent of diesel tank plus an allowance for rainwater for a 24-hour, 25-year storm event). An SPCC Plan will be prepared and implemented that includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines.

Lubricating Oil

The Project Site will store 200 gallons of lubricating oil. The lubricating oil will be stored in a large AST. The storage tank will be equipped with secondary containment capable of holding 100 percent of the tank volume. Liquid detection equipment will be installed to detect any potential leaks generated and collected in the secondary containment annular space. An SPCC Plan will be prepared and implemented that includes requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines.

Hydrogen

Hydrogen will be stored on site (30,000 scf) within a multi-tube trailer. The multi-tube trailer will feed into the power plant process. Hydrogen will be monitored and controlled through the use of flow meters and pressure monitors. The hydrogen system will also be equipped with pressure-relief valves and automatic shutdown.

Carbon Dioxide

CO_2 for fire suppression and purging (50,000 scf) will be stored on site in large, pressurized cylinders and/or tanks, which will be equipped with pressure sensors and automatic shutdown controls, and pressure-relief valves.

Oxygen

The Project will generate oxygen on site that will be stored in a large above-ground vessel. A maximum of 1,100 tons of liquid oxygen will be stored on site. Pressure-relief valves and automatic shutdown equipment will be provided for the oxygen delivery system.

Sulfur

The Project Site will store 100,000 gallons of degassed liquid sulfur in an above-ground sulfur storage pit and one above-ground tank, as further described in Section 2.0, Project Description.

Methanol

The Project will use methanol in the Rectisol® unit, which will be stored in a single 300,000-gallon AST with secondary containment. The methanol is used as a purification solvent that is regenerated in the process. An additional 250,000 gallons of methanol will also be contained within the process vessels, equipment, and piping of the Rectisol® unit. The AST is located away from the process unit to reduce hazards. A pump and isolation valve are placed on the piping between the storage tank and the AGR unit, physically isolating the AST and AGR unit. The tank will also be equipped with leak detectors to identify the presence of any liquid accumulation below the tank bottom or in the containment area.

The methanol delivery system will be equipped with a flow meter and automatic shutdown capabilities. The methanol transfer pump and piping will have secondary containment to collect any potential spills.

Sodium Phosphate

Sodium phosphate will be used for raw water treatment, gasification, and plant wastewater ZLD. A maximum of 1,500 gallons of sodium phosphate contained in ASTs will be stored at the indoor chemical storage area. The sodium phosphate ASTs will be equipped with secondary containment and leak detectors to detect the presence of a rupture.

Propylene Glycol

A maximum 25,000 gallons of propylene glycol will be used in this Project as a heat-transfer fluid circulating in the closed-loop cooling system of the process equipment. Leak detection equipment will be installed on the system to control any accidental releases.

Nitric Acid

Nitric acid is an intermediate product used to produce UAN solution. A maximum 21,000 gallons of nitric acid is contained in the process equipment in the unit.

Ammonium Nitrate

Ammonium nitrate is an intermediate product used to produce UAN solution. A maximum 8,000 gallons of ammonium nitrate is contained in the process equipment in the unit.

UAN Solution

UAN solution is a final product. A maximum 11,500,000 gallons of UAN solution contained in ASTs will be stored. The UAN solution ASTs will be equipped with secondary containment.

HAZMAT-7: Materials Safety Data Sheets

MSDSs for the hazardous materials will be kept on site as required by 29 CFR §1910 OSHA Hazard Communication rules and regulations.

HAZMAT-8: Worker Training and Equipment

Personnel working with chemicals will be trained in proper handling and emergency response to chemical spills or accidental releases. Additionally, designated personnel will be trained as plant hazardous materials first responders.

Safety equipment will be provided for use as required during chemical containment and cleanup activities, and will include safety showers and eyewash stations. Service water hose connections will be provided near chemical use and storage areas to allow flushing of chemical spills, if needed.

HAZMAT-9: Hazardous Materials Management – Plans and Procedures

Several programs will address hazardous materials storage locations: emergency response procedures, employee training requirements, hazard recognition fire safety, first-aid/emergency medical procedures, hazardous materials release containment/control procedures, hazard communication training, personal protective equipment (PPE) training, and release reporting requirements. These programs will include the HMBP, workers' safety program, fire response program, Project safety program, and facility standard operating procedures. The HMBP will include procedures on hazardous materials handling, use, and storage; emergency response; spill prevention and control; training; record keeping; and reporting.

As discussed below, an RMP for anhydrous ammonia will also be prepared.

HAZMAT-10: Spill Response Procedures

The following describes the general spill response procedures for the Project. The Project will maintain spill response kits on the Project Site. These kits will contain absorbents appropriate for the hazardous materials kept on site, and each kit will be clearly designated for the type of spilled material it should be used for. Typically, these kits contain a barrel, shovel, and absorbents. In addition, the Project will maintain a supply of gloves and protective clothing for use during spill response events.

Personnel discovering a spill will report to the on-shift Control Room Operator. The Control Room Operator will notify the Operations Superintendent or the Plant Manager. The Superintendent or Manager will function as the On-Site Coordinator and will be in charge of activities related to spill containment, control, and cleanup, and regulatory agency reporting, if needed.

The On-site Coordinator will assess the situation, contain the leak or spill, begin cleanup operations with on-site staff or off-site contractors, as needed, and collect information for reporting, if needed. The following information will be needed for reporting:

- Type of chemical released;
- Amount of release or spill, i.e., volume and description, liquid, vapor, etc.;
- Direction of release and distance traveled if the release is outside the secondary containment;
- Cause of spill or release;
- Potential hazard to off-site personnel and local water bodies, including groundwater; and
- Actions undertaken to mitigate the spill or release.

The appropriate governmental authorities will be contacted if required by laws and regulations, or as deemed necessary by the On-Site Coordinator.

In the case of a small spill involving 55 gallons (or less) of liquid hazardous materials, the spill will typically be retained by a secondary containment structure. This type of spill will be confined to as small a space as possible using absorbent pigs or pillows, and be cleaned up with properly trained employees using absorbents available on site. Similarly, small spills outside of secondary containment structures could be cleaned up by trained employees with on-site spill kit equipment.

Larger spills will normally be contained within secondary containment and will be cleaned up by outside contractors using trained spill response personnel, if on-site employees could not handle the spill using available on-site spill response equipment.

Waste generated from spill cleanup will be placed in closed, labeled containers, typically 55-gallon drums or roll-off containers. Labeling will include the name of the facility (HECA), date of start of accumulation, name of the spilled material, Hazardous Waste identification language from CCR 22 66262.32, and the established DOT shipping name, as needed.

Collected waste will be properly disposed off site at an approved recycling, landfill, or other appropriate disposal facility. Off-site transportation of spill wastes will be contracted with a licensed, hazardous materials and/or waste transportation company, as applicable.

HAZMAT-11: Gas Release Response Procedures

The following describes the general procedures that will be applied at the Project during a gas release. Personnel will be trained in appropriate response and system shutdown procedures.

Personnel discovering a gas leak or release will report to the on-shift Control Room Operator. The Control Room Operator will notify the Operations Superintendent or the Plant Manager. The Superintendent or Manager will function as the On-Site Coordinator, and will be in charge of activities related to spill containment, control, and cleanup, and regulatory agency reporting, if needed.

The On-Site Coordinator will assess the situation and determine the appropriate course of action. In the event of a gas release, the On-Site Coordinator will institute some of the appropriate following measures:

- Immediate cessation of all work that may produce any type of ignition source;
- Evacuation of the affected area;
- Restricted access to affected area;
- Shutdown of affected portion of system for repairs; and
- Shutdown of entire facility for repairs.

The appropriate governmental authorities will be contacted if required by laws and regulations, or as deemed necessary by the On-Site Coordinator.

5.12.7 Laws, Ordinances, Regulations, and Standards

Construction and operation of the Project will be in accordance with all applicable LORS pertaining to hazardous materials. Applicable laws and regulations address the use and storage of hazardous materials to protect the environment from contamination, and to also protect Project workers and the surrounding community from exposure to hazardous and acutely hazardous materials.

5.12.7.1 Federal

SARA of 1968 Title III, also known as Emergency Planning and Community Right-to-know Act (EPCRA) §§302, 304, 311, and 313, and regulations pursuant to the Clean Air Act (CAA) of 1990 (40 CFR 68) established a nation-wide emergency planning and response program, and imposed reporting requirements for businesses that store, handle, or produce significant quantities of extremely hazardous materials. The Acts require the states to implement a comprehensive system to inform local agencies and the public when a significant quantity of such materials are stored or handled at a facility (see 40 CFR, §68.95). The requirements of these Acts are reflected in the CHSC, Section 25531 *et seq*. The Project will comply with these requirements as discussed below in Section 5.12.6.2, State. As required by the act, the Project will prepare and implement a Risk Management Plan.

Title 49, CFR Parts 171-177, govern the transportation of hazardous materials, the types of materials defined as hazardous, and the marking of the transportation vehicles.

Title 40, CFR Part 112, establishes the procedures, methods, equipment, and other requirements to prevent the discharge of oil from non–transportation-related on-shore and off-shore facilities into or upon the navigable waters of the United States or that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States. As required by the act, the Project will prepare and implement a Spill Prevention Control and Countermeasure Plan.

Title 29, CFR Part 1910.119 establishes the requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals that may result in toxic, fire, or explosion hazards. As required by the act, the Project will prepare and implement a Process Safety Management Plan.

5.12.7.2 State

The CHSC, §25500, requires companies that handle hazardous materials in sufficient quantities to develop an HMBP. The HMBP includes basic information on the location, type, quantity, and health risks of hazardous materials handled, stored, used, or disposed of that could be accidentally released into the environment. It also includes a plan for training new personnel, and for annual training of all personnel in safety procedures, to follow in the event of a release of hazardous materials. It also includes an emergency response plan and identifies the business representative able to assist emergency personnel in the event of a release.

An HMBP will be developed prior to construction and operation of the power plant.

The CFC, §2701.5.1 and 2701.5.2, states that local fire agencies can require information in addition to the state requirements for HMBPs be included in HMBP submittal. In the case when the quantities of hazardous material present do not exceed the state HMBP thresholds but the

CFC permit thresholds, some of which are lower than the state levels, the local fire agencies can require the submission of HMBP.

The CHSC, §25534, directs facility owners storing or handling acutely hazardous materials in reportable quantities to develop an RMP and submit it to appropriate local authorities, USEPA, and the designated local Administering Agency for review and approval. The RMP includes an evaluation of the potential impacts associated with an accidental release, the likelihood of an accidental release occurring, the magnitude of potential human exposure, any pre-existing evaluations or studies of the material, the likelihood of the substance being handled in the manner indicated, and the accident history of the material. This recently developed program supersedes the California Risk Management and Prevention Plan, and is known as CalARP. The Project will prepare an RMP for the use and storage of anhydrous ammonia.

CCR, Title 8, §5189, requires facility owners to develop and implement effective Safety Management Plans to ensure that large quantities of hazardous materials are handled safely. While such requirements primarily provide for the protection of workers, they also indirectly improve public safety and are coordinated with the RMP process.

California Government Code, §65850.2, states that a city or county shall not issue a final certificate of occupancy unless there is verification that the applicant has met the applicable requirements of CHSC, §25531 and 25505, for a permit from the air pollution control district.

The California UBC contains requirements regarding the storage and handling of hazardous materials. The Chief Building Official must inspect and verify compliance with these requirements prior to issuance of an occupancy permit.

5.12.7.3 Local

The designated, certified, unified program agency (CUPA) for the Project is the Kern County EHSD, and it is responsible for (1) the implementation of the HMBP and emergency response plan and (2) the storage of hazardous materials in underground storage tanks (USTs) and cleanup of petroleum releases.

The EHSD will be contacted in the event of a release of hazardous wastes or materials to the environment.

The Kern County Fire Code, §2701.7, directs that when required by the fire code official, business owners are to submit a Facility Correction Plan to Fire Prevention. The Facility Correction Plan shall demonstrate that hazardous materials stored, dispensed, handled, or used in the facility shall be transported, disposed of or handled in a manner that eliminates the need for further maintenance, that any threat to public health and safety will be eliminated, and that all federal, state, and local requirements will be met to ensure the safe closure or correction of the facility.

5.12.7.4 Industry Standards

The UFC contains provisions regarding the storage and handling of hazardous materials. These provisions are contained in Articles 79 and 80. Article 80 was extensively revised in the latest edition (1994). These articles contain requirements that are generally similar to those contained in the CHSC §25531 *et seq*. The UFC does, however, contain unique requirements for secondary containment, monitoring, and treatment of toxic gases emitted through emergency venting. These unique requirements are generally restricted to extremely hazardous materials, which are not being used by this Project.

The applicable LORS related to hazardous materials handling are summarized in Table 5.12-5, Summary of LORS – Hazardous Materials Handling.

5.12.8 Involved Agencies and Agency Contacts

There are a number of federal and state agencies that regulate hazardous materials, including USEPA at the federal level, and the Cal-EPA at the state level. However, local agencies are the primary enforcers of hazardous materials laws. For the Project Site, the local agency is the Kern County EHSD, shown in Table 5.12-6, Agency Contact List for LORS.

5.12.9 Permits Required and Permit Schedule

The Project will develop an HMBP prior to construction activities. See Table 5.12-7, Applicable Permits, for a list of potential permit requirements.

5.12.10References

Cal-EPA (California Environmental Protection Agency), Central Valley Regional Water Quality Control Board (RWQCB), 2008. http://www.waterboards.ca.gov/centralvalley. March 2008.

Kern County, Building Department, 2008. http://www.co.kern.ca.us/bid/. March 2008.

Kern County, Planning and Community Department, 2008. http://www.co.kern.ca.us/planning/. March 2008.

DTSC (California Department of Toxic Substances Control), 2008. http://www.dtsc.ca.gov/. March 2008.

Kern County Environmental Health Services Department, 2008. http://www.co.kern.ca.us/eh. March 2008.

Kern County Fire Department, 2008. http://www.kerncountyfire.org/. March 2008.

USEPA (U.S. Environmental Protection Agency), 1999. Risk Management Program Guidance for Off-Site Consequence Analysis. EPA Document EPA550B99009. April 1999.

Table 5.12-1
Hazardous Materials Usage and Storage During Construction
Based on Title 22 Hazardous Characterization[1]

Material	Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Diesel Fuel	Ignitability, Toxicity	Refueling construction vehicles and equipment	Laydown Area	4,000 gallons	Tank
Acetylene, Oxygen, Other Welding Gases	Ignitability	Maintenance Welding	Temporary Gas Cylinder Storage Area	2,000 standard cubic feet	Cylinders of various volumes
Lead/Acid and Alkaline Batteries	Corrosivity, Toxicity	Power for Equipment	Warehouse/ Shop Area	<50 units	Unit
Paints, Solvents, Adhesives, Resins, Cleaning Acids, etc.	Toxicity, Ignitability, Corrosivity	Painting and Paint Removal, general construction activities	Temporary Chemical Storage Area	300 gallons/ week	Drum
Gasoline	Ignitability, Toxicity	Refueling Construction Vehicles and Equipment	Warehouse/ Shop Area	4,000 gallons/ week	Tank

Source: HECA, 2012.

Notes:
1 All numbers are approximate
2 Hazardous characteristics identified per California Code of Regulations Title 22 §§66261.20 et seq., for hazardous wastes

Table 5.12-2
Hazardous Materials Usage and Storage During Construction
Based on Material Properties[1]

Material	Potential Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Lubricating Oil	Mildly Toxic	Lubricating Equipment Parts	Laydown area	400 gallons	Tanks/Drums
Cleaning Chemicals/ Detergents	Toxic, Irritant	Periodic Cleaning	Contained in storage tanks on equipment skids	1,000 pounds	Tanks and containers or equipment

Source: HECA, 2012..

Notes:
1 All numbers are approximate
2 Potential hazardous characteristics based on material properties and potential health hazards associated with those properties

Table 5.12-3
Hazardous Materials Usage and Storage During Operations
Based on Title 22 Hazardous Characterization[1]

Material	Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Sodium Hydroxide (Caustic Solution)	Corrosivity Toxicity	Plant Wastewater ZLD, Sour Water Treatment, Demineralizers, Caustic Scrubber, Desuperheater Contact Condenser	Outdoor	150,000 gallons (5 to 50 wt% NaOH)	Carbon steel AST with secondary containment
Spent Caustic	Corrosivity Toxicity	Intermediate storage pending treatment off site	Outdoor	150,000 gal	Carbon steel AST with secondary containment
Degassed Liquid Sulfur	Ignitability, Reactivity	Product	Outdoor	700 tons	One sulfur pit and one AST
Methanol	Ignitability Toxicity	AGR solvent make-up	Outdoor	300,000 gallons	1 × 300,000 gal AST with secondary containment + 250,000 gal contained in process vessels of AGR
Compressed Gases (Ar, He, H_2)	Ignitability	Laboratory Services	Indoor	Minimal	Cylinders of various volumes
Chemical Reagents (acids/bases)	Corrosivity, Reactivity	Laboratory Services	Indoor chemical storage	<5 gallons	Small original containers
Flammable/ Hazardous Gases (H_2, CO, H_2S), Syngas and Hydrogen-Rich Fuel	Ignitability, Toxicity	Intermediate product used for power generation and nitrogen-based product generation	Process piping	In process quantities only, no storage on site	None
Miscellaneous Industrial Gases (Acetylene, Oxygen, Other Welding Gases, Analyzer Calibration Gases)	Ignitability, Toxicity	Maintenance Welding/ Instrumentation Calibration	Gas cylinder Storage in Shop/ shelters	Minimal	Cylinders of various volumes
Natural Gas	Ignitability	Provides fuel service to consumers	Supply piping only	Utility supply on demand via pipeline	None
Diesel Fuel	Ignitability	Emergency generator/ firewater pump fuel	Outdoor	2,000 gallons	ASTs with secondary containment
Sulfuric Acid	Corrosivity, Reactivity, Toxicity	Plant waste water treating, cooling Water, BFW pH control. Demineralizers	Outdoor	14,000 gallons	AST with secondary containment
Paint, Thinners Solvents, Adhesives, etc.	Ignitability, Toxicity	Shop/Warehouse	Indoor chemical storage area	<20 gallons	Small original containers
Boiler Feedwater Chemicals (e.g., Morpholine, Cyclohexamine, Sodium Sulfite)	Corrosivity	Boiler feedwater pH/ corrosion/dissolved oxygen/biocide control	Outdoor chemical storage area	<500 gallons	Small original containers

Table 5.12-3
Hazardous Materials Usage and Storage During Operations
Based on Title 22 Hazardous Characterization[1]

Material	Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Hydrogen	Ignitability	STG & CTG generator cooling	Outdoor	30,000 standard cubic feet	Pressurized multi-tube trailer
CTG and HRSG Cleaning Chemicals (e.g., HCl, Citric Acid, EDTA Chelant, Sodium Nitrate)	Toxic, Reactive	HRSG Chemical Cleaning	Stored off site or temporarily on site	Intermittent cleaning requirement Temp storage only	Small original containers
Anhydrous Ammonia (Liquid)	Irritant, Corrosive to skin, eyes, respiratory tract, and mucus membranes	Intermediate, produced in and used in Manufacturing Complex	Outdoor	~10,800 tons (~7 day usage)	Double integrity tanks
Ammonium Nitrate Solution (75-85wt %)	Irritant	Intermediate, produced/used in UAN Plant	Outdoor	54 tons	Contained in process vessels
Nitric Acid (~60wt %)	Corrosivity, Reactivity, Toxicity	Intermediate, produced/used in UAN Plant	Outdoor	2,600 tons (3 days)	AST
UAN Solution	Corrosivity	Plant Product	Outdoor	63,000 tons (45 days of production)	AST

Source: HECA, 2012

Notes:

1 All numbers are approximate.

2 Hazardous characteristics identified per California Code of Regulations Title 22 §§66261.20 *et seq*., for hazardous wastes.

% = percent
< = less than
~ = approximately
AGR = acid gas removal
Ar = argon
AST = above-ground storage tank
BFW = boiler feed water
CO = carbon monoxide
CO_2 = carbon dioxide
CTG = combustion turbine generator
EDTA = ethylene diamine tetra-acetic acid
gal = gallons
H_2 = hydrogen
H_2S = hydrogen sulfide
HCl = hydrochloric acid
He = helium
HRSG = heat recovery steam generator
HDPE = high-density polyethylene
SCR = selective catalytic reduction
NaOH = sodium hydroxide
NO_X = nitrogen oxide
STG = steam turbine generator
UAN = urea ammonium nitrate
wt% = percent by weight
ZLD = zero liquid discharge

Table 5.12-4
Hazardous Materials Usage and Storage During Operations
Based on Material Properties[1]

Material	Potential Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Sodium Hypochlorite	Corrosivity, Reactivity	Raw Water Treatment and Cooling Tower biological control	Outdoor	7,000 gallons	Polyethylene ASTs with secondary containment
Combustion Turbine Wash Chemicals (specialty detergents and surfactants)	Toxic, Irritants	Combustion Turbine Cleaning	Chemicals are contractor provided and are either not stored on site or are stored only temporarily in a chemical storage area.	Intermittent use/cleaning by contractor	Small original containers
Water Treatment Chemicals	Irritant, Mildly Toxic	Raw water, demineralized water, and cooling water treatment	Indoor chemical storage area	<500 gallons	Drums or ASTs
Oxygen (99.5%), vapor	Oxidizer	Gasification, SRU	Outdoor	1,200 tons	AST within the ASU
Nitrogen[3]	Asphyxiant	Syngas fuel diluent for NO_X control, Purge gas, Ammonia plant feed, Gasification	Outdoor	100 tons based on 2.5 hr of feed	AST within the ASU
Cooling Water Chemical Additives (e.g., Magnesium Nitrate, Magnesium Chloride)	Mild Irritant, Mildly Toxic	Corrosion Inhibitor/ Biocides	Outdoor chemical storage area near each cooling tower	<500 gallons	Small quantities in original containers
Diethylene glycol monobutyl ether (industrial cleaner)	Basic Compound, Toxic, Mild Irritant	Routine cleaning, degreasing, oxygen pipeline cleaning	Indoor	None	Temporary storage as needed provided by contractor
Compressed CO_2 Gas[3]	Asphyxiant	Generator purging and fire protection	Outdoor	50,000 standard cubic feet for purging	CO_2, for fire suppression, stored in pressurized cylinders or tank

Table 5.12-4
Hazardous Materials Usage and Storage During Operations
Based on Material Properties[1]

Material	Potential Hazardous Characteristics[2]	Purpose	Storage Location	Maximum Stored	Storage Type
Propylene Glycol	Mild Irritant	Heat Transfer Fluid		<300 gallons (100 vol. % solution)	4 × ~55 gallon drum or ASTs
Propylene Glycol	Mild Irritant	Heat Transfer Fluid	Closed Loop Cooling System -In process inventory	25,000 gallons (45 vol. % solution)	Contained in process equipment
Sodium Bisulfite	Irritant, Mildly Toxic	Raw Water Treatment	Indoor chemical storage area	<500 gallons	Drums or ASTs
Sodium Phosphate	Irritant, Mildly Toxic	Raw Water Treatment, Plant Wastewater ZLD	Indoor chemical storage area	1,500 gallons	AST with secondary containment
UAN Solution	Corrosivity	Plant Product	Outdoor	63,000 tons (45 day production)	AST

Notes:
[1] All numbers are approximate
[2] Potential hazardous characteristics based on material properties and potential health hazards associated with those properties
[3] Nitrogen and CO_2 are not hazardous materials but may be asphyxiants under some circumstances
< = less than
AGR = acid gas removal
Ar = argon
AST = above-ground storage tank
ASU = Air Separation Unit
BFW = boiler feed water
CO = carbon monoxide
CO_2 = carbon dioxide
CTG = combustion turbine generator
CCW = closed cooling water system
EDTA = ethylene diamine tetra-acetic acid
H_2 = hydrogen
H_2S = hydrogen sulfide
HCl = hydrochloric acid
He = helium
HRSG = heat recovery steam generator
HDPE = high density polyethylene
SCR = selective catalytic reduction
NaOH = sodium hydroxide
NO_X = nitrogen oxide
SO_2 = sulfur dioxide
SRU = sulfur recovery unit
STG = steam turbine generator
TGTU = tail gas treating unit
wt% = percent by weight
ZLD = zero liquid discharge

Table 5.12-5
Summary of LORS – Hazardous Materials Handling

LORS	Requirements	Conformance Section (Section 5.12.6.1/2/3/4)	Administering Agency	Agency Contact
Federal Jurisdiction				
SARA Title III, EPCRA	Imposes reporting requirements of hazardous materials to state and local agencies	Section 5.12.6.1	USEPA	Region IX (800) 231-3075
U.S. DOT Regulations, 49 CFR 171-177	Governs the transportation of hazardous materials, including the marking of the transportation vehicles.	Section 5.12.6.1	DOT FMCSA	Amy Hope, California Division (916) 930-2760
State Jurisdiction				
Health and Safety Code Section 25500 *et seq.* (Waters Bill), CCR Art. 1, Ch. 6.95	Requires preparation of an HMBP if hazardous materials are handled or stored in excess of TQ.	Section 5.12.6.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Health and Safety Code Section 25531 *et seq*. (La Follette Bill)	Requires registration of the facility with local authorities and preparation of an RMP if hazardous materials stored or handled in excess of TQ.	Section 5.12.6.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
CCR, Title 8, Section 5189	Facility owners are required to implement safety management plans to ensure safe handling of hazardous materials.	Section 5.12.6.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
California UBC	Requirements regarding the storage and handling of hazardous materials.	Section 5.12.6.2	Kern County Planning and Building Department	Lorelei Oviatt, Director (661) 862-8600
California Government Code Section 65850.2	Restricts issuance of COD until the facility has submitted an RMP.	Section 5.12.6.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Local Jurisdiction				
CUPA Kern County EHSD	Requires new/modified businesses to complete an HMBP prior to final plan/permit approval.	Section 5.12.6.3	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Industry Standards Jurisdiction				
UFC (Articles 79 and 80)	Requirements for secondary containment, monitoring, etc., for extremely hazardous materials.	Section 5.12.6.4	Kern County Fire Department	Dennis Thompson Fire Chief (661) 391-7000

Source: DTSC, 2008; Cal-EPA, Central Valley RWQCB, 2008; Kern County Planning and Community Development Department, 2008; Kern County Building Inspection Department, 2008; Kern County Environmental Health Services Department, 2008; and Kern County Fire Department, 2008.

Notes:
CCR = California Code of Regulations
CFR = Code of Federal Regulations
COD = Commercial Operating Date
DOT = Department of Transportation
EHSD = Environmental Health Services Department
EPCRA = Emergency Planning and Community Right-to Know Act of 1986
FMCSA = Federal Motor Carrier Safety Administration
HMBP = Hazardous Materials Business Plan
LORS = laws, ordinances, regulations, and standards
RMP = Risk Management Plan
SARA = Superfund Amendments and Reauthorization Act
TQ = Threshold Quantity
UBC = Uniform Building Code
UFC = Uniform Fire Code
U.S. = United States
USEPA = U.S. Environmental Protection Agency

Table 5.12-6
Agency Contact List for LORS

	Agency	Contact	Address	Telephone
1	Kern County, Environmental Health Services Department (EHSD)	Matthew Constantine, Director	2700 M Street, Suite 300 Bakersfield, CA 93301	(661) 862-8700
2	Kern County Fire Department	Dennis Thompson Fire Chief	5642 Victor Avenue Bakersfield, CA 93308	(661) 391-7000
3	Department of Toxic Substances Control (DTSC)	Noel Laverty DTSC Duty Officer Clovis Field Office	1515 Tollhouse Road Clovis, CA 93611	(916) 255-3618 (559) 297-3901

Source: DTSC, 2008; Kern County Environmental Health Services Department, 2008; and Kern County Fire Department, 2008.

Note:
LORS = laws, ordinances, regulations, and standards

Table 5.12-7
Applicable Permits

Responsible Agency	Permit/Approval	Schedule
Federal	RMP	30 days prior to ammonia delivery
State	RMP	30 days prior to ammonia delivery
Local	HMBP	30 days prior to storage of hazardous materials on site

Source: Kern County Environmental Health Services Department, 2008.

Notes:
HMBP = Hazardous Materials Business Plan
RMP = Risk Management Plan

PLANNED TRANSPORT ROUTES FOR PROJECT-RELATED HAZARDOUS MATERIALS

April 2012 — Hydrogen Energy California (HECA)
28068052 — Kern County, California

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FIGURE 5.12-1

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Appendices [In Volume III]

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5.13 WASTE MANAGEMENT

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.

- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.

- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration**.**

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A-1 of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  — **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  — **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

This section includes the waste management impact evaluation for the HECA Project, including the HECA linear facilities, and the CO_2 linear. The waste management impact evaluation for the OEHI CO_2 EOR Processing Facility is covered in Appendix A-1, Section 4.16, Utilities and Services.

5.13.1 Affected Environment

5.13.1.1 Project Site

An update of the Phase I Environmental Site Assessment (ESA) of the Project Site originally prepared in 2009 has been conducted in accordance with American Society for Testing and

Materials (ASTM) guidance document *ASTM Standards on Environmental Site Assessments for Commercial Real Estate*, Designation Practice E 1527 as required by the California Energy Commission for an AFC. The ESA report is included in this AFC Amendment as Appendix L. The objective of the Phase I ESA was to identify Recognized Environmental Conditions (RECs) that may exist on the Project Site. The ASTM guidance document defines RECs as "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property."

Based on information generated for the Phase I Environmental Site Assessment prepared by URS (2012), the following RECs were identified at the Project Site:

- The 2010 Phase II investigation conducted by AECOM identified elevated concentrations of petroleum hydrocarbons and other contaminants on the former equipment wash area immediately north of the Subject Property (same as Project Site) boundary. Because the vertical and horizontal extent of contamination was not defined by the Phase II ESA, and this wash area discharged into a ditch south of the Farm Operations Area boundary, the contamination is considered a potential off-site REC to the Subject Property.

- Stained soils were observed during the Subject Property visit, as detailed in Section 6.3.13. The soil staining is likely to derive from handling of fuels, lubricating oils, and/or pesticides. The AECOM 2010 Phase II ESA sampled in the vicinity of the stained soil and identified selected contaminants; however, the extent of any subsurface impacts is not defined.

In addition to these RECs, the following potential environmental issues were noted that in URS' opinion are not considered RECs:

- Surficial samples collected from the agricultural fields on the Subject Property identified concentrations of the pesticides dieldrin, endrin, and endosulfan that exceed the Regional Water Quality Control Board (RWQCB) Environmental Screening Levels, but did not exceed the state California Human Health Screening Levels or federal Regional Screening Levels (RSLs). These results are consistent with the historical agricultural use, and no consistent spatial pattern of pesticides above Environmental Screening Levels was observed.

- An agency database lists five former underground storage tanks (USTs) located at Palm Farms, Inc., on Adohr Road. Because the Subject Property is also located on Adohr Road, and the property was purchased from Palm Farms, Inc., the USTs may have historically been located on or adjacent to the Subject Property. The 2010 AECOM Phase II ESA investigated selected potential locations for these USTs and identified no USTs and no contamination associated with USTs.

URS recommended further investigation be conducted at the Subject Property to determine the presence and/or extent of potential environmental contamination associated with the RECs. The investigation should address potential contamination arising from each REC and environmental issues listed above, including the following issues:

- Performing step-out sampling to investigate the vertical and horizontal extent of contamination in the area adjacent to the former equipment wash area, including sampling surficial soil and sediment along the drainage ditch where washwater was discharged, to evaluate potential impact to the Subject Property.

- Performing step-out sampling to investigate the vertical and horizontal extent of contamination in the stained soil area adjacent to the drainage ditch, including sampling surficial soil.

The Phase I ESA report is included in this AFC Amendment as Appendix L.

Adjacent land uses consist of Adohr Road and agricultural uses to the north; Tupman Road and agricultural uses to the east; agricultural uses and an irrigation canal to the south; and a residence, agricultural uses, and Dairy Road right-of-way to the west. The Outlet Canal, the Kern River Flood Control Channel, and the California Aqueduct are located approximately 500, 700, and 1,900 feet, respectively, to the south of the Project Site. The land southwest of the California Aqueduct is used for mineral and petroleum purposes. The EHOF is located approximately 1 mile south of the Project Site.

The land adjacent to the northwestern corner of the Project Site formerly contained the Port Organics Products, Ltd. (Port Organics), natural fertilizer manufacturing plant, farming operations, and a residence. Port Organics operations ceased at the beginning of 2009.

As described in more detail in Section 5.13.2, Environmental Consequences, the Project will generate hazardous and non-hazardous wastes during the construction and operational phases of the Project that are typical of an IGCC polygeneration facility.

Facility workers will receive hazardous materials training as required by the Occupational Safety and Health Administration, Hazard Communication Standard. Additionally, workers will be trained in hazardous waste procedures, spill contingencies, and waste minimization procedures in accordance with California Code of Regulations (CCR) Title 22.

5.13.1.2 Non-Hazardous Solid Waste Disposal

Existing non-hazardous solid waste disposal facilities in the general area of the Project Site are listed in Table 5.13-1, Waste Recycling/Disposal Facilities. Several available Class III landfills are listed in Table 5.13-1. These landfills accept non-hazardous wastes and inert solid wastes, including construction/demolition wastes. Industrial process solid wastes are accepted on a case-by-case basis. Based on the Project’s low anticipated waste volumes, the remaining capacity, and estimated closure dates of the Class III landfills in California, non-hazardous waste generated during construction and operational phases at the Project is not expected to significantly impact available landfill capacity.

5.13.1.3 Hazardous Solid Waste Disposal

Hazardous waste generated at the Project Site will be taken off site for recycling or disposal by a permitted hazardous waste transporter to a permitted Treatment, Storage, and Disposal Facility

(TSDF) or Class I landfill. There are currently two Class I landfills accepting waste in California: Clean Harbors' Buttonwillow facility in Kern County, and Chemical Waste Management's Kettleman Hills Landfill in Kings County. The permitted, operating, and remaining capacities of these landfills are described in Table 5.13-1. Based on the Project's low anticipated waste volumes, the remaining capacity, and estimated closure dates of the Class I landfills in California, hazardous waste generated during construction and operational phases at the Project is not expected to significantly impact available landfill capacity.

5.13.2 Environmental Consequences

The wastes that would be generated during both the construction and the operation phases of the Project were identified to determine whether the Project would result in any potentially significant impacts. The significance criteria are based on the California Environmental Quality Act (CEQA) Guidelines, Appendix G, Environmental Checklist Form (approved January 1, 1999), and on performance standards or thresholds adopted by responsible agencies. An impact may be considered significant if:

- Construction activities result in waste materials being introduced into the environment in violation of federal, state, or local waste management and disposal regulations.
- Construction and/or operation activities generate waste materials that exceed the receiving capacity of appropriate disposal or recycling facilities.
- Operation of the facility results in waste materials being introduced into the environment in violation of federal, state, or local waste management and disposal regulations.
- Non-hazardous liquid wastes cause a publicly owned treatment system to violate any applicable waste discharge requirements.
- The Project breaches standards relating to solid waste or litter control.
- The Project creates a potential public health hazard or involves materials that pose a hazard.
- The Project results in a need for new systems or substantial alterations to waste disposal facilities.

The following sections describe the wastes that are expected to be generated during construction and operation of the Project, and how non-hazardous solid waste, wastewater, and hazardous solid and liquid wastes will be disposed.

5.13.1.4 Construction Phase

Project Site Construction

The Project will generate wastes typical for the construction of an IGCC polygeneration facility. Table 5.13-2, Summary of Construction Waste Streams and Management Methods, summarizes the anticipated waste streams generated during construction, along with appropriate management methods for treatment, recycling, or disposal. A waste management plan that encompasses hazardous and non-hazardous wastes will be prepared prior to construction.

Non-Hazardous Waste

Solid waste generated from construction activities may include paper, wood, glass, plastics from packing material, waste lumber, insulation, scrap metal and concrete, and empty non-hazardous containers. These wastes will be segregated, where practical, for recycling. Non-recyclable wastes will be placed in covered dumpsters and removed on a regular basis by a certified waste-handling contractor for disposal. Based on the remaining capacity and estimated closure dates of the Class III landfills in California, the non-hazardous wastes that cannot be recycled are not expected to significantly impact the capacity of the Class III landfills. With the implementation of Waste Mitigation Measure (WM)-2, described in Section 5.13.4, Mitigation Measures, impacts related to non-hazardous waste will be less than significant.

Hazardous Waste

Small quantities of hazardous wastes are likely to be generated over the course of construction. These wastes may include waste paint, spent solvents, waste cleaners, waste oil, oily rags, waste batteries, and spent welding materials. Hazardous wastes generated during Project construction will be handled and disposed of in accordance with applicable laws, ordinances, regulations, and standards (LORS) and in accordance with Mitigation Measures WM-3 through WM-7. Hazardous wastes will be either recycled or disposed of in a licensed hazardous waste disposal facility, as appropriate. Managed and disposed of properly, these wastes will not cause significant environmental or health and safety impacts. Most of the hazardous waste can be recycled, such as turbine-cleaning wastes and used oil generated during construction. Based on the remaining capacity and estimated closure dates of the Class I landfills in California, the hazardous wastes that cannot be recycled are not expected to significantly impact the capacity of the Class I landfills. With the implementation of Mitigation Measures WM-3 through WM-7, described in Section 5.13.4, impacts related to hazardous waste will be less than significant.

Wastewater

Wastewater generated during construction of the Project will include sanitary wastes, equipment washwater, hydrotest water, and storm water runoff. Non-hazardous equipment washwater will be routed to the appropriate process area storm water retention basin for reuse. Sanitary waste will be disposed of off site by a sanitary waste contractor.

Section 5.14, Water Resources, of this AFC Amendment provides additional detail regarding hydrotest water. In summary, the source of the water to be used for hydrostatic testing of the pipelines will be an on-site irrigation well, supplemented by potable water from West Kern Water District. The hydrostatic testing will be performed on new pipelines, and no chemicals will be added to the test water. As such, the expected quality of the test water will be similar to the quality of the source water (i.e., non-hazardous). After all hydrotesting has been completed, the hydrotest water will be sampled, tested, and disposed of in compliance with National Pollutant Discharge Elimination System permit(s). Clean water with suitable chemistry will be routed to the storm water retention basin. Water that is not suitable for routing to the retention basin will be transported by truck to an appropriately licensed off-site treatment or disposal facility.

Section 5.14, Water Resources, of this AFC Amendment provides additional detail regarding storm water runoff. In summary, storm water runoff will be routed to retention basins during the initial grading operation to prevent the release of sediment from the Project Site. Best management practices as described in the Draft DESCP submitted in response to previous data requests will be used during construction to minimize the potential for erosion (see Responses to Data Request 95 and Data Request 202). A construction storm water pollution prevention plan will be prepared and implemented in accordance with the General Permit for Construction Activities. With implementation of Project design elements and mitigation measures proposed in Section 5.14, Water Resources, of this AFC Amendment, the impacts to surface water quality will be less than significant.

Off-Site Linear Facilities

Non-Hazardous and Hazardous Waste

During the installation of the railroad spur, the electrical transmission line, the natural gas pipeline, the CO_2 pipeline, and the process and potable water supply lines, non-hazardous soils and surface demolition debris (e.g., concrete, asphalt, and piping) are anticipated. These wastes will be transported and disposed at an appropriate disposal facility. Contaminated soil may be encountered during installation. Soil sampling is likely to be required to profile the waste for disposal classification purposes. Soil may be recycled, disposed as a non-hazardous waste at a Class III landfill or soil recycling facility, or disposed as hazardous waste at a Class I landfill. The disposal option will depend on the characterization of the waste per Resource Conservation and Recovery Act (RCRA) and CCR Title 22 criteria. Waste disposal facilities are listed in Table 5.13-1, Waste Recycling/Disposal Facilities.

Non-hazardous and hazardous wastes are not expected to be encountered at paved parking and equipment staging locations. If site grading is necessary to use unpaved parking and equipment staging locations, then non-hazardous soil and debris (trash, asphalt) may be generated. With the implementation of Mitigation Measures through WM-7, described in Section 5.13.4, impacts will be less than significant.

OEHI Project

According to the analysis contained in Appendix A-1, Section 4.16, construction of the OEHI Project would not result in significant adverse impacts related to the generation of waste.

5.13.1.5 Operation Phase

Project Operations

Operation of the plant will generate wastes resulting from processes, routine plant maintenance, and office activities typical of IGCC polygeneration facility. Table 5.13-3, Summary of Operating Waste Streams and Management Methods, describes them in more detail. Non-hazardous wastes generated during operation of the Project will be recycled to the greatest extent practical, and the remainder will be removed on a regular basis by a certified waste-handling contractor. Operation of the electrical transmission line, the natural gas pipeline, the CO_2 pipeline, and the water supply pipelines will not generate any significant amounts of waste. The types of waste and their estimated quantities are shown in Table 5.13-3. A waste management plan that encompasses hazardous and non-hazardous wastes will be prepared prior to operations.

Non-Hazardous Solid Waste

The following types of non-hazardous solid waste may be generated: paper, wood, plastic, metal cardboard, deactivated equipment and parts, defective or broken electrical materials, empty non-hazardous containers, and other miscellaneous solid wastes, including the typical refuse generated by workers.

Office paper, newsprint, aluminum cans, wood, insulation, yard debris, concrete, gravel, scrap metal, cardboard, glass, plastic containers, and other non-hazardous waste material will be segregated and recycled to the extent practical, and the remainder will be removed on a regular basis by a certified waste-handling contractor for disposal at a Class III landfill. Based on the remaining capacity and estimated closure dates of the Class III landfills in California, the non-hazardous wastes that cannot be recycled are not expected to significantly impact the capacity of the Class III landfills. With the implementation of the mitigation measures described in Section 5.13.4.2, impacts related to non-hazardous waste during operation will be less than significant.

Gasification Solids

The gasifier will produce a solid vitrified by-product called “gasification solids.” These solids are made of ash from the coal and petcoke that exit the gasifier.

Because the Project has not yet been constructed, the gasification solids have not yet been generated. Consequently, the composition can only be projected, based on feed materials. An extensive review was performed of publicly available documents pertaining to the gasification solids generated by other IGCCs. Other IGCC power plants with beneficial reuse of the gasification solids match within normal variances the Project design, operation, gasification equipment, process specifications, and feed material blends. HECA has studied the beneficial reuse of gasification solids in a variety of industrial applications. Areas currently being evaluated include reuse for the production cement, roofing granules and sandblast grit.

Gasification solids produced from the use of a feedstock that is at least 50 percent coal is excluded from hazardous waste regulations and requirements, per the exclusions in applicable federal and California regulations—i.e., Title 40 of the Code of Federal Regulations (40 CFR) § 261.4(b)(7)(ii)(F), and California regulation 22 CCR § 66261.4(b)(5)(A). The Project is designed to operate on feedstock of 75 percent coal.

Liquid Wastes

There will be no direct surface water discharge of industrial wastewater or storm water from process areas. The primary sources of wastewater at the Project will be from cooling tower blowdown, raw water treatment, process condensate wastewater from the gasifier, the sour water stripper, the Acid Gas Removal unit, and the Urea plant. Process wastewater will be treated on site and recycled to the cooling towers as make-up water. Cooling tower blowdown will also be treated on site to produce demineralized and utility water. The reject from the cooling tower blowdown treatment plant is sent to a zero liquid discharge (ZLD) system. The ZLD solids will be disposed of at an approved off-site facility. Solids from the ZLD system have the potential to be classified as hazardous pursuant to the hazardous waste regulations of CCR Title 22, and are listed as such in the summary table, Table 5.13-3. Additional information on the ZLD processes is provided in the Zero Liquid Discharge subsection below.

Sanitary wastewater from the Project restrooms, showers, and kitchens will be disposed to a private on-site sewage disposal system consisting of a conventional septic tank and leach field. No municipal system is available in the vicinity of the Project Site.

Zero Liquid Discharge

The ZLD system will be comprised of traditional thermal water-treatment technology. The pure distillate produced from the evaporators will be returned to the gasification or power blocks for reuse. The ZLD solids will be trucked to an approved off-site material disposal facility.

Storm Water Management

Storm water management for the Project will be designed to avoid direct discharge to off-site surface waters.

Retention basins and storm water collection/conveyance systems will be designed in accordance with the Kern County Development Standards. The retention basin locations are shown in Figure 2-36, Preliminary Storm Water Drainage Plan, in Section 2, Project Description, of this AFC Amendment.

Storm water generated at the Project will be managed as follows:

- Storm water from inside the process plant area will be routed to lined retention basins. After solids have settled and water is determined to be suitable for reuse, storm water will be pumped to the water treatment plant for further treatment and reuse. If this collected storm water is determined to be unsuitable for reuse, it will be transferred and processed in the ZLD system at the wastewater treatment plant.

- Storm water that may be contaminated with oil will be separately collected and routed to an oil/water separator. Recovered waste oil from the separator will be disposed of off site. The separated water will be transferred and processed at the wastewater treatment plant.

- Storm water in the Acid Gas Removal (AGR) Unit will be collected in a separate lined, dedicated AGR storm water retention basin. The AGR Unit collection system is isolated to contain any potentially contaminated water that could result in the unlikely event of a methanol spill.

- Storm water from chemical and oil storage areas will be held in the associated secondary containment. Storm water held in these areas will first be tested. If it is acceptable for cooling water makeup, it will be routed to the lined retention basin. Oily storm water will be routed through an oil/water separator of the wastewater treatment plant.

- Storm water within the process plant area where solids are present (e.g., coal, petcoke, or gasification solids) will be collected and conveyed to the solids handling water collection facility. The collection facility will be constructed of concrete and will provide for mobile equipment access to remove accumulated solids. Water that accumulates within the solids handling collection facility will be processed in the ZLD system at the wastewater treatment plant.

- Storm water from remote solids handling areas, such as feedstock unloading and the crusher station, will be collected in lined retention basins for settlement, testing, reuse, and/or treatment as appropriate.

- Storm water from outside the process plant area but within the Project Site will be separately collected in retention basins located throughout the Project Site.

- A Storm Water Pollution Prevention Plan will be developed prior to operations. The Project storm water will be managed in accordance with this plan, which will include the measures outlined above.

Hazardous Wastes

Various types of hazardous wastes will be generated during operational activities, which may include spent catalysts, filters and ZLD solids, water softener solids, spent caustics and solvents, used oils from equipment maintenance, and oil-contaminated materials such as spent oil filters, rags, or other cleanup materials. Spent catalysts will be returned to the manufacturer for metals reclamation or disposed of. Used oil generated will be recycled. Waste filters and ZLD solids, sludge, spent caustics and solvents, and all other hazardous wastes requiring disposal will be disposed of in a licensed hazardous waste disposal facility. Other occasional waste streams include alkaline- or acid-cleaning solutions used during chemical cleaning of equipment. Table 5.13-3, Summary of Operating Waste Streams and Management Methods, summarizes the hazardous waste to be generated from operation of the Project.

Hazardous wastes will be collected by a licensed hazardous waste hauler and disposed of at a licensed hazardous waste facility. Hazardous wastes will be transported off site using a hazardous waste manifest. Copies of manifest reports, waste analysis, exception reports, destruction certifications, biennial reports, etc., will be kept on site and accessible for inspection for 3 years. Land disposal restriction notices/certificates will be kept on site and accessible for inspection for 5 years.

Based on the remaining capacity and estimated closure dates of the Class I landfills in California, the hazardous wastes that cannot be recycled are not expected to significantly impact the capacity of the Class I landfills. With the implementation of the mitigation measures described in Section 5.13.4.2, Operations, impacts related to hazardous waste during operations will be less than significant.

OEHI Project

According to the analysis contained in Appendix A-1, Section 4.16, operation of the OEHI Project would not result in significant adverse impacts related to the generation of waste.

5.13.1.6 Abandonment/Closure

Section 3.0, Facility Closure, of this AFC Amendment contains a detailed discussion of closure issues that are summarized in this subsection. If it becomes necessary to close the plant temporarily for any reason (due to a disruption in the natural gas supply or feedstocks, flooding, damage from an earthquake, fire, storm, etc.), facility security will be maintained on a 24-hour basis and the California Energy Commission will be notified. A contingency plan for temporary closure will be prepared prior to start-up of the facility to protect human health and the environment. Depending on the duration of any temporary shut-down, the plan will direct the safe shut-down of all equipment and the draining of all chemicals from the process. Any waste generated under these circumstances will be disposed of in accordance with all applicable LORS.

The planned life of the facility is a minimum of 25 years. A general closure plan identifying the handling and disposal requirements for non-hazardous and hazardous wastes will be prepared prior to closure. This plan will identify opportunities for recycling. All equipment containing liquids will be drained and decommissioned as part of closure procedures to protect public health, safety, and the environment. Unused chemicals will be sold back to the suppliers or other purchasers where practicable. All non-hazardous wastes will be disposed of in appropriate landfills or recycled. Hazardous wastes will be disposed of according to all applicable LORS. The Project Site will be secured 24 hours per day during the decommissioning activities.

5.13.2 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines § 15130). A "cumulative impact" consists of an impact that is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines § 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines § 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines § 15065 [a][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines § 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines § 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines § 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines § 15130[b]).

A cumulative impact analysis starts with a list of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines § 15130[b]). Factors to consider when determining whether to include a related project include the nature of the environmental resource being examined, the location of the project, and its type (CEQA Guidelines § 15130[b]). For purposes of this AFC Amendment, Kern County was contacted to obtain a list of related projects, which is contained in Appendix I. Depending on its location and type, not every project on this list is necessarily relevant to the cumulative impact analysis for each environmental topic.

Past, current, and potential future projects, including the Project, would generate waste. There are, however, adequate recycling facilities and landfill capacities to dispose of the waste from the Project over the next 25 years. While waste generated by the Project would add to the total waste generated in Kern County and in California, recycling of wastes from the Project and other proposed developments listed above will play a significant role in reducing the amount of material that is sent to landfill. There are adequate recycling and waste disposal facilities to handle the wastes from the Project and other proposed developments; thus, the cumulative impacts from the Project would be considered less than significant.

According to the analysis contained in Appendix A-1, Section 4.16, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts related to waste generation.

5.13.3 Mitigation Measures

5.13.3.1 Construction

Waste Mitigation Measure WM-1

Prior to the initiation of the Project construction phase, construction workers will receive waste-related training. Training will focus on the recognition and proper handling of subsurface soil contamination, as well as contingency procedures to be followed to provide worker safety and protect the public.

WM-2

A detailed waste management plan for waste generated during construction will be prepared at least 60 days prior to rough grading to assure proper storage, labeling, packaging, recordkeeping, manifesting, waste minimization, and disposal of hazardous materials and waste. A waste management plan will also be prepared for operation of the Project. The waste management plan will include:

- Waste classification procedures
- A description of each hazardous waste stream
- Waste container and label requirements
- Accumulation, handling, transport, treatment, and disposal procedures for each waste
- Waste minimization procedures
- Preparedness, prevention, contingency, and emergency procedures
- Personnel training

WM-3

Hazardous wastes will be accumulated on site for fewer than 90 days (or other accumulation periods as allowed by 22 CCR Section 66262.34 for hazardous waste generators) and will be managed in accordance with state and federal hazardous waste generator requirements. Hazardous wastes, as well as hazardous materials that are spilled or otherwise become unsuitable for use, will be stored in an appropriately segregated hazardous waste storage area surrounded by a containment structure to control leaks and spills. The containment area will be constructed according to local codes and requirements. Hazardous waste containers and labels will be maintained according to applicable LORS. The hazardous waste storage areas will be inspected and maintained at least weekly, as required.

WM-4

Hazardous wastes will be collected by a licensed hazardous waste hauler and disposed of at a licensed hazardous waste facility in accordance with applicable LORS. Hazardous wastes are transported off site using a hazardous waste manifest. Copies of manifest reports, waste analysis, exception reports, destruction certifications, etc., will be kept on site and accessible for inspection for 3 years. Land disposal restriction notices/certificates will be kept on site and accessible for inspection for 5 years.

WM-5

Spill control and management procedures will be included in the emergency response procedures developed for the Project prior to operation. The purpose of spill control and management procedures is to avoid accidental mixing of incompatible chemicals and spills during transfer of chemicals. The design of spill control and management procedures will include the containment, collection, and treatment systems. The spill response procedures are discussed further in Section 5.12, Hazardous Materials Handling.

WM-6

Facility workers will receive hazardous materials training as required by the Occupational Safety and Health Administration (OSHA), Hazard Communication Standard. Additionally, workers will be trained in hazardous waste procedures, spill contingencies, and waste minimization procedures in accordance with CCR Title 22. Hazardous waste training includes the following subjects:

- Hazardous waste characteristics
- Use and management of containers
- Waste packing
- Marking and labeling
- Accumulation/storage areas
- Inspections
- Emergency equipment preparedness and prevention
- Contingency plan
- Emergency response procedures
- Spill response and containment
- Hazardous waste manifesting and transportation requirements
- Waste minimization practices

WM-7

Procedures to minimize hazardous waste generation will be established. Workers will be trained in procedures to reduce the volume of hazardous wastes generated at the Project. The procurement of hazardous materials will be controlled to minimize surplus materials on site and to prevent unused materials from becoming "off-spec." Non-hazardous materials will be used in lieu of hazardous materials whenever possible. Hazardous wastes will be recycled whenever possible.

Implementation of the above waste management procedures for handling construction-related debris and hazardous wastes, where encountered, will mitigate demolition and construction-related impacts to a less-than-significant level. No further mitigation is proposed.

5.13.3.2 Operations

Project Site

The Applicant will update the waste management procedures for construction of the Project Site and implement them for operations at the Project. In addition, the Applicant will develop and implement procedures and requirements as outlined in the Hazardous Materials Business Plan (HMBP). These procedures and programs will minimize potential site-operations–related impacts.

Off-Site Structures

Periodic inspection and maintenance of the railroad spur, the electrical transmission line, the natural gas pipeline, the CO_2 pipeline, and the process and potable water supply line in accordance with applicable LORS will mitigate potential operations-related impacts associated with the linear facilities.

5.13.3.3 Monitoring Program

Environmental impacts related to waste management issues caused by construction and operation of the Project are expected to be minimal. Therefore, extensive monitoring programs are not anticipated. Monitoring of generated waste volumes and characteristics during construction and operation of the Project will be conducted in accordance with monitoring and reporting requirements in the appropriate permits that will be obtained for construction and operation.

5.13.4 Laws, Ordinances, Regulations, and Standards

5.13.4.1 Federal

RCRA, 42 United States Code (USC) § 6901–6992k, provides the basic framework for federal regulation of non-hazardous and hazardous waste. RCRA's Subtitle D establishes state responsibility for regulating non-hazardous wastes, while Subtitle C controls the generation, transfer, storage, and disposal of hazardous waste through a comprehensive "cradle-to-grave" system of hazardous waste management techniques and requirements. The U.S. Environmental Protection Agency (USEPA) is responsible for implementing the law, and the implementing regulations are set forth in 40 Code of Federal Regulations (CFR) 260 *et seq*. The law allows USEPA to delegate the administration of the RCRA programs to the various states, provided that the state programs meet or are more stringent than the federal requirements. California's program was authorized by USEPA on August 1, 1992, and the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) is responsible for administering the program.

The Clean Water Act (CWA) 33 USC § 1251 *et seq*. provides the regulatory framework for managing the discharge of wastewater to waters of the U.S. The USEPA has nationwide authority to implement the CWA, but states may be authorized to administer various aspects of the National Pollutant Discharge Elimination System (NPDES), as well as pretreatment programs. California is authorized under the CWA to administer the NPDES program, implement publicly owned treatment works' pretreatment programs, oversee federal facilities, and issue general permits.

Under 49 CFR 172, 173, and 179, controls are provided on labeling, placarding, and packaging for hazardous waste shipments that will be shipped off site over the state highways and roads. The U.S. Department of Transportation and the California Highway Patrol are responsible for its administration and enforcement.

5.13.4.2 State

Non-hazardous solid waste is regulated by the California Integrated Waste Management Act, Public Resources Code § 40000 *et seq.* The law provides a solid waste management system to reduce, recycle, and reuse solid waste generated in the state to the maximum extent feasible in an efficient and cost-effective manner to conserve natural resources, to protect the environment, and to improve landfill safety. Local agencies are required to develop and establish recycling programs, reduce paper waste, purchase recycled products, and implement integrated waste management programs that conform to the state's requirements. Kern County Environmental

Health Services Department (EHSD) has the authority to assure the proper storage and disposal of solid waste in Kern County.

Wastewater is regulated under California's Porter–Cologne Water Quality Control Act, which established a statewide system for water pollution control, Water Code § 13000 *et seq.* The State Water Resources Control Board (SWRCB) and the nine RWQCBs are the principal agencies responsible for control of water quality, and issuing permits under the NPDES program.

Accumulation of hazardous waste on site is regulated under 22 CCR § 66262.34. Hazardous waste cannot be stored on site for more than 90 days, so any hazardous waste stored on site at the Project will have to be appropriately transferred within that time period.

As stated previously, RCRA allows states to develop their own programs to regulate hazardous waste. California has developed its own program by passage of the California Hazardous Waste Control Law (HWCL), California Health and Safety Code § 25100 *et seq.* It should be noted that California's HWCL includes non-RCRA hazardous wastes. In addition, the law specifies two hazardous waste criteria (Soluble Threshold Limit Concentration and Total Threshold Limit Concentration) that are not required under RCRA. Primary authority for the statewide administration and enforcement of California's HWCL rests with the DTSC. However, the Kern County EHSD provides most regulatory functions covering those who generate hazardous waste.

5.13.4.3 Local

For hazardous waste, the designated Certified Unified Program Agency for the Project area is the Kern County EHSD. They have delegated authority to administer state and federal programs. In addition, the County EHSD regulates the storage of hazardous materials in USTs and cleanup of petroleum releases from USTs. The EHSD will be contacted in the event of a release of hazardous wastes or materials to the environment. The EHSD assumes enforcement responsibility for the implementation of Title 23 of the CCR and regulates the generation and storage of hazardous waste for the Project area through the requirement for a HMBP.

The following summarizes the applicable LORS that govern the handling of non-hazardous and hazardous wastes. The LORS applicable to the handling of waste at the Project Site are also summarized in Table 5.13-4, Summary of LORS—Waste Management.

5.13.5 Involved Agencies and Agency Contacts

Agencies with jurisdiction to issue applicable permits or enforce LORS related to waste management are shown in Table 5.13-5, Agency Contact List for LORS.

5.13.6 Permits Required and Permit Schedule

The Project will apply for a USEPA hazardous waste generator identification number from the USEPA and a hazardous waste generator permit from the Kern County EHSD.

The Project will be required to develop an HMBP for the Kern County EHSD.

A summary of applicable waste permits is presented in Table 5.13-6, Applicable Permits.

5.13.7 References

Cal/EPA (California Environmental Protection Agency), Central Valley RWQCB (Regional Water Quality Control Board), 2008. Information downloaded from: http://www.waterboards.ca.gov/centralvalley. March 2008.

Cal/EPA (California Environmental Protection Agency), DTSC (Department of Toxic Substances Control), 2008. Information downloaded from: http://www.dtsc.ca.gov. March 2008.

CIWMB (California Integrated Waste Management Board), 2008. Information downloaded from: http://www.ciwmb.ca.go/SWIS. March 2008.

Kern County Building Department, 2008. Information downloaded from: http://www.co.kern.ca.us/bid/. March 2008.

Kern County Planning Department, 2008. Information downloaded from: http://www.co.kern.ca.us/planning/. March 2008.

Kern County Environmental Health Services Department. Information downloaded from: http://www.co.kern.ca.us/eh. March 2008.

URS (URS Corporation), 2012. Phase I Environmental Site Assessment.

Table 5.13-1
Waste Recycling/Disposal Facilities

Solid Recycling/Waste Disposal Site	Title 23 Class	Permitted Throughput	Permitted Capacity	Remaining Capacity	Estimated Closure Date	Enforcement Action Taken?
Taft Sanitary Landfill (Solid Waste Facility) 13351 Elk Hills Road Taft, CA 93626	Class III	90 tons per day	8.8 million cubic yards	6.0 million cubic yards	2070	No
Bakersfield Metropolitan (Bena) Sanitary Landfill Facility (SLF) (Solid Waste Facility) 2951 Neumarkel Road Caliente, CA 93518	Class III	1.3 thousand tons per day	53 million cubic yards	34.3 million cubic yards	2042	No
Shafter-Wasco Sanitary Landfill (Solid Waste Facility) 17621 Scofield Avenue Shafter, CA 93668	Class III	330 tons per day	21.9 million cubic yards	15 million cubic yards	2056	No
U.S. Borax Inc. Refuse Waste Pile (Solid Waste Facility) 14486 Borax Road Boron, CA 93516	Class III	443 tons per day	8.5 million cubic yards	1.4 million cubic yards	2023	No
McKittrick Waste Treatment Site (Solid Waste Facility) 56533 State Route 58 McKittrick, CA 93251	Class II	1.2 thousand tons per day	2.1 million cubic yards	84.1 thousand cubic yards	2029	No
Chemical Waste Management Kettleman Hills Landfill (Solids Waste Facility) 36251 Old Skyline Road Kettleman City, CA 93239	Class I	400 trucks per day	10.7 million cubic yards	<100 thousand cubic yards[1]	2022	No

Table 5.13-1
Waste Recycling/Disposal Facilities (Continued)

Solid Recycling/Waste Disposal Site	Title 23 Class	Permitted Throughput	Permitted Capacity	Remaining Capacity	Estimated Closure Date	Enforcement Action Taken?
Clean Harbors Buttonwillow Landfill (Solid and Liquid Waste Facility) Lokern Road Kern County, CA 93251	Class I	10.48 thousand tons per day	14.29 million cubic yards	Not available	2068	No
American Remedial Technologies (Solids Recycling) 2680 Seminole Avenue Lynwood, CA 90262	N/A	25 thousand tons per month	300 thousand tons per year	N/A	N/A	No
TPS Technologies, Inc. (Soil Recycling) 12328 Hibiscus Avenue Adelanto, CA 92301	N/A	N/A	350,000 tons per year	N/A	N/A	No
Thermal Remediation Solutions (Solids Recycling) 1211 West Gladstone Avenue Azusa, CA 91702	Class III	200,000 tons per year	2,000 tons per day	N/A	N/A	No

Source: California Integrated Waste Management Board, 2008.

Notes:

1. Currently, the remaining capacity at this facility is less than 110,000 cubic yards. A new cell is proposed to open to open in 2013/2014 but final approval has not been granted

N/A = not applicable

Table 5.13-2
Summary of Construction Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount	Units	Disposal Method	Estimated Density (lb/CF)	Estimated Density (short tons/CY)	Volume (CY/year)[2]
Used Lube Oils, Flushing Oils	Hazardous	7	55-gallon drums per month	Recycle	N/A	N/A	N/A
Hydrotest Water (One time per commissioning, reuse as practical, test for hazardous characteristics)	Hazardous or non-hazardous	2,800,000	gallons total	Characterize. Drain non-hazardous to the Retention Basin. Dispose of hazardous at a hazardous waste treatment and disposal facility	N/A	N/A	N/A
Chemical Cleaning Wastes (Chelates, Mild Acids, TSP, and/or EDTA – During Commissioning)	Hazardous or non-hazardous recyclable	525,000	gallons total	Hazardous or non-hazardous waste treatment and disposal facility	N/A	N/A	N/A
Solvents, Used Oils, Paint, Adhesives, Oily Rags	Cal-hazardous recyclable	160	gallons per month	Recycle or hazardous waste treatment and disposal facility	N/A	N/A	N/A
Spent Welding Materials	Hazardous	300	pounds per month	Dispose at a hazardous waste landfill	200	3.1	0.69
Used Oil Filters	Hazardous	100	pounds per month	Dispose at a hazardous waste landfill	50	0.68	0.9
Fluorescent/Mercury Vapor Lamps	Hazardous recyclable	50	units per year	Recycle	N/A	N/A	N/A
Misc. Oily Rags, Oil Absorbent	Non-hazardous or Hazardous Recyclable	1	55-gallon drum per month	Recycle or dispose at a hazardous waste landfill	N/A	N/A	3.3
Empty Hazardous Material Containers	Hazardous Recyclable	1	cubic yard per week	Recondition, recycle, or dispose at a hazardous waste landfill	N/A	N/A	52

Table 5.13-2
Summary of Construction Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount	Units	Disposal Method	Estimated Density (lb/CF)	Estimated Density (short tons/CY)	Volume (CY/year)[2]
Used Lead/Acid and Alkaline Batteries	Hazardous Recyclable	1.2	ton per year	Recycle	N/A	N/A	N/A
Sanitary Waste from Workforce (Portable Chemical Toilets)	Non-hazardous	450	gallons per day	Pump and dispose by sanitary waste contractor	N/A	N/A	N/A
Site Clearing – Grubbing, Excavation of Non-Suitable Soils, Misc. Debris	Non-hazardous	Minimal	N/A	Reuse Soils or dispose at a non-hazardous waste landfill (see Section 2.6.1, Project Site Construction, of this AFC Amendment)	N/A	N/A	N/A
Scrap Materials, Debris, Trash (Wood, Metal, Plastic, Paper, Packing, Office Waste, etc.)	Non-hazardous	60	cubic yards per week	Recycle or dispose at a non-hazardous waste landfill	N/A	N/A	N/A
					Total Annual Cubic Yards:		**3,177**

Source: HECA, 2012.
Notes:
[1] All Numbers are estimates.
[2] Volumetric quantities shown for wastes expected to be disposed in non-hazardous or hazardous waste landfills. Volumetric quantities are not shown for wastes that are expected to be recycled or treated and disposed by means other than landfill.
AFC = Application for Certification
CF = cubic feet
CTG = combustion turbine generator
CY = cubic yards
EDTA = ethylene diamine tetra-acetic acid
lb = pounds
N/A = not applicable (due to waste not being landfilled)
STG = steam turbine generator
TSP = trisodium phosphate

Table 5.13-3
Summary of Operating Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount/year	Units	Disposal Method	Density (lb/CF)	Density (short tons/CY)	Volume (CY/year)[2]
Spent Claus Sulfur Recovery Catalyst (Activated Alumina)	Nonhazardous	7	tons	Dispose at a nonhazardous waste landfill.	40	0.54	4
Claus Catalyst Support Balls (Activated Alumina)	Nonhazardous	1	ton	Recycle or Dispose at a nonhazardous waste landfill.	40	0.54	1
Spent Sour Shift Catalyst (Cobalt Molybdenum)	California Hazardous	30	tons	Send to reclaimer for metals recovery.	40.6	0.548	56
Spent Titania (TiO_2)	Nonhazardous	10	tons	Dispose at a nonhazardous waste landfill.	57.0	.77	4
Spent Hydrogenation Catalyst (Cobalt Molybdenum)	California Hazardous	10	tons	Send to reclaimer for metals recovery.	41	0.55	3
Hydrogenation Catalyst Support Balls (Alumina Silicate)	Nonhazardous	1	ton	Recycle or Dispose at a nonhazardous waste landfill.	81.0	1.09	1
Spent SCR Catalyst (Titanium, vanadium, tungsten, combustion contaminants, and inert ceramics)	Hazardous	1,600	cu ft	Return to supplier to reclaim/dispose.	N/A	N/A	N/A
Spent CO/VOC oxidation catalyst (Noble metals, other inerts, and combustion contaminants)	Nonhazardous	600	cu ft	Send to reclaimer for noble metals recovery.	N/A	N/A	N/A
Spent Mercury Removal Carbon Beds (Impregnated activated carbon)	Hazardous	3	tons	Stabilize and dispose at a hazardous waste landfill.	35.6	0.481	6
Plant Wastewater ZLD Solids (Inorganic and organic salts)	Anticipated Nonhazardous	15,000	tons	Stabilize and Characterize for landfill disposal.	78.2	1.056	14,209

Table 5.13-3
Summary of Operating Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount/year	Units	Disposal Method	Density (lb/CF)	Density (short tons/CY)	Volume (CY/year)[2]
CO_2 Purification Catalyst for COS Removal (activated Alumina)	Hazardous	300	cu ft	Stabilize and dispose at a hazardous waste landfill.	46	0.62	11.1
CO_2 Purification Catalyst for H2S Removal (Zinc Oxide)	Hazardous	1200	cu ft	Stabilize and dispose at a hazardous waste landfill.	76.8	1.04	44.4
Ammonia Synthesis Catalyst iron-oxide based	Non-Hazardous	2500	cu ft	Dispose at a nonhazardous waste landfill.	170	23	92.6
Spent Urea Unit platinum-based catalyst for CO_2 Dehydrogeneration	Non-Hazardous	10	cu ft	Send to reclaimer for metals recovery.	N/A	N/A	N/A
Spent Nitric Acid Plant platinum-based catalyst	Non-Hazardous	250	lbs	Send to reclaimer for metals recovery.	N/A	N/A	N/A
Spent N_2O and NO_X decomposition catalyst SCR-type	Hazardous	150	cu ft	Return to supplier to reclaim/dispose.	N/A	N/A	N/A
Spent PSA Adsorbent	Hazardous	50	tons	Stabilize and dispose at a hazardous waste landfill.	18.2	0.25	204
Sour Water System Solids	Hazardous	30	tons	Dispose at an incinerator or hazardous waste landfill.	125	1.7	17.8
Spent Caustic	Hazardous	400,000	gal	Offsite treatment to oxidize sulfides to sulfates. Adjust pH and dispose as nonhazardous.	N/A	N/A	N/A
Off-Line Combustion Turbine Wash Wastes (Detergents and residues)	Hazardous or Nonhazardous	15,000	gal	Characterize and dispose as nonhazardous or treat and dispose as hazardous waste.	N/A	N/A	N/A

Table 5.13-3
Summary of Operating Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount/year	Units	Disposal Method	Density (lb/CF)	Density (short tons/CY)	Volume (CY/year)[2]
HRSG Wash Water (Infrequent) (Detergent, residues, neutralized acids)	Hazardous or Nonhazardous	100,000	gal	Characterize and dispose as nonhazardous or treat and dispose as hazardous waste	N/A	N/A	N/A
Water Softener Solids and Used Water Filter Media	Nonhazardous	90	ton	Characterize and dispose as nonhazardous or hazardous waste.	40.0	0.540	167
Used Oil	Hazardous	8,000	gal	Recycle.	N/A	N/A	N/A
Spent Grease	Hazardous	20	55-gallon drums	Characterize and dispose as hazardous waste.	N/A	N/A	N/A
Miscellaneous Filters and Cartridges	Hazardous or Nonhazardous	150	cu yd	Characterize and dispose as nonhazardous or hazardous waste.	N/A	N/A	150
Miscellaneous Solvents	Hazardous	2	55-gallon drums	Recycle or treatment and disposal as hazardous waste.	N/A	N/A	N/A
Flammable Lab Waste	Hazardous	2	55-gallon drums	Characterize and recycle or treat and dispose as hazardous waste.	N/A	N/A	N/A
Waste Paper and Cardboard	Nonhazardous	300	cu ft	Recycle	N/A	N/A	N/A
Combined Industrial Waste (Used PPE, materials, small amounts of refractory, slurry debris, etc.)	Nonhazardous	300	cu yd	Dispose at a nonhazardous waste landfill.	N/A	N/A	12

Table 5.13-3
Summary of Operating Waste Streams and Management Methods[1]

Waste Stream	Waste Classification	Anticipated Maximum Amount/year	Units	Disposal Method	Density (lb/CF)	Density (short tons/CY)	Volume (CY/year)[2]
Gasification solids (Vitrified Ash) Dry Basis	Anticipated to be Nonhazardous or covered by regulatory exclusion	277,000	tons	Reuse, reclaim sellable metals, or characterize for landfill disposal.	82.5	1.114	246,016
				Total Cubic Yards w/o Gasifier Solids			**14,983**

Source: HECA, 2012.

Notes:

[1] All numbers are estimates.

[2] Volumetric quantities shown for wastes expected to be disposed in nonhazardous or hazardous waste landfills. Volumetric quantities are not shown for wastes that are expected to be recycled or treated and disposed by means other than landfill.

CF = cubic feet
CO = carbon monoxide
COS = carbonyl sulfide
cu ft = cubic feet
CY = cubic yards
HRSG = heat recovery steam generator
lb = pound
LORS = laws, ordinances, regulations, and standards
N/A = not applicable
PPE = personal protective equipment
PSA = Pressure Swing Adsorption
SCR = selective catalytic reduction
TiO2 = Titania
TGTU = tail gas treating unit
VOC = volatile organic compounds
ZLD = zero liquid discharge

Table 5.13-4
Summary of LORS—Waste Management

LORS	Requirements	Conformance Section	Administering Agency	Agency Contact
Federal Jurisdiction				
RCRA Subtitle C and D, 42 USC § 6901–6992k and § 6.12.2.1	Regulate non-hazardous and hazardous wastes. Laws implemented by the state.	Section 5.13.5.1	USEPA Region IX and DTSC	Tetra Tech EMI (Contractor for USEPA) (415) 495-8895 and DTSC Duty Officer Clovis Field Office (519) 297-3901
40 CFR § 260 *et seq*.	Implementing regulations for RCRA Subtitle C law. Implemented by USEPA by delegating to the state.	Section 5.13.5.1	DTSC	DTSC Duty Officer Clovis Field Office (519) 297-3901
49 CFR 172,173, and 179	Controls labeling, placards, and packaging for hazardous waste shipments.	5.13.1	California Highway Patrol and Department of Transportation	California Highway Patrol (Bakersfield Office) 4040 Buck Owens Blvd., Bakersfield (661) 864-4444
Federal Clean Water Act, 33 USC § 1251 *et seq*.	Regulates wastewater discharges to waters of the U.S. The NPDES program is administered at the state level.	Section 5.13.5.1	Central Valley RWQCB	Doug Patteson (519) 445-5156
State Jurisdiction				
California Integrated Waste Management Act, Public Resources Code § 40000 *et seq.*	Implements RCRA regulations for non-hazardous waste.	Section 5.13.5.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Porter-Cologne Water Quality Control Act of 1998, Water Code § 13000 *et seq.*	Regulates wastewater discharges to surface and groundwater of California. NPDES program implemented by SWRCB.	Section 5.13.5.2	Central Valley RWQCB	Doug Patteson (519) 445-5156
22 CCR § 66262.34	Regulates accumulation periods for hazardous waste generators. Typically hazardous waste cannot be stored on site for more than 90 days.	Section 5.13.5.2	DTSC	DTSC Duty Officer Clovis Field Office (519) 297-3901
California Hazardous Waste Control Law, California Health and Safety Code § 25100 *et seq.*	Regulates hazardous waste handling and storage.	Section 5.13.5.2	Kern County EHSD	Matthew Constantine, Director (661) 862-8700

Table 5.13-4
Summary of LORS – Waste Management (Continued)

LORS	Requirements	Conformance Section	Administering Agency	Agency Contact
Local Jurisdiction				
Kern County EHSD	Regulates enforcement responsibility for the implementation of Title 23, Division 3, Chapters 16 and 18 of the CCR, as it relates to hazardous material storage and petroleum UST cleanup.	Section 5.13.5.3	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Kern County EHSD	Regulates hazardous waste generator permitting, and hazardous waste handling and storage.	Section 5.13.5.3	Kern County EHSD	Matthew Constantine, Director (661) 862-8700
Kern County General Plan Public Facilities Element	Will ensure all new development complies with applicable provisions of County Integrated Solid Waste Management Plan.	Section 5.13.5.3	Kern County Planning and Building Department	(661) 862-8600

Source: Cal/EPA DTSC, 2008; Cal/EPA, Central Valley RWQCB, 2008; Kern County, Planning Department, 2008; Kern County, Building Department, 2008; and Kern County Environmental Health Services Department, 2008.

Notes:

CCR = California Code of Regulations
CFR = Code of Federal Regulations
DTSC = Department of Toxic Substances Control
EHSD = Environmental Health Services Department
LORS = laws, ordinances, regulations, and standards
NPDES = National Pollutant Discharge Elimination System
RCRA = Resource Conservation and Recovery Act of 1976
RWQCB = Regional Water Quality Control Board
SWRCB = State Water Resources Control Board
U.S. = United States
USC = United States Code
USEPA = U.S. Environmental Protection Agency
UST = underground storage tank

Table 5.13-5
Agency Contact List for LORS

Agency		Contact	Address	Telephone
1	USEPA	Tetra Tech EMI (Contractor for USEPA) Attention: Notifications	135 Main Street Suite 1800 San Francisco, CA 94105	(415) 495-8895
2	DTSC	Noel Laverty, DTSC Duty Officer Clovis Field Office Charles Corcoran Office of Policy	1515 Tollhouse Road Clovis, CA 93611 P.O. Box 806 Sacramento, CA 95812	(916) 255-3618 (559) 297-3901 (916) 327-4499
3	Kern County EHSD	Matthew Constantine, Director	2700 M Street, Suite 300 Bakersfield, CA 93301	(661) 862-8700
4	RWQCB Central Valley Region	Doug Patteson, (NPDES) Surface Water Discharges	1685 E Street Fresno, CA 93706	(559) 455-6190

Source: Cal/EPA DTSC, 2008; Cal/EPA, Central Valley RWQCB, 2008; and Kern County Environmental Health Services Department, 2008.
Notes:
DTSC = Department of Toxic Substances Control
EHSD = Environmental Health Services Department
LORS = laws, ordinances, regulations, and standards
NPDES = National Pollutant Discharge Elimination System
RWQCB = Regional Water Quality Control Board
USEPA = U.S. Environmental Protection Agency

Table 5.13-6
Applicable Permits

Responsible Agency	Permit/Approval	Schedule
USEPA	USEPA Hazardous Waste Generator Identification Number	Prior to start of plant construction
Regional Water Quality Control Board	Central Valley Region NPDES Construction	Notice of Intent filed 30 days prior to construction
Kern County EHSD	Hazardous Waste Generator Program Permit	30 days prior to the generation of hazardous waste
Kern County EHSD	Hazardous Materials Business Plan	30 days prior to the storage and use of hazardous materials

Source: Cal/EPA DTSC, 2008; and Kern County Environmental Health Services Department, 2008.
Notes:
DTSC = Department of Toxic Substances Control
EHSD = Environmental Health Services Department
NPDES = National Pollutant Discharge Elimination System
USEPA = U.S. Environmental Protection Agency

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5.14 WATER RESOURCES

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.

- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.

- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration**.**

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  - **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  - **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

This section evaluates impacts to water resources. The analysis included in this section focuses on the HECA Project as well as the CO_2 pipeline associated with the OEHI Project. The analysis of the CO_2 EOR Processing Facility associated with the OEHI Project is included in Appendix A-1, Section 4.8, Hydrology and Water Quality, of this AFC Amendment. No construction impacts to water resources related to coal transportation Alternative 2 (existing coal transloading facility) are expected because the coal transloading facility is an existing use and trucks would use existing roads. Therefore, operation of coal transportation Alternative 2 (existing coal transloading facility) and construction and operation of coal transportation Alternative 1 (new railroad spur) are evaluated in section.

In its water resources formulation and evaluation of water resource options, the HECA Project considered the benefits and potential impacts on subjects ranging from environmental to commercial. Each subject was considered on a local, regional, state, and federal basis, where appropriate. The Project's water source evaluation criteria included the following:

- Project objectives
- Existing water-related conditions and water demands in the surrounding Project area
- Projected future needs of the county, including regional coordination with irrigation and other districts on water matters
- Applicable laws, ordinances, regulations, standards, and policies
- Project source water and wastewater demands (at maximum annual load), and their inter-dependency
- Mitigation needs and plans, where appropriate

The HECA Project's evaluation and preferred raw water source and wastewater disposal option are presented in this section. The water resources data and information for the area, and the water demand data, were used to identify and evaluate the potential effects of the Project on local water resources, and to identify mitigation measures that will reduce potential significant impacts (if any) to a level of insignificance.

5.14.1 Affected Environment

5.14.1.1 Physiographic Setting

The Project Site is located in the Central Valley as shown on Figure 2-1, Project Vicinity. Figure 5.14-1 shows the Project Site on USGS topographic mapping (i.e., at a scale of 1:24,000). The Project is located in the southern end of the Central Valley region of California. The topography at the Project Site is characterized by relatively flat, low-lying terrain that slopes very gently from southeast to northwest.

Several regional irrigation and water supply canals are located in the vicinity of the Project Site (see Figure 5.14-1). The West Side Canal (and the Outlet Canal) and the Kern River Flood Control Channel (KRFCC) are approximately 500 and 700 feet south of the Project Site, respectively. The East Side Canal is located approximately 0.25 mile east of the Project Site boundary. The California Aqueduct, which was constructed in the 1970s and supplies agricultural and municipal areas in Southern California, is located parallel to, and west of the West Side and Outlet Canals, approximately 1,900 feet south of the Project Site. The California Aqueduct generally runs north-south and is the major conveyance feature for the California State Water Project that brings water from Northern to Southern California. The aqueduct is 444 miles long and is mostly an open concrete-lined canal. The canal width and depth vary along the length of the aqueduct, but it is generally approximately 50 feet wide and approximately 30 feet deep.

An irrigation canal extends generally from the east to the west from Tupman Road along the southern border of the Project Site. This irrigation canal connects the East Side Canal with the West Side and Outlet Canals.

An irrigation ditch crosses the Project Site from south to north and ends just south of Adohr Road. This ditch is approximately 7 feet deep and feeds the smaller irrigation ditches that traverse the Project Site from north to south and east to west around the crop fields. These irrigation ditches are fed by the West Side Canal and the East Side Canal.

5.14.1.2 Climate

The climate of the Central Valley in the vicinity of the Project can be characterized as semi-arid. The valley experiences long, hot, dry summers and relatively mild winters. Monthly average, maximum, and minimum temperature data based on a 69-year record for the Bakersfield World Service Office (WSO) Airport, Station No. 040442, are presented in Table 5.14-1, Monthly Temperature Data for Bakersfield, California. Based on 69 years of record, the average annual temperature for Bakersfield is 65.4 degrees Fahrenheit (°F).

Precipitation in the area is characterized by long, dry summers and intermittent wet periods. Based on the 69-year record of precipitation, the average annual precipitation is 6.23 inches. See Table 5.14-2, Average Monthly Precipitation Bakersfield, California.

5.14.1.3 Flooding

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the Project Site is not located in an area identified as having flood hazards or shallow groundwater (FEMA, 2008).

The Kern River Flood Control Channel is located approximately 0.5 mile south of the Project Site. This channel conveys overflows from the Kern River during flood events. The floodplain associated with this channel does not extend onto the Project Site.

5.14.1.4 Groundwater Conditions

Geology

Project Site

The Project Site is situated in the asymmetrical San Joaquin Valley basin, a structural trough that comprises the southern portion of the Great Central Valley of California. It is defined by the Coast Ranges to the west, the San Emigdio and Tehachapi Mountains to the south, the Sierra Nevada to the east, and the delta of the San Joaquin and Sacramento rivers to the north. The axis of the valley is closer to the Coast Ranges than to the Sierra Nevada (Belitz and Heimes, 1990). The oldest rocks in the valley comprise a mass of plutonic and metamorphic rocks commonly referred to as the Sierra Nevada batholith of pre-Tertiary age. The valley is filled with up to 32,000 feet of marine sedimentary rock eroded from the Diablo coastal range and granitic, sedimentary, and metamorphic rock eroded from the western Sierra Nevada. Sierran sands do not generally extend very far west of the axis of the valley trough; as such, in the Project vicinity, the geology is dominated by Coast Range alluvium. The continental sediments form an alluvial wedge that thickens toward the valley axis (DWR, 2006).

The Project Site is located approximately 2 miles north of the Elk Hills, an east-trending anticlinal uplift consisting of a series of low hills, also known as the EHOF. The Elk Hills form the surface expression of an anticline composed of gravel and mudstone derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the material on an apron of small coalescing fans along the northeast flank of the hills which abut the much larger Kern River fan to the north. The Elk Hills are composed of Tertiary to Quaternary rocks, of which the Tulare Formation is the shallowest unit. An unconformity separates the Elk Hills from the flatter portion of the valley on which the Project Site is located.

The surficial deposits in the vicinity of the Project Site are Quaternary alluvial gravel and sand. Bedrock underlying alluvium at the Project Site is the Pliocene- to Pleistocene-age Tulare Formation, which consists of alternating beds of sand and mudstone. According to Dibblee (2005), these deposits are stream-laid, weakly indurated, light gray pebble gravels, sands, and clays; pebbles are primary composed of Monterey siliceous shale and debris from bedrock in the adjacent Temblor Range (URS, 2009).

The soils at the Project Site consist of Lokern clay and Buttonwillow clay (NRCS, 1988). These soils are very deep and somewhat poorly drained. Both soil types formed in alluvium weathered mainly from granitic rock, but a variety of rock sources are included. Typically, in units, the surface layer is dark gray clay about 21 to 28 inches thick. The underlying material is light yellowish brown sandy loam to a depth of 60 inches or more. In some areas, the surface layer is loamy sand.

Permeability of the Buttonwillow clay is moderately rapid between depths of 28 and 55 inches and slow below a depth of 55 inches, while the permeability of the Lokern clay is slow. Available water capacity is moderate or high for both soil types. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

A preliminary geotechnical investigation was conducted at the Project Site in January 2009. The field exploration program included drilling and sampling of five borings and eight cone penetration test (CPT) probes, as well as conducting percolation tests at two locations. Results indicate that the upper 10 feet of soils materials are generally fine-grained materials (e.g., sandy clays or silty sands). The underlying sandy soils consist of interbedded layers of sands, silty sands and sandy silts with varying degrees of consistencies from medium dense to very dense. Below 30 feet below grade, the sandy soils become dense, grading denser to the maximum depth explored in the borings (100 feet below grade) (URS, 2009).

Proposed Well Field

The BVWSD well field is located approximately 15 miles northwest of the Project Site, as shown on Figure 5.14-2, Water Supply Well Field Locations. The geology for the proposed well field area is similar to that described for the Project Site above. The approximate location of the well field is located 6 miles north of the Elk Hills and approximately 8 to 10 miles northeast of the Temblor Range, a northwest-trending, Miocene to Plio-Pleistocene assemblage of marine sedimentary rocks. Temblor Range and Sierra Nevada derived sediments, interbed under and east of the well field area, predominantly consist of sands and gravels with some silt and clay layers of minor thickness and extent. They are vertically and laterally discontinuous as evidenced in local geophysical logs described below.

A 1991 study prepared by Kern County Water Agency (KCWA) (referred to as the "Clay Study") characterized the area geology within 2,000 feet below grade as alluvial, fluvial, and lacustrine clastic sediments dominated by sands and silts, with clays being less common and typically associated with oxbow lake depositional settings or, alternatively, small lacustrine settings within basin lows (KCWA, 1991).

Due to a paucity of geologic logs, spontaneous potential (SP) and resistivity geophysical logs for wells located in and around the proposed well field were reviewed to evaluate the geology of the proposed well field area. The logs available generally are not deeper than 500 to 600 feet below grade. The logs reveal that the sediments below the well field and in the vicinity are dominated by coarser-grained material (sand or gravel). The proportion of coarse-grained material generally decreases with depth. However, the sediments are consistently coarse-grained at depth. Fine-grained layers were observed in some of the logs, possibly correlative with the Corcoran Clay (see "Hydrogeology"), although the distance between logs (i.e., typically from 0.5 to 3 miles) precluded the correlation of these layers over large distances.

Hydrogeology

Project Site

The Project Site is located in the Kern County subbasin (DWR Subbasin No. 5-22.14) of the San Joaquin Valley groundwater basin. The subbasin is bounded by the Kern County line and the Tule groundwater subbasin on the north, by granitic bedrock of the Sierra Nevada foothills and Tehachapi Mountains on the east and southeast, and by the marine deposits of the San Emigdio Mountains and Coast Ranges on the southwest and west (DWR, 2006).

The southern San Joaquin Valley, of which the Kern County subbasin is part, has been further divided into additional hydrogeological subbasins that are bounded by distinct structural highs due to folding or faulting. These subbasins may contain isolated hydrogeological systems (KCWA, 1991). The Project Site is located in what is termed as the Buttonwillow Subbasin which is separated from the Jerry Slough Subbasin to the east and the Tulare Subbasin to the north and west as shown on Figure 5.14-3, Groundwater Subbasins in Kern County.

Shallow-to intermediate-depth water-bearing sediments in the Kern County subbasin are dominated by Tertiary and Quaternary continental deposits (KWBA, 2009). In the Project vicinity, the two main water-bearing units consist of the Plio-Pleistocene Tulare Formation and the overlying Pleistocene "older" alluvium/steam deposits (DWR, 2006).

The Tulare Formation, primarily derived from the Coast Range, is moderately to highly permeable and consists of up to 2,200 feet of interbedded sands, gypsiferous clays, and gravels (DWR, 2006). In the Project vicinity, the Tulare gently dips to the northeast beneath the valley

(Page, 1986).The Tulare Formation is included in undifferentiated non-marine strata approximately 2,580 feet thick encountered in the upper portion of nearby gas wells (DOGGR, 1998). Much of the San Joaquin Valley north of the Project Site includes the Corcoran Clay, which is an extensive lacustrine deposit of low permeability that divides the groundwater flow system into a lower confined zone and an upper semi-confined zone. While the Corcoran Clay has been encountered in the San Joaquin Valley north of the Project Site, it does not appear to be present in the Project area (Williamson, et al., 1985; KCWA, 1991).

Above the Tulare Formation, older alluvium/stream deposits are up to 250 feet thick and are dominated by loosely consolidated to cemented clay, silt, sand, and gravel. These are mainly exposed at the subbasin margins and are moderately to highly permeable (DWR, 2006). Together with the Tulare Formation, the older alluvium/stream deposits constitute the main water-bearing body of the subbasin.

Based on information available from the KWBA (KWBA, 2009), the upper 200 feet of the aquifer within the Kern Water Bank area east of the Project Site consists of discontinuous, thick sand intervals interbedded with gravel and silt, characterized as an unconfined aquifer. Below 200 feet, strata are dominated by interbedded sand, gravel, silt, and clay of limited lateral continuity. There are no widespread confining beds in the area. However, based on pumping response and the occurrence of downward leakage within the Kern Water Bank area, the deeper portion of the water-bearing zone is consistent with a semiconfined aquifer. As such, the aquifer below the Project area is characterized as a combination of an unconfined and a semiconfined system.

Proposed Well Field

In the well field vicinity, the two main water-bearing units consist of the Plio-Pleistocene Tulare Formation and the Pleistocene “older” alluvium/stream deposits (DWR, 2006). The Clay Study proposed further subdivision of the Kern County Subbasin, whereby the Project Site and proposed well field are located within a northwest-trending subbasin (“Buttonwillow Subbasin”) within the Kern County Subbasin bounded by subsurface structural highs (anticlines) mapped from borehole and seismic data (KCWA, 1991).

The regional hydrogeology for the well field is similar to that described for the Project Site. However, unconsolidated sediments underlying the approximate well field area include Temblor Range marine sediments from the west interbedding with alluvial sediments from the Sierra Nevada (Kern Fan) from the east. These sediments predominantly consist of sands and gravels with some silt and clay layers of minor thickness and extent (vertically and laterally discontinuous as evidenced in local geophysical logs described in the well field geology section). Figure 5.14-4, Generalized Hydrogeologic Cross Section, is a generalized cross section of the hydrogeologic system (tending southwest to northeast) from the Temblor Range to the well field area. Figure 5.14-5, Example Geophysical Log, is a geophysical log from a representative boring/well nearby the proposed well field that depicts the predominance of sands and gravels with minor interbeds of silts and clay. The dominance of coarse-grained alluvium and stream deposits, in combination with the presence of discontinuous lacustrine clay lens(es), suggest that the aquifer below the proposed well field is a combination of an unconfined and a semiconfined system.

The dominant recharge source in the subbasin is applied irrigation water (DWR, 2006). Although water levels in different parts of the subbasin have varied over the last several decades (e.g., 25-foot decrease in the Bakersfield area and 30-foot increase in the Lost Hills/ Buttonwillow areas), average groundwater levels in the subbasin have been relatively stable since 1970 (DWR, 2006). Data provided by the BVWSD for 2008 indicate that depth to groundwater in the proposed well field area is approximately 30 feet below grade, which corresponds to a groundwater elevation of approximately 220 feet msl. Information provided by the BVWSD indicates that in 2008 depths to water ranged from 20 feet below grade in the north to 130 feet below grade in the south near the Project Site (see Figure 5.14-6, 2008 Depth to Groundwater). BVWSD also reports perched groundwater zones in the northern-most portions of the Buttonwillow Service Area with depths to water ranging from less than 5 feet below grade to 10 feet below grade.

Aquifer Characteristics

DWR estimates of specific yield (Sy) for Kern County range from 8 to 19.5 percent, with the highest specific yield values for the subbasin associated with the Kern River alluvial fan west of Bakersfield and east of the Project Site (DWR, 2006). Information provided by the BVWSD indicates that the local aquifer system is prolific, of high permeability and yields high volumes of water to wells (typical pumping rates are 1,500 to 2,000 gpm in most of BVWSD's service area agricultural wells). Personal communications with Dr. Robert Crewdson of Sierra Scientific Services (BVWSD's Hydrogeologic Consultant), indicate there has been very little pumping impact (i.e., minimal drawdown) in local agricultural wells and that the local aquifer system responds similarly to and most likely exhibits similar hydraulic characteristics to nearby Kern County areas already studied in detail (Sierra Scientific Services, 2003; 2004; 2007a; and 2007b). Sy values reportedly range from 10 to 20 percent and hydraulic conductivity (K) values is estimated to be in the range of 57 feet/day (426 gpd/ft^2) for the sandy zones which appear to predominate the well field area. The aquifer is characterized as unconfined (shallow-water table portion) to semi-confined (due to apparent lack of thick or laterally continuous clay or aquitard-like deposits). The aquifer is also anisotropic with high anisotropic ratios—i.e., horizontal K to vertical K Kh/Kv) on the order of 30 to 50 or more. This means that water flows quicker in the horizontal rather than vertical direction because the unconsolidated alluvial sediments comprising the aquifer system were deposited in horizontal layers. The aquifer thickness in the well field area is as deep as 2,000 feet thick.

Assumptions for the aquifer parameters included in the groundwater model used to evaluate aquifer response to Project-specific pumping are summarized in Table 5.14-3, Aquifer Parameters. Sensitivity analyses for various parameters were also performed to account for uncertainties associated with a lack of site-specific hydraulic data in the well field area and to evaluate model response to the parameters. See Appendix N-2, Groundwater Model Documentation for additional information.

In late 2009, URS in cooperation with the BVWSD, implemented a Hydrogeologic Data Acquisition Program to evaluate hydrogeologic conditions in the vicinity of the proposed process water well field. Prior to the Hydrogeologic Data Acquisition Program, there was no known pumping test information in the proposed well field area. The results of this field program were provided to the CEC in the Draft – Hydrogeologic Data Acquisition Report (Draft HDAR), Groundwater Monitoring and Process Water Well Field Development Project (URS, 2010a) and the Draft Data Acquisition Report Addendum (URS, 2010b). The primary goals of the field program and the Draft HDAR were:

- To gather initial field data to verify that the assumptions used in the May 2009 Revised AFC Water Resources Section (with supporting Groundwater Model Appendix N-2) were reasonable
- To use the data to support anticipated data requests from the CEC
- To evaluate whether the BVWSD's brackish groundwater remediation project (BGRP) area identified for the BVWSD well field was reasonable with respect to HECA process water demand—7,500 acre feet per year (afy) and water quality criteria (average total dissolved solids (TDS) of 2,000 milligrams per liter (mg/L).

This work was preliminary in nature, using existing agricultural wells for pumping tests and water quality sampling. The Draft HDAR concluded that the assumptions used in the analysis of Project pumping from the BVWSD well field were reasonable, and the BGRP area appears feasible from both a water demand and quality standpoint. This preliminary work was to be followed by more robust exploratory drilling and well installation programs directed towards designing and constructing the well field. It is our understanding that the BVWSD is now planning those follow-on drilling and testing programs.

Groundwater Occurrence and Flow

Regional

On a regional scale, the development of irrigated agriculture in the western San Joaquin Valley has significantly altered the groundwater flow system. Percolation of irrigation water past crop roots has caused a rise in the elevation of the water table. Pumpage of groundwater from wells has caused a lowering of the potentiometric surface of the confined zone over much of the western valley. Percolation of irrigation water from agricultural fields, drainage ditches and canals has replaced infiltration of intermittent streamflow as the primary mechanism of recharge. Pumpage of groundwater from wells and crop evapotranspiration have replaced natural evapotranspiration and seepage to streams in the valley trough as the primary mechanisms of discharge. Decreases in groundwater pumping following delivery of surface water have allowed consequent recovery in hydraulic head throughout the groundwater flow system. The present-day groundwater flow system is in a transient state and is adjusting to the stresses placed upon it in both the past and present (Belitz and Heimes, 1990).

The dominant recharge source in the subbasin is applied irrigation water (DWR, 2006). Although water levels in different parts of the subbasin have varied over the last several decades, the average groundwater level in the subbasin has been relatively stable since 1970 (DWR, 2006). A groundwater divide is approximately located at the Kern River (Dale et al., 1966). The Elk Hills, together with the nearby Buena Vista Hills, restrict groundwater movement from the Buena Vista Valley (Page, 1986).

The average subbasin water level is essentially unchanged from 1970 to 2000, after experiencing cumulative changes of approximately a 15-foot decrease through 1978, a 15-foot increase through 1988, and an 8-foot decrease through 1997. However, net water level changes in different portions of the subbasin were quite variable through the period 1970 to 2000. These changes ranged from increases of more than 30 feet at the southeast valley margin and in the Lost Hills/Buttonwillow areas to decreases of more than 25 and 50 feet in the Bakersfield area and McFarland/Shafter areas, respectively.

The Kern Water Bank Authority recharges, stores, and recovers groundwater in the Bakersfield area. The western boundary of the approximately 20,000-acre water bank property is located 1 mile east of the Project Site. The Kern Water Bank, which receives water from the California Aqueduct, the Kern River, and the Friant–Kern Canal, can store more than 1 million acre-feet of water and can recover up to 240,000 acre-feet of water per year (KWBA, 2009). Banking facilities, including recharge basins, occupy approximately 7,000 acres of water bank property. Eighty recovery wells, with total depths ranging from 700 to 1,000 feet below grade, are located throughout the water bank, and are capable of being pumped at rates ranging from 2,500 to 5,000 gpm (KWBA, 2009).

Project Site

The Project Site is in an area of relatively deep groundwater conditions. A BVWSD 2008 Depth to Groundwater Map indicates that first groundwater at the Project Site should be encountered at between 120 and 130 feet below grade (Figure 5.14-6). The groundwater surface was not encountered within 60 to 100 feet of the ground surface based on the geotechnical borings and CPT probes (URS, 2009). During the on-site geotechnical investigation conducted in late January 2009, one boring was drilled to approximately 100 feet below grade, four borings were drilled to approximately 60 feet below grade and eight CPT probes were advanced to approximately 60 to 80 feet below grade. No groundwater was observed in the borings or CPTs at the time of the investigation. Anecdotal information provided by the property owner during the geotechnical investigation suggests that groundwater could be expected to be encountered at approximately 50 to 100 feet below grade. In the vicinity of the Project Site, spring-time groundwater elevations based on regional data from the DWR have ranged from approximately elevation 180 to 250 above msl in recent years, which corresponds to approximately 40 to 110 feet below grade (DWR, 2000 through 2006).

Proposed Well Field

Groundwater in the proposed BVWSD water supply well field area occurs under unconfined to semi-confined conditions depending on the depth of the water bearing zones. As stated previously, the well field is located in the Buttonwillow Subbasin (KCWA, 1991). Geophysical logs suggest that the aquifer system at and adjacent to the well field is interconnected laterally and vertically with a dominance of coarse-grained sediments and a lack of aquitard-like sediments. The depth to water in the well field area is approximately 20 to 30 feet below grade with general groundwater flow direction to the east and northeast (Figures 5.14-6, 2008 Depth to Groundwater, and 5.14-7, 2008 Groundwater Elevations).

Groundwater in Storage

Kern County Water Agency estimates that the total volume of groundwater in storage in the Kern River subbasin is approximately 40,000,000 acre-feet. The dewatered aquifer storage is estimated to be approximately 10,000,000 acre-feet. These estimates consider areas of the subbasin which are known to overlay useable groundwater, which is estimated to be about 1,000,000 acres (DWR, 2006).

From 1962 to 2000, BVWSD's operations in the Buttonwillow Service Area have resulted in a positive groundwater balance of approximately 46,000 acre-feet per year (afy). Based on future projections by BVWSD for the Buttonwillow Service Area, a positive groundwater balance of approximately 25,000 afy is estimated (BVWSD and Sierra Scientific Services, 2009). Therefore, even though the southern San Joaquin Valley has been classified by the DWR as an overdrafted groundwater basin, the BVWSD has historically been able to achieve a positive groundwater balance. As stated previously, water levels in the BVWSD Buttonwillow Service Area (which includes the proposed Project well field area) have and are expected to continue to rise in response to BVWSD's positive water balance operations. This may be attributed to the BVWSD's Buttonwillow Service Area location within the Buttonwillow subbasin (KCWA, 1991), which may be partially isolated from adjacent hydrogeological subbasins by structural highs due to folding or faulting (see Figure 5.14-3).

Aquifer storage in the Buttonwillow Service Area is approximately 7,000,000 acre-feet (af) (Sierra Scientific Services, 2009).

Groundwater Wells

Project Site

According to the Environmental Data Resources, Inc. (EDR) report that was compiled for the 2012 Phase I Environmental Site Assessment (see Appendix L), there are two water wells on the Project Site: W1 (USGS3174524) and W3 (CADW40000021752). Another well, W2 (USGS3175401), is located in the Controlled Area. There is also another water well (known as the Ackerman Well) located adjacent and northwest of the Project Site in the parcel that was acquired subsequent to the 2009 Revised AFC and that is now in the Controlled Area; this well was not identified in the EDR report. No information on well depth or water table elevation was available, per the EDR report; however, based on a discussion with a representative of the property owner, the Ackerman Well is completed to a depth of 680 feet below ground surface (bgs), with a perforated interval from 600 to 680 feet. It is constructed of 6-inch-diameter steel casing and has a cement annular seal from the ground surface to 500 feet bgs. The pump is set at 468 feet, and pumps 50 to 55 gallons per minute (gpm) at 70 pounds per square inch, gauge. The pump is an electric 5-horsepower "Grundfos" model 40s50-15 installed on October 17, 2007. There is a 1,000-gallon holding tank adjacent to the well.

The March 2012 EDR report indicated that there are two off-site water wells (Well C and Well D) and one on-site well (Well W1) that are approximately 0.5 mile or less from the Ackerman Well.

In addition to the water wells, the March 2012 EDR Report also listed one state oil and gas well located on the Project Site, identified as CAOG80000105543. The EDR report indicates that the oil and gas well was operated by the Quintana Production Company and was abandoned in November 1950.

Proposed Well Field

An EDR well search for the BVWSD water supply well field area and a 0.5-mile buffer around the well field was conducted (EDR, April 3, 2009). The locations of wells within the boundaries of the search area are presented on Figure 5.14-8, Well Location Map. The BVWSD reports that the Buttonwillow Service Area has more than 200 agricultural supply wells as shown on Figure 5.14-9, BVWSD and Private Water Well Location Map. According to BVWSD, typical agricultural wells are of large diameter, are completed to depths up to 450 feet below grade and are typically capable of pumping between 1,500 and 2,000 gpm of groundwater.

According to BVWSD, there are ten private landowner water supply wells at nine locations and no BVWSD supply wells located within 0.5 mile of the proposed well field. Four of the wells are located within the proposed well field area and the other six are located within the buffer zone. The EDR well search report provided information on wells located within 0.5 mile of the proposed well field culled from two databases: the USGS National Water Inventory System and the DWR Water Well Database. Eleven wells were listed in the USGS database and eight wells were listed in the DWR database. Based on latitude and longitude information provided in the EDR report, it is likely that the eight DWR database wells correspond to eight of the USGS wells, indicating that the well listings are duplicative, although it is not possible to determine this definitively.

Comparison of well location information provided by BVWSD to the EDR database reveals that six of the EDR well locations correspond to BVWSD well locations. At one of the EDR well locations with a BVWSD equivalent, two wells are listed as being present. Three of the nine BVWSD well locations do not have equivalent listings in the EDR report; at one of these locations, two wells are listed as being present, according to BVWSD. Therefore, accounting for duplicative listings in the BVWSD database and the EDR report, there are at least 15 private landowner water supply wells at 13 locations located within 0.5 mile of the proposed well field.

Groundwater Quality

Groundwater within the Coast Range alluvium is generally considered to be of relatively low quality due to the presence of water-soluble deleterious minerals within the parent rocks (Gilliom et al., 1989).

Groundwater in the Project area is primarily sodium sulfate to calcium-sodium sulfate type. The average total dissolved solids (TDS) of groundwater is 400 to 450 milligrams per liter (mg/L) with a range of 150 to 5,000 mg/L. Shallow groundwater presents problems for agriculture in the vicinity of the Project with high concentrations of TDS, sodium chloride, and sulfate. Analytical results for a water sample collected from the Ackerman Well on March 10, 2010 show that the total dissolved solids are 960 milligrams per liter (mg/L). The water quality data are summarized on Table 5.14-4 (URS, 2010c).

In the vicinity of the proposed BVWSD water supply well field, groundwater quality exhibits elevated TDS. As shown on Figure 5.14-10, Total Dissolved Solids—Summer 2001, TDS concentrations in summer 2001 were about 3,000 mg/L. According to BVWSD, TDS concentrations in groundwater in this area are expected to range from approximately 1,000 to 4,000 mg/L. BVWSD water quality information indicates that within the Buttonwillow Service Area, sulfate (SO_4) can range up to 1,200 mg/L and chloride (Cl) can range up to 900 mg/L. Water of this quality is consistent with the California State Water Resources Control Board Resolution No. 75-58 Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (CWRCB Res. No. 75-58) definition of brackish water which includes all waters with a salinity (i.e., TDS) range of 1,000 to 30,000 mg/L and a chloride concentration of 250 to 12,000 mg/L. According to BVWSD, the only use for groundwater in the well field area is agricultural but the impaired groundwater is considered objectionable by local users because it is unsuitable for good crop yields and crop diversification.

In addition to the above, additional water quality data were provided in the Draft Hydrogeologic Data Acquisition Report (URS, 2010a) and the Draft Hydrogeologic Data Acquisition Report Addendum (URS, 2010b).

TDS data from BVWSD's water chemistry database, collected from January 2000 to October 2007, and TDS data collected during URS' Hydrogeologic Data Acquisition Field Program (HDAR field program) between September 2009 and January 2010 indicate that there is an axial interface east of the BVWSD well field between good-chemistry (i.e., low TDS) groundwater (<2,000 milligrams per liter [mg/L] TDS) and poor-chemistry (i.e., high TDS) groundwater (>2,000 mg/L TDS). The poor-chemistry groundwater area to the west of the axial interface was defined by TDS concentrations ranging from 2,900 mg/L (Well 96, east of the southern portion of the proposed HECA Well Field) to 4,300 mg/L (Well 70A, northeast of the proposed HECA Well Field). The good-chemistry groundwater area east of the axial interface is defined by TDS concentrations ranging from 530 mg/L to 1,510 mg/L (URS, 2010e).

The TDS data were collected within the last 10 years from 15 wells within or near the eastern boundary of the BVWSD service area, and in some cases included data from multiple sampling events. Therefore, these data were considered reliable, reflective of current conditions, constitute the appropriate basis for well-field analysis, and demonstrate that the axial interface lies east of the proposed BVWSD Well Field.

Groundwater chemistry data west of the BVWSD service area were not available, but that part of the Belridge Water Storage District is not under active agricultural production and, because of poor groundwater chemistry, continues to be unusable for agriculture. An EDR Geocheck® report in October 2010 identified wells within a 3-mile radius from a central point located 3 miles west of the proposed well field. The EDR report identified mostly oil and gas wells, with some state and USGS wells within the 3-mile radius search. However, TDS data were not provided for any of the wells.

Despite the lack of TDS data west of BVWSD, it is widely accepted that groundwater west of BVWSD is of poor chemistry due to high TDS concentrations. A report published by the California Department of Water Resources (DWR), "Report on Proposed Bellridge Water Storage District" (DWR, 1961) notes that TDS from the five wells within the Belridge Water

Storage District range in concentration from 2,848 mg/L to 13,800 mg/L. An October 2010 discussion with the Kern County Water Agency (KCWA) indicated that the KCWA lacks data for the area west of BVWSD, because TDS is so high and groundwater is not used for either agricultural or domestic purposes.

5.14.1.5 Water Supply History and Future Projections

Water Supply History

Water supply within Kern County is provided by groundwater, the Kern River and other surface water imports, which include deliveries by the California State Water Project via the Friant-Kern Canal and the federally operated Central Valley Project via the California Aqueduct. In Kern County, about 60 percent of the water used for domestic and agricultural use is pumped from groundwater and agricultural uses comprise almost 90 percent of the total amount of water used in the region (Kern County Planning Department, 2004). Several water agencies in Kern County manage groundwater and surface-water supply resources for both domestic and agricultural uses. Water agencies with service areas in the vicinity of the Project are shown on Figure 5.14-11, Water Districts in Vicinity of Project, and include Buena Vista Water Storage District, West Kern Water District and the Kern Water Bank Authority (KWBA). Also numerous private water supply wells are located within the region.

Buena Vista Water Storage District

The BVWSD is located northwest of the Project Site, as shown on Figure 5.14-11, Water Districts in Vicinity of Project. The area served by the BVWSD consists primarily of irrigated farmland. The BVWSD Buttonwillow Service Area covers approximately 50,000 acres and the underlying aquifer has a storage capacity of approximately 7,000,000 acre-feet.

Early farmers in the BVWSD made use of surface and groundwater for irrigation. Water supplies for the BVWSD include a 2nd Point Kern River entitlement of 150,000 afy average. In 1973, the BVWSD contracted with the State Department of Water Resources via the Kern County Water Agency for an additional surface water supply. The contract provided for an annual firm entitlement of 21,300 acre-feet and surplus entitlement of 3,750 acre-feet. The BVWSD currently has access to five turnouts from the California State Water Project, that provide the system with about 850 cubic feet per second of added gravity inflow capacity directly into the District’s distribution system.

BVWSD consumptive use demand is about 100,000 afy which is met by a combination of canals and groundwater pumping. As stated previously, with its water allocations, the BVWSD has been able to maintain a historic positive groundwater balance amounting to approximately 47,000 afy above groundwater withdrawals. This balance is projected to be approximately 30,000 afy in the future.

A local issue in the BVWSD’s Buttonwillow Service Area is the movement of poor quality, high TDS, groundwater from the west to the east entering the shallow aquifer system. The TDS is derived from dissolution of salts from the marine sediments as groundwater flows eastward entering the western part of the BVWSD’s service area. Figure 5.14-10 is a contour map of TDS concentrations in groundwater for summer 2001. Elevated TDS in groundwater presents crop yield and diversification issues that have prompted the BVWSD to develop a BGRP, which includes extraction of groundwater in the elevated TDS area of BVWSD's service area. BVWSD began developing the BGRP long before this Project was proposed. The BGRP is Component 4 of the BVWSD Groundwater Management Plan (GMP) for which an EIR was prepared and certified in December 2009 (Krieger and Stewart, Incorporated, 2009). The BVWSD GMP states that the problem areas will require "...new and innovative solutions and corresponding management practices to enable the area to continue as a viable farming area over the long term."

After decades of irrigation pumping, the BVWSD determined that it is not possible to just remove the higher-TDS water from the aquifer simply by extraction because lateral recharge from the west brings in the brackish groundwater faster than it can be removed. The BGRP is designed to remediate brackish groundwater by recovering the brackish groundwater and brackish shallow perched groundwater from strategic locations within the aquifer to reduce the lateral recharge from the west. The recovered brackish groundwater is then transported to users, such as the Project. Implementation of the BGRP increases available water supplies and improves areas in BVWSD's service area for agricultural use.

West Kern Water District

The West Kern Water District (WKWD) service area covers approximately 250 square miles of western Kern County south of the Project Site (see Figure 5.14-11). This water district serves a population of approximately 25,000 people, residing in the communities of Taft and Maricopa, and other unincorporated communities (WKWD, 1997). The district also serves industrial users. WKWD obtains its potable water supply from local groundwater. The district has eight groundwater wells located within the Kern River groundwater basin on the western edge of the Kern River Alluvial Fan (WKWD, 2007). This well field is located in the Tupman area. In water year 1995-1996 the total water demand from the district was approximately 13,000 acre-feet (WKWD, 1997). Water demands have been steadily increasing and currently are estimated to be on the order of approximately 28,500 afy of which approximately 24,000 afy is delivered from WKWD's well field and the remainder delivered directly from the California Aqueduct (ESA, 2010).

In order to enhance reliability and operational flexibility, WKWD has acquired 480 acres northeast of the Project Site between Interstate 5 and the California Aqueduct. WKWD has initiated a groundwater banking project at this location that includes recharge basins and groundwater production wells. The groundwater production wells at this well field are designed to deliver up to 24,000 afy, i.e., the same pumping capacity as provided by the well field in the Tupman area. The purpose is to improve access to banked water and not increase WKWD water supplies or entitlements. WKWD prepared an EIR for the groundwater banking project, which was certified in March 2010 (ESA, 2010).

Other sources of WKWD's water supply include State Water Project water deliveries and agreements with various Kern County water agencies.

Kern Water Bank Authority

Kern Water Bank Authority (KWBA) owns approximately 20,500 acres of land along the Kern River in Kern County southwest of Bakersfield and east of the Project Site. This land is used for groundwater recharge and banking operations. The water bank receives water from the Kern River, the California Aqueduct and Friant–Kern Canal. This water is recharged into the underlying water supply aquifer and then later extracted and distributed for beneficial use by the member agencies via a system of wells, pipelines and canals. The KWBA has appropriated water rights to store 500,000 afy of which most is allocated for irrigation use (490,000 afy) and the remainder for municipal and industrial uses (5,000 afy each). Of the total area owned by the KWBA, only approximately 5,900 acres are used for recharge basins and approximately 481 acres are used for water bank facilities. The remainder is used for habitat preservation, farming, conservation banking, and other uses (KWBA, 2007). The nearest recharge area to the Project Site is located approximately 1 mile east of the site's eastern boundary (see Figures 5.14-1 and 5.14-11).

5.14.1.6 Project Water Use

Process Water Needs

The Project proposes to construct and operate a facility producing approximately 300 MW of low-carbon baseload power, low-carbon nitrogen-based products, and CO_2 for EOR . The HECA Combined Cycle Power Block will include one single-shaft nominal 405 MW MHI 501GAC® "G" class, air-cooled advanced combustion turbine (CT)/steam turbine (ST)/ generator configured to use hydrogen-rich fuel, one heat recovery steam generator (HRSG), and a water-cooled surface condenser. The CT, HRSG, and ST will convert chemical energy contained in the syngas fuel to electricity through the shaft power developed by the CT and ST generator and through the thermal energy recovered from the CT exhaust. This exhaust gas is converted to high-energy steam in the HRSG and combined with the high-energy steam recovered in the gasification process to generate additional electricity in the ST. The G-class machine is arranged in a single shaft configuration where the CT and ST share a common shaft/ generator.

Mechanical draft cooling towers are provided for the plant for indirect heat rejection where low process outlet temperatures are critical to overall plant efficiency. Mechanical draft cooling towers serve multiple heat loads in more than one process unit.

The Project will have three mechanical draft cooling towers (one for the Combined Cycle Power Block, the second for the Gasification Block/Process Units and the third dedicated for the Air Separation Unit).

The water balance diagram (Figure 5.14-13, Mass Water Balance) shows the potable and process water flow streams. Table 5.14-5, Daily and Annual Water Flows, shows the maximum daily, average daily, and average annual water supply and demand flows. These correspond to the Heat and Mass Balance Diagram (Table 2-10 in Section 2, Project Description), which provides further information for various ambient temperatures.

The Project's average annual water use of brackish groundwater provided by BVWSD is projected at approximately 7,430 afy. HECA signed an agreement with BVWSD for up to 7,500 afy (see Appendix N-1). The water contract between HECA and the BVWSD was negotiated in 2008, when deep well injection was the proposed method of water disposal for the Project. Deep well injection increases overall Project water demand significantly, and the water contract was negotiated on that basis. Subsequent to contract enactment, HECA reanalyzed water processing for the Project and changed the method of wastewater treatment to zero liquid discharge (ZLD).

The Project's water use per unit of net power output is reflective of large internal parasitic demand of the CO_2 separation and compression equipment. This large internal demand decreases net output and artificially increases water consumption per net MW exported. In light of this and to reduce water usage, the HECA Project has undertaken significant effort to reduce water demand. The most significant output of this activity was the selection of a ZLD design, which eliminated liquid water discharge from the Project and dramatically improved the water efficiency of the facility. The HECA Project productively uses all water consumed, either by vaporization for cooling needs or via chemical consumption for fuel generation, without losses from liquid-phase water discharge.

In addition to the brackish groundwater provided by BVWSD, the Project will recycle water from various process streams, as shown on Table 5.14-5 and Figure 5.14-13. Approximately 568 acre-feet per year (or approximately 7 percent) of the Project's total water usage will come from these other streams, which include boiler blowdown, gasification wastewater and sour water blowdown. In addition, wastewater from the Acid Gas Removal Unit and storm water runoff collected in the Project's detention basins will be used when available to offset the amount of water delivered by BVWSD.

The raw water requirement rates are greater than those presented in the 2009 Revised AFC because of the following two main factors:

- Project design improvements resulted in an approximately 150 percent increase in syngas production. Increased syngas production drives a need for more water, which is consumed in the shift reaction to produce more hydrogen.

- Project design addition of the Manufacturing Complex, which increased the process cooling tower duty, thereby increasing its water evaporation rate.

Project Water Supply Plan

Brackish groundwater provided by the BVWSD will be used at the Project for raw water supply. A copy of the will-serve letter from BVWSD is provided in Appendix N-1, Water Resources Information.

The primary uses of the raw water supply will be for cooling tower makeup, evaporative cooling, fire water, gasification, service water, and steam generation. The BVWSD supply was selected as the process water supply as it was determined to be most optimal in terms of environmental impact, capital cost, technical risk, and volume availability/reliability. (See Section 6.0, Alternatives, of this AFC Amendment.) The BVWSD is a local water district with impaired groundwater sources not suitable for agricultural or drinking use without extensive treatment. These impaired groundwater sources are found in various locations within BVWSD's Buttonwillow Service Area. According to the BVWSD, the impaired groundwater is considered objectionable by local agricultural users because it is unsuitable for good crop yield or crop diversification. As such this water currently poses a negative impact on agriculture. Elevated TDS in groundwater has prompted the BVWSD to develop the BGRP. This program includes extraction of groundwater in elevated TDS areas.

With the desire to use poor quality groundwater for the Project's process water needs, HECA LLC entered into an agreement with the BVWSD to purchase as much as 7,500 afy of groundwater. Accordingly, this water would come from a BVWSD well field located in the elevated TDS area as shown on Figure 5.14-10. Extraction of water from the line of wells (i.e., picket fence well field) is directed toward impeding eastward flow of high TDS groundwater from the shallow aquifer system (first water up to 400 feet below grade) with the possibility of shifting the water quality divide in the eastern part towards the western part of BVWSD's service area. This Project-specific pumping would also remove considerable volumes of TDS from the local groundwater system during the lifetime of Project operation.

The effects of Project pumping and the potential benefits to the BVWSD are summarized below (URS, 2010d):

- Based on well-water quality data, the expected zone of influence of the well field, and a quantitative estimate of the long-term quality produced by the well field, there is an estimated axial interface location between east and westward flowing water (URS, 2010e).

- There will be a net benefit of in terms of salt removal (i.e., TDS removal in terms of rate and mass) as a result of Project pumping.

- BVWSD's BGRP Area B picket fence well field design (the proposed BVWSD Well Field) is specifically intended to improve local groundwater chemistry (URS, 2010e). The two benefit areas are:

  - **Area 1.** Salt Shadow zone, which represents the zone of net TDS mass movement induced by Project pumping which includes the net capture zone, and the area between the capture zone and the simulated net axial interface after 25 years of pumping.

  - **Area 2.** Zone of Maximum Benefit (the area between the current estimated axial interface and the simulated net axial interface) representing the westward shift of the axial interface during the 25 years of Project pumping.

- The BVWSD well field will not pump good-chemistry groundwater because the axial interface between good and poor groundwater chemistry is east of the well field and, as such, Project pumping would pull the axial interface to the west, thereby increasing the volume of good-chemistry groundwater within the BVWSD service area. Ultimately this would help to increase crop diversity and crop yield within BVWSD.

- Analysis performed to date supports that the proposed production water supply will be in conformity with state water policy. The BVWSD-HECA water contract (see Appendix N-1) states that average TDS in the groundwater supply from BVWSD will be about 2,000 mg/L TDS and range will be between about 1,000 and 4,000 mg/L TDS. California State Water Resources Control Board Resolution 75-58, entitled "Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling" (Resolution 75-58), defines "brackish waters" as ". . . all waters with a salinity range of 1,000 to 30,000 mg/L and a chloride concentration range of 250 to 12,000 mg/L." The water proposed for use by HECA meets this definition of brackish waters, and is therefore consistent with relevant policy regarding the use of inland waters for power plant cooling. Furthermore the BVWSD groundwater monitoring and operating plans would ensure that conditions would be in place to ensure that waters of described quality for the Project would be provided to and used by the Project.

- A groundwater monitoring/operating plan will be followed by BVWSD during the 25-year duration of HECA Project pumping to ensure that high quality groundwater that did not meet the water transfer terms would not be used by the Project. BVWSD proposes an operating plan that considers the following good-chemistry groundwater breakthrough mitigations: 1) isolating and plugging back aquifer zones to eliminate recovery of good-chemistry groundwater; 2) isolating or shutting down wells to eliminate recovery of good chemistry groundwater; 3) using an existing well that is 0.25 to 0.5 mile away from the proposed BGRP well field and has acceptable TDS concentrations; and/or 4) drilling replacement wells, as necessary, in adjacent areas of elevated TDS. BVWSD has also affirmed that there is more than enough groundwater of poor quality along the western boundary of the BVWSD immediately adjacent to the proposed well field to ensure that the proposed well field could be expanded to the north and south into broader areas (as much as 500 percent larger), if necessary, to replace or augment the primary source area.

- The currently proposed well configuration at Target Area B is optimal for the intended purpose of the BGRP Well Field process water supply.

- A perceived TDS concentration "divide" at Seventh Standard Road, that suggests that the BVWSD well field may have better-chemistry groundwater, is not supported by data (URS, 2010d).

- BVWSD does not have a tile drainage system and the shallow perched aquifer in the northern area of the BVWSD (Target Area A) is not available to HECA due to other planned BVWSD projects.

Recharge of the aquifer supplying the brackish groundwater will be provided by ongoing irrigation and replenishment activities in BVWSD's service area. There is sufficient brackish groundwater available to meet the needs of the Project. The use of brackish groundwater is consistent with California State Water Resources Control Board Resolution No. 75-58 Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (CWRCB Res. No. 75-58).

As shown on Table 5.14-5, the average process water requirement to be supplied by BVWSD's brackish groundwater will be approximately 6.6 mgd, and the maximum water consumption will be approximately 7.4 mgd. BVWSD has stated that it will be able to provide brackish groundwater with an average TDS concentration of approximately 2,000 mg/L, with an acceptable range from about 1,000 to 4,000 mg/L, to the Project for the estimated life of the Project. Table 5.14-6, BVWSD Supply Water Quality, provides a summary of recent water quality analytical data from the currently-available brackish groundwater supply.

The water quality data shown on Table 5.14-6 was substantiated by groundwater sample results presented in Table 6 of the Draft Hydrogeologic Data Acquisition Report (URS, 2010a). Sample results from wells 70A, 96, and 98, which are located closest to the proposed BGRP Area B HECA production well field, had TDS values of 4,300, 2,900, and 2,400 mg/L, respectively, resulting in an average TDS value of 3,200 mg/L. The BVWSD will design, construct and operate the water supply system.

Process Water Uses

The raw water supply from BVWSD to the Project will be used for the Power Block cooling tower, process cooling tower, HRSG stack, ASU cooling tower, gasification solids, and low-carbon nitrogen-based products.

Project Water Supply Facilities

Water from BVWSD will be conveyed to the Project by a pipeline that will be installed in the District's unpaved service road along the east bank of the West Side Canal.

The brackish water supply will be treated on site prior to use. Storage tanks will be used to maintain a backup supply of raw water, treated water, purified water, demineralized water, and fire water. Water storage tanks include: 0.6 million gallons (MGAL) demineralized water storage tank, 2.8 MGAL raw water storage tank, 2.1 MGAL treated water storage tank, 1.6 MGAL purified water storage tank, and a 0.5 MGAL utility water storage tank. The on-site water storage that can be used if the raw water supply is interrupted is equivalent to about one day of operation at full capacity on coal/petcoke feedstock. The on-site water storage is equivalent to about two days of operation on natural gas feedstock. The raw water storage tank has been sized to cover the expected time for maintenance and repair of the raw water pipeline. The raw water supply is provided by multiple wells that operate independently to supply the raw water pipeline. For this reason outages or maintenance of individual wells is not expected to have a significant impact on the raw water supply.

Project Water Treatment

Preliminary engineering indicates that BVWSD brackish water requires pre-filtration, nano filtration and some degree of ion removal prior to cooling tower and other utility use. Purified water is produced in the Wastewater Zero Liquid Discharge Unit. Additional treatment to the purified water consisting of mixed bed polishing of the ZLD unit distillate will be required to produce demineralized water for gasifier and HRSG make-up use.

Water for non-potable use (service water and fire protection) will be provided by treating the industrial supply water to appropriate quality levels by blending purified water and treated water to appropriate quality levels.

Demineralized Water

High quality water for use as boiler feedwater makeup will be produced by further treatment of ZLD distillate with mixed bed deionization.

Potable Water Supply

Potable water consumption for personnel, typically 120 persons on site at any one time, is estimated to be 1,800 gallons per day (gpd). The peak potable water demand is not expected to exceed 2,700 gallons per day (gpd). Estimated average annual consumption is approximately 2 afy.

Potable water will be supplied by WKWD. The point of connection will be located 1.2 miles east of the northeast corner of the Project Site. The pipeline will be constructed and owned by HECA LLC. The pipeline will be placed within the electrical transmission corridor ROW (see Figure 2-7, Project Location Map). The 4-inch pipeline will be installed at least 5 feet below grade for most of the route and will cross the East Side Canal. Installation of the water supply pipeline will involve industry standard construction activities for pipelines, including trenching; hauling and stringing of pipe along the routes; welding; radiographic inspection and coating of pipe welds; lowering welded pipe into the trench; hydrostatic testing; and backfilling and restoring the approximate surface grade. Construction of the water pipeline is expected to take approximately 3 months to complete. Hydrotest water will be supplied by WKWD.

WKWD recently acquired 480 acres of land northeast of the Project Site for implementation of a groundwater banking project to aid in the management of WKWD's existing water supplies. This groundwater banking project includes recharge basins, groundwater monitoring wells, groundwater production wells and conveyance facilities. Currently there are two existing irrigation water supply wells on the 480-acre property. The pumping rates for Well #1 and Well #2 have ranged from approximately 1,800 to 2,500 gpm and from 1,900 to 2,900 gpm, respectively. WKWD's main water supply well field is located approximately 7 miles south of the Project Site. This well field has eight wells that provide approximately 24,000 afy of WKWD's current customer demand of 28,500 afy. Ultimately, WKWD will replace the existing two wells with five new wells on the 480-acre property that will be designed to have the capacity to recover up to 24,000 afy to increase water supply reliability and operational flexibility for WKWD's customers. (ESA, 2010).

A will-serve letter from WKWD stating that the district will provide potable water during construction and operation of the HECA Project is provided in Appendix N.

Table 5.14-7, WKWD Supply Water Quality, provides a summary of recent water quality analytical data from WKWD's groundwater supply wells.

Construction Water Supply

During Project construction, drinking water for personnel will be delivered by truck.

Water for construction uses (e.g., compaction, dust control, and hydrotesting) will be provided by existing on-site irrigation wells or supplied by WKWD. No new wells will be installed for construction water supply. Water supplied by WKWD for construction at the Project Site will be provided by 1) WKWD's wells east of the Project Site via the proposed potable water pipeline, once constructed, and 2) WKWD water transported via truck. Water will be transported to the linear construction sites via truck. A will-serve letter from WKWD stating that the district will provide water during construction of the HECA Project is provided in Appendix N-1.

Average daily water usage during construction (e.g., compaction, dust control, and hydrotesting) is summarized in Table 5.14-8. This table provides details for the estimated construction water use for the activities associated with construction of the Project Site and the linears (URS, 2009b).

The average daily water use over the construction period is estimated as follows:

- Project Site:
  - Water use is estimated to be 24,000 gpd during the first 2 months of construction, reducing to 14,000 gpd for the following 5 months. Construction activities during this phase include site grading, underground work, and dust control.
  - During the next 26 months, water use is estimated to be 12,000 gpd. Construction activities during this phase include day-to-day construction, foundations, backfill, compaction, dust control, and road cleaning.
  - Over the following 5 months, water use for the hydrostatic testing of the equipment and plant piping is estimated to be approximately 5,600 gpd.
  - In the final 4 months of construction, water use for final grading, construction cleanup, and ongoing dust control is estimated to be approximately 8,000 gpd.
- Linears:
  - An average construction water use of 900 gpd is estimated over a 6-month period for the construction of linear systems; this includes backfill/compaction of the trenches and dust control.
  - An additional 2,300 gpd of water is estimated to be required for the HDD. The average water use for hydrotesting the linear systems is estimated to be 2,000 gpd over a period of 6 months. This estimate is based on reuse of the water where possible. For example, water used to hydrotest portions of a pipeline would be re-circulated back to a holding water truck to be used on subsequent portions of the pipeline.

Construction of the linear systems is expected to take place within the overall Project construction schedule.

The Project also considered other options for construction water supply; however all of these options were determined to be unavailable or infeasible (URS, 2009b).The Project Site is approximately 17 miles northeast of the City of Bakersfield Wastewater Treatment Plant #3. This plant treats a portion of the municipal effluent generated from the City of Bakersfield. The current design capacity of this plant is 16 million gallons per day (mgd). The existing facility provides primary and secondary treatment of incoming wastewater. The secondary treated effluent is used for irrigation on 400 acres of City-owned land adjacent to the treatment plant facility and is provided by contract to the City of Los Angeles for crop irrigation on 4,700 acres of land alongside Interstate 5 (I-5). The I-5 site uses 14 mgd, with the remaining 2 mgd used near the plant.

The City is in the process of expanding and upgrading Wastewater Treatment Plant #3. Upon completion of the expansion project, the design treatment capacity of the plant will be increased to 32 mgd to accommodate potential future growth. The project also includes improvements to the primary and secondary treatment systems, as well as a 2 mgd tertiary treatment facility to produce recycled water for use on nearby landscaping and at the wastewater treatment plant. In August 2009, the Central Valley Regional Water Quality Control Board issued Waste Discharge Requirements (WDR) Order No. R5-2009-0087 for Wastewater Treatment Plant #3 to cover discharges from the existing and expanded plant.

WDR No. R5-2009-0087 specifies that the use of secondary treated wastewater effluent is limited to flood irrigation of crops that are not intended for human consumption or for grazing of non-milking cattle. Public contact with secondary treated wastewater is prohibited.

While the City of Bakersfield may have secondary treated municipal wastewater available in the future, the City cannot guarantee availability and the Applicant is concerned with the personnel exposure hazard associated with using the wastewater for construction purposes. It is expected that personnel will come into occasional contact with construction water and City of Bakersfield municipal effluent is not appropriate for human contact. As stipulated in WDR No. R5-2009-0087, direct contact with the effluent from the City's plant is prohibited. Other municipal wastewater treatment plants in Kern County are much smaller than Bakersfield's Wastewater Treatment Plant #3 and are not able to provide the necessary quantity of water to the HECA Project.

5.14.1.7 Project Wastewater

Wastewater Treatment and Recovery

The Project will recycle water to the maximum extent practical and will incorporate Zero Liquid Discharge (ZLD) technology; therefore there will be no wastewater discharge. Because the Project is a ZLD facility, the wastewater is, by definition, completely recycled. The primary sources of wastewater at the Project treated and recovered in the process wastewater ZLD will be from raw water supply treatment and cooling tower blowdown. Table 5.14-5, Daily and Annual Water Flows, shows the major wastewater streams and how they will be treated and recycled.

The cooling tower circulation water will be concentrated to the maximum practical extent. Cooling tower blowdown that cannot be recycled is sent to a plant ZLD unit where it is treated and recovered as high purity water and ZLD solids. The ZLD solids will be disposed of at an approved off-site facility.

Domestic/Sanitary Wastewater

No municipal sanitary sewer is available in the vicinity to serve the Project. The sanitary sewer system will consist of a septic collection and forwarding lift station system and holding tank designed to handle the sanitary sewer flow from the administration and control building and other restrooms, if any, located on the Project Site. The sanitary waste from the facility will be disposed of in an on-site leachfield.

For purposes of designing the septic system, it is assumed that sanitary wastewater discharge rates will be based on a maximum plant population of 120 persons at 35 gpd per person in accordance with Table K-3 of the Uniform Plumbing Code for estimating sanitary wastewater flowrates.

5.14.1.8 Storm Water Runoff

Details of the Project's storm water management features are provided in Section 2.0 (Project Description) of this AFC Amendment. The Project Site is relatively flat. All existing irrigation ditches within the Project Site will be abandoned and filled in to meet grade. The irrigation ditches only serve the current agricultural uses on the property and will no longer be needed once the Project Site is developed. The smaller irrigation ditches on the Project Site that serve the individual crop fields will also be abandoned and filled where not required for crop irrigation.

As shown on Figure 5.14-1, the topography in the vicinity of the Project Site is relatively flat, with a very gentle slope from the southeast to the northwest. In general, the roads in the vicinity of the site are slightly raised above the agricultural fields. Tupman Road, along the eastern boundary of the site, and the levee associated with the irrigation canal south of the site create barriers that limit runoff from upstream (i.e., from the east and south) areas flowing onto the site. Similarly, the roads at the downstream edges of the site (e.g., Dairy Road along the western boundary and Adohr Road along the northern boundary) limit the amount of runoff that leaves the Project Site.

An irrigation ditch crosses approximately three-quarters of the Project Site from south to north and ends just south of Adohr Road. This ditch feeds the smaller irrigation ditches that traverse the Project Site from north to south and east to west around the crop fields. These irrigation ditches are fed with water pumped from the canal south of the Project Site, which is supplied by the West Side Canal and the East Side Canal. The canal no longer connects to the property north of the Project Site. The canal crossing the Project Site is used only for irrigation and drainage within the Controlled Area of the Project; therefore, filling in the canal will not impact any off-site drainage paths of adjacent properties.

The storm water management for the Project is described in Section 2.5.16 in Section 2, Project Description and shown on Figure 2-45, Preliminary Storm Water Drainage System. In response to Data Requests (specifically Data Request 95 and Data Request 202), HECA prepared a Draft Drainage, Erosion, and Sediment Control Plan (DESCP). While some Project details may have been modified, the overall approach to storm water management and erosion control remains the same as described in the previous Draft DESCP that was filed in November 2010 (URS, 2010e).

Storm water management for the Project is designed to avoid direct discharge to surface waters. The site drainage system will be separated in two distinct systems: 1) potentially contaminated storm water from the process, power block and administration building areas, and 2) noncontact storm water runoff from the undeveloped open areas.

Storm water from inside the process plant area will be routed to lined retention basins before it is reused. Water will be tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or processed in the ZLD system at the wastewater treatment plant.

Storm water from outside the process plant area but within the Project Site should be relatively clean. Storm water from these areas will be separately collected in unlined retention basins located throughout the Project Site. Low permeability soil under these retention basins will be replaced with well graded permeable soil to allow percolation of the storm water into the sandy layer found to be approximately 6 to 12 feet bgs. Retention basins and storm water collection/ conveyance systems will be designed in accordance with the Kern County Development Standards. There are two types of retention basins, one for collection of clean storm water and the other for potentially contaminated storm water. The retention basin locations and types are shown on Figure 2-45, Preliminary Storm Water Drainage Plan.

Preliminary Drainage Calculations were prepared and included as Revised Appendix B in the 2009 Revised AFC and the Draft DESCP prepared in response to Data Request 202. While some Project details may have been modified, the overall approach for the drainage system remains the same as described in the previous calculations. These calculations demonstrate that the retention basins, both lined and unlined basins, have been sized to meet or exceed the Kern County standards. Storm water will be managed such that there will be no off-site surface water discharge from the Project Site.

Storm water generated at the Project Site will be managed as follows:

- Storm water runoff from inside the process plant areas will be routed to lined retention basins. After solids have settled and water is determined to be suitable for reuse, storm water will be pumped to the water treatment plant for further treatment and reuse. If this collected storm water is determined to be unsuitable for reuse, then it will be transferred and processed in the ZLD system at the wastewater treatment plant.

- Storm water that may be contaminated with oil will be separately collected and routed to an oil/water separator. Recovered waste oil from the separator will be disposed off site. The separated water will be transferred and processed at the wastewater treatment plant.

- Storm water from chemical and oil storage areas will be held within the associated secondary containment. Storm water held in these areas will first be tested. If it is acceptable for cooling water makeup, then it will be routed to the lined retention basin. Oily storm water will be routed through an oil/water separator at the wastewater treatment plant.

- Storm water within the process plant area where solids are present (e.g., coal, petcoke, or gasification solids) will be collected and conveyed to the solids handling water collection facility. The collection facility will be constructed of concrete, and will provide for mobile equipment access to remove accumulated solids. Water that accumulates within the solids handling collection facility will be processed in the ZLD system at the wastewater treatment plant.

- All hazardous materials will be properly stored, and spill prevention measures will be implemented to prevent storm water contact with these materials. The preliminary DESCP included a summary of hazardous materials that would be used and stored on site for plant operations (see Tables 4 and 5 in the DESCP filed under confidential cover in response to DR 202 [URS, 2010e)]). Storm water from process areas where potential contaminants will be stored will be routed to lined on-site storm water retention basins as described below.

  — **Process Area.** The process area of the Project Site has a drainage area of approximately 104 acres. Potential contaminants that would be present in the process area of the Project Site were summarized in the November 2010 Draft DESCP. All hazardous materials would be properly stored, and spill prevention measures would be implemented to prevent storm water contact with these materials. Storm water runoff from the process areas will be directed to a retention basin. The retention basin would be lined with high-density polyethylene (HDPE) because this material is chemically inert with the materials that would be present on site. Storm water runoff from the process area would be conveyed to the retention basin via an underground network of pipes made of cast iron or carbon steel and HDPE. A monitoring system will be installed to detect potential leaks.

  — **AGR Process Area.** A separate HDPE-lined retention basin is proposed for the AGR unit as an additional protection measure to segregate and contain storm water in the unlikely event of a methanol spill.

  — **Gasification Area.** Storm water and washdown water within the gasifier area will be intercepted by a network of underground piping made of cast iron, carbon steel, or HDPE piping, draining to a concrete sump. Potential contaminants consist of off specification feedstock and solid waste material from the gasifier process. The gasification solids are currently anticipated to be a product that will be sold for reuse, not classified as a waste. If the gasification solids are not sold or reused, they are anticipated to be characterized as nonhazardous waste. Regarding the chemical analytical characterization of the gasification solids, the anticipated compositional range of constituents are summarized in in Table 2-9 in Section 2 (Project Description). More precise chemical composition data will not become available until the gasification solids are generated during operation. The gasification solids are dewatered and the solids are accumulated for off-site disposal. Upon exiting the gasifier, the liquids are recovered for reuse. The remaining dried gasification solids will be retained on site until sufficient quantities are accumulated to facilitate their economical transportation to the designated off-site location. No wastes would be generated during the temporary storage of the gasification solids.

- **Admin/Control Room/Warehouse Building Complex.** Potential pollutants include those commonly associated with vehicles and storage of chemical reagents, paint, thinners, solvents, and adhesives. Storm water will be conveyed to a lined retention basin to contain any contaminants associated with the warehouse operations.

- **Feedstock Unloading / Product Loading Area.** Contact storm water will be conveyed to a lined retention basin to contain contaminants associated with the feedstock unloading and operations.

- **Urea and UAN Production, Storage, and Transfer Area.** The urea pastille handling system consists of the urea collection/transfer area, urea storage domes, urea reclaim system, and urea loadout system. All conveyors are fully enclosed in uninsulated tubular galleries for weather protection and for control of fugitive dust. All urea handling buildings are fully enclosed with uninsulated roofing and siding. Dust collection systems, and/or transfer system design, are used to control dusting and fugitive dust emissions. The UAN solution is stored in tanks, and then loaded into railcars or tank trucks for shipment.

Existing drainage patterns outside the Project Site will be maintained, such that storm water runoff will be conveyed around the Project Site and not commingled with on-site storm water. The existing drainage ditches located along the site property will be improved where necessary.

The storm water management system will be designed in accordance with the U.S. Environment Protection Agency's (USEPA's) guidance document entitled "Storm Water Management for Construction Activities – Developing Pollution Prevention Plans and Best Management Practices" (USEPA, 1992), the California Storm Water Best Management Practices Handbook, the National Pollution Discharge Elimination System (NPDES) Industrial General Permit Requirements, and the NPDES Construction General Permit requirements.

The DESCP prepared and submitted in response to Data Request 202, provided information on inspection and maintenance procedures for the storm water management system and erosion and sedimentation control system. Prior to every rainy season (October 15 to April 15), all drainage facilities will be inspected, maintained, and properly repaired. An inspection and monitoring program will be developed to ensure that the systems are maintained in good operating condition and in good working order throughout the rainy season.

The Applicant will provide separate DESCP and SWPPP documents. A draft DESCP has been submitted in response to Data Request 95 and revised in response to Data Request 202. A Construction SWPPP will be provided as a post-certification submittal to allow for finalization of the Project Site and construction facilities design during detailed engineering. The Operations SWPPP will be prepared and submitted at least 60 days before commencement of commercial operations of the facility.

5.14.2 Environmental Consequences

Project effects on water resources can be evaluated relative to significance criteria derived from the California Environmental Quality Act (CEQA) Appendix G checklist. Under CEQA, the project is considered to have a potentially significant effect on water resources if it would:

- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner which will result in substantial erosion or siltation on or off site, or in flooding on or off site.
- Create or contribute runoff water which will exceed the capacity of existing or planned storm water drainage systems, or provide substantial additional sources of polluted runoff.
- Violate any water quality standards or waste discharge requirements, or otherwise substantially degrade water quality.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there will 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 will drop to a level which will not support existing land uses or planned uses for which permits have been granted).
- Place within a 100-year flood hazard area structures that will impede or redirect flood flows.

5.14.2.1 Effect on Subbasin Water Balance

Construction Water Supply

The estimated average annual groundwater consumption (if not supplemented by WKWD) during construction period is estimated to be approximately 13 acre-feet per year (afy). The estimated total consumption of groundwater would be approximately 40 acre-feet (af). The aquifer storage in the Buena Vista Water Storage District is estimated to be approximately 7,000,000 af. Therefore, the amount of groundwater extracted by the Project during construction would have a negligible effect on subbasin water balance.

Process Water Supply

Even though the southern San Joaquin Valley has been classified by the DWR as an overdrafted groundwater basin, the BVWSD has historically been able to achieve a positive groundwater balance. Water levels in the BVWSD Buttonwillow Service Area aquifer (which includes the proposed water supply well field) have and are expected to continue to rise in response to BVWSD recharge and replenishment operations due to the partially-isolated nature of the Buttonwillow subbasin in which BVWSD is located.

Aquifer storage is approximately 7,000,000 af (Sierra Scientific Services, 2009). Annual pumping for the Project is expected to average 7,430 afy with a maximum at 7,500 afy per the HECA/BVWSD agreement. This amounts to 0.1 percent of total aquifer storage on an annual basis. The Project's annual extraction of up to 7,500 afy is part of the BVWSD's BGRP which is currently planned to handle up to 12,000 afy (Krieger and Stewart, 2009). The Project's pumping volume would be offset by recharge from BVWSD's normal recharge and replenishment operations that maintain or increase overall aquifer storage. BVWSD has historically maintained a positive water balance and expects to maintain a positive balance of approximately 25,000 afy in the future. Overall Project-specific pumping is seen as a benefit to BVWSD in that it impedes eastward flow of poor quality groundwater and enhances westward flow of good quality groundwater.

As such, the use of impaired quality groundwater proposed by the Project will result in a less than significant impact to the subbasin water balance.

Potable Water Supply

The Project will use a small amount of potable water (approximately 2 afy). This water will be supplied by WKWD. This is a very small amount of water compared to the overall water usage within the district's service area. The estimated average annual water usage within WKWD's service area is on the order of approximately 28,500 afy. The personnel associated with the operation of the Project will not create significant additional demands on the potable water supply. Therefore the Project impact to potable water supplies in the area will be less than significant.

5.14.2.2 Water Level Drawdown Effects

Process Water Supply

Groundwater modeling was conducted to evaluate the potential effects of Project-specific pumping on drawdown of groundwater levels. The groundwater model documentation and results are included in Appendix N-2, Groundwater Model Documentation. The groundwater model simulates probable drawdown effects associated with pumping from three of five wells located in the proposed water supply well field area (two additional wells are redundant and serve as backup wells for well maintenance and repairs). Simulated pumping rates total 4,650 gpm (i.e., 1,550 gpm per well with continuous pumping for 365 days per year for 25 years) to correspond to the maximum amount of impaired groundwater to be provided to the Project by BVWSD (i.e., 7,500 afy). The model results include simulated drawdowns in the pumping wells and at various distances from the well field. Normal BVWSD recharge activities that would offset Project-specific pumping were included in the model to simulate what would be expected during the Project lifetime. Sensitivity analyses were also performed to account for aquifer parameter uncertainties due to a lack of site-specific hydraulic data in the well field area.

The base case groundwater model results indicate that the net effect of Project-specific pumping is a cone of depression that extends approximately 1.4 miles to the north, south, and east of the well field and approximately 2.5 miles to the west of the well field. Beyond those distances drawdown is negligible, and to the north, south, and east water levels rise slightly due to BVWSD's positive water balance recharge. Maximum drawdown 0.5 mile from the pumping wells was simulated to be 5.2 feet to the east, 5.6 feet to the west, 3.9 feet to the north, and 3.9 feet to the south. Accordingly, wells within 0.5 mile of the pumping wells would be subject to greater drawdown. The model estimates the maximum drawdown at the central pumping well to be approximately 37 feet. As would be expected, drawdown decreases outward from the pumping wells, for example drawdown 200 feet east is estimated to be approximately 5.2 feet. As noted in Section 5.14.1.4 under Groundwater Wells, there are at least 11 and as many as 20 wells located within 0.5 mile of the proposed Project water supply well field. All of these wells were located within the BVWSD's service area. Depending on location, drawdowns between 3.9 and 37 feet would be expected, but are not considered significant as this would be an acceptable operating condition for the BVWSD BGRP. In fact some of the wells identified may be used as Project-specific pumping wells under the BGRP.

Simulation results also indicate that maximum drawdown occurs within the first 9 years of the Project, after which overall water levels stabilize, with annual fluctuations of approximately 2 feet in response to the continued pumping cycle and 75-day annual recharge cycle. Approximately 90 percent of the drawdown would occur during the first 3 years of pumping, after which drawdown gradually continues to increase until maximum drawdown is reached at approximately year nine. Once Project-specific pumping stops in year 25, water levels would recover to pre-project conditions as an inverse to the above, with 90 percent recovery expected within the first 3 years and probably sooner as BVWSD's recharge program would be ongoing as part of their operations.

These groundwater modeling results are consistent with what the BVWSD has observed for high yield agricultural wells in the Buttonwillow Service area. Information provided by the BVWSD indicates that the local aquifer system is prolific, of high permeability, and yields high volumes of water to wells (typical pumping rates are 1,500 to 2,000 gpm in most of the service area agricultural wells). Personal communications with Sierra Scientific Services, indicate there has been very little pumping impact (i.e., minimal drawdown) in local agricultural wells in the vicinity of the proposed well field area. This response is similar to nearby Kern County areas already studied in detail (Sierra Scientific Services personal communications January through April 2009). Local hydrogeologic information supplied by the BVWSD based on more than 40 years of observations indicates that there have been no impacts to wells in their Buttonwillow Service Area (which includes more than 200 agricultural supply wells).

As described in Section 5.15, Geological Hazards and Resources, the Project area is not located within an area mapped as having more than 1 foot of land subsidence in about 50 years (Poland, et al, 1975; Galloway and Riley, 1999); and therefore, it is considered unlikely that subsidence will occur. The California Aqueduct is located approximately 1.5 to 2 miles west of the BVWSD well field. Groundwater modeling as outlined above and in Appendix N-2 indicates that the net effect of Project-specific pumping is a cone of depression that extends approximately 2.5 miles to the southwest of the well field beyond which drawdown is almost non-existent. That cone of depression is radial and only a portion of the California Aqueduct lies at the distal end of that cone of depression where the maximum pumping effect from the well field would be on the order of approximately 1 to 2 feet. The proposed production wells will be completed to expected depths of 300 to 400 feet bgs. According to the BVWSD, the well field area is underlain by a single, thick sequence of interbedded sands and silty sands from ground surface to depths exceeding 700 feet (Sierra Scientific Services, 2009). As such, fine grained clay and silt beds are not considered thick or laterally extensive enough for conditions to exist in which subsidence would be expected to occur from Project-specific pumping. This is particularly the case in distal locations such as that at the California Aqueduct where drawdown is only expected in the 1- to 2-foot range. Once Project-specific pumping stops (i.e., at the end of the Project life) water levels would recover quickly to pre-Project conditions, with 90 percent recovery expected within the first 3 years and probably sooner, as BVWSD's recharge program would be ongoing as part of their operations.

Based on the modeling analysis described above, the Project's impact to water level drawdown will be less than significant.

Construction Water Supply

The existing Ackerman Well may be used to supply water during construction. Groundwater modeling was conducted to evaluate the potential effects of on-site irrigation well pumping for construction water supply on groundwater levels (i.e., drawdown) (URS, 2010c). This evaluation assumed that all construction water would be supplied by an on-site irrigation well, even though it is expected that construction water would be supplied by the WKWD. The groundwater model for the process water well field pumping presented in Appendix N-2 was used as the base model. This evaluation consisted of simulating pumping groundwater from one well at a flow rate of approximately 17 gpm during the first 2 months of Project construction (the highest expected construction related pumping rate), followed by pumping at a flow rate of approximately 8 gpm during the remaining pumping period (equating to the projected average use of 11,800 gpd over the whole construction period). These pumping rates are simulated as being continuous for 24 hours per day, 365 days per year, for the construction period. The pumping well perforated interval assumed in the model is from 600 to 680 feet bgs; similar to the Ackerman Well. No recharge was simulated. The aquifer parameters are the same as the model for the BVWSD well field presented in Appendix N-2.

Simulation results show that the maximum drawdown after construction is 0.009 foot 0.5 mile from the pumping well. The simulated cone of depression after construction is roughly 0.41 foot near the pumping well, decreasing to 0.062 foot one-quarter mile from the pumping well and to 0.009 foot at a distance of one-half mile. This drawdown is significantly less than the drawdown simulated by the process water well field model. Maximum drawdown simulated for the well field was 5.6 feet at a distance of one-half mile from the pumping wells after 25 years of Project operation. The pumping flow rate in the process water well field model was 4,650 gpm—several orders of magnitude greater than the approximately 17 gpm pumping rate (first 2 months) and approximately 8 gpm pumping rate (remaining months). For comparative purposes, typical agricultural wells in the area produce water rates greater than 1,500 to 2,000 gpm during irrigation periods. As such, construction-related groundwater pumping effects would be less than significant in such a prolific aquifer system.

Drawdown Effects on Nearby Wells (one-half mile radius)—Construction Period Pumping

The March 2012 EDR report indicated that well (W1 or USGS3175424) is located approximately 0.5 mile south-southeast of the Ackerman Well and is on the Project Site. Other wells (W3 or CADW40000021752, W2 or USGS3175401, and W10 or USGS3175257) are located approximately 1 mile to the southeast, 1 mile to the south-southeast, and 1 mile to the east of the Ackerman Well, respectively. Well W3 is located on the Project Site, well W2 is located in the Controlled Area, and well W10 is located off site. The simulated drawdown of 0.009 foot 0.5 mile from the pumping well establishes that there would be no drawdown effects to wells even if they were present within 0.5 mile of the pumping well.

5.14.2.3 Water Quality Effects—Groundwater

Process Water Supply

The use of impaired quality groundwater proposed by the Project will result in a less than significant impact on local groundwater quality and, in fact, will serve to improve local water quality during the Project lifetime.

BVWSD will provide impaired quality groundwater from existing and/or new wells (that comprise a well field) located in the elevated TDS area as shown on Figure 5.14-10. Extraction of water from the line of wells (i.e., picket fence well field) is directed toward impeding eastward flow of high TDS groundwater from the shallow aquifer system (first water up to 400 feet below grade) while locally shifting the water quality divide in the eastern part towards the western part of the BVWSD's service area. Groundwater modeling (Appendix N-2, Groundwater Model Documentation) indicates that the net movement of groundwater is about 0.8 mile towards the well field for the 25-year lifetime of the Project.

The positive effects on local groundwater quality were further documented based on information obtained during the 2009/2010 Hydrogeologic Data Acquisition Program (URS, 2010a and 2010b). This Project-specific pumping would remove considerable volumes of TDS from the local groundwater system. Figure 5.14-14, TDS Concentration vs. Mass Removal Data, illustrates TDS mass removal in US tons per year for a range of TDS concentrations and pumping rates. For example, if the average TDS concentration is 2,000 mg/L, the estimated amount of TDS that would be removed from the aquifer would be approximately 20,177 tons/year at a the average annual pumping rate of 7,427 afy.

Use of the brackish groundwater for the Project would remove salts from the aquifer, thereby improving the aquifer's water quality. As a result, the Project will facilitate efforts by the BVWSD to improve local groundwater quality and agriculture. Therefore, the proposed use of the brackish groundwater will beneficially affect local groundwater quality and the Project's impacts to water quality will be less than significant.

Construction Water Supply

A particle tracking simulation was applied to the groundwater modeling simulation, as described above under Water Level Drawdown Effects – Construction Period Pumping, as a means of evaluating groundwater flow paths and the capture zone around the existing irrigation well that may be used for construction water supply. For purposes of the analysis, it was assumed that all construction water would be supplied by the irrigation well (URS, 2010c). The particle tracking results indicate that the maximum net movement of groundwater induced by pumping the construction water supply well is approximately 210 feet (i.e., radial movement toward the pumping well) over the construction period. This is a very small net movement of groundwater and would not be expected to result in a change to local groundwater quality. Accordingly, no significant impact to local groundwater quality is expected from the use of on-site irrigation wells during the Project construction period.

Project Construction

Construction or maintenance of the facility could potentially affect groundwater quality through inadvertent spills or discharge that could then infiltrate and percolate down to groundwater. The Project Site is underlain by approximately 10 feet of clay, which would impede migration of any inadvertent spills to groundwater. Estimated depth of site excavation for the proposed Project is up to 40 feet. Excavation dewatering during construction is not anticipated since the depth to groundwater at the site is approximately 40 to 100 feet below grade. Due to the depth to groundwater, the Project is not expected to degrade groundwater during construction and the impact to groundwater quality is less than significant.

Project Operation

Operation and maintenance of the facility could potentially affect groundwater quality through inadvertent spills or discharge that could then infiltrate and percolate down to groundwater. As described above, the Project Site is underlain by approximately 10 feet of clay, which would impede migration of any inadvertent spills or releases of contaminated storm water from retention basins to groundwater.

Storm water runoff from the Project Site will be directed to on-site retention basins. The retention basins that will be used to collect and store storm water from areas where hazardous materials will be stored will be lined with HDPE to prevent infiltration to underlying groundwater. Potentially contaminated storm water collected in the retention basins will be tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or disposed in the ZLD system.

Since no municipal system is available in the immediate area to serve the Project, sanitary waste water from the Project restrooms, showers, and kitchens will be conveyed by an underground gravity collection system and discharged to a private on-site sewage disposal system consisting of a conventional septic tank and leach field. The septic system will be designed and constructed in accordance with Kern County and the Central Valley Water Quality Control Board (CVWQCB) requirements, which will require the system to be protective of groundwater supplies. Current standards are provided in “Standards and Rules and Regulations for Land Development, Sewage Disposal, Water Supply and Preservation of Environmental Health” (KCEHSD 2008). No impacts to groundwater are anticipated.

For all of these reasons, there will be no discharge of wastes or potentially contaminated storm water from the Project’s operations to groundwater. Therefore, impacts to groundwater will be less than significant.

5.14.2.4 Water Quality Effects—Surface Water

Construction, operation, or maintenance of the Project could affect surface water quality of nearby canals through inadvertent spills or discharges. Construction activities could also increase the potential for erosion and uncontrolled runoff of storm water contaminated with sediments or other pollutants that could impact surface water quality and sedimentation. The existing topography at the Project Site and vicinity is shown on Figure 2-7, Project Location Map and Figure 5.14-1. The preliminary site drainage and grading plans of the proposed facility after construction are shown on Figures 2-36, Preliminary Storm Water Drainage Plan and 2-41, Preliminary Grading Plan. Best management practices (BMPs) as described in the Draft DESCP submitted in response to previous data requests will be used during construction to minimize the potential for erosion (see Responses to Data Request 95 and Data Request 202). A construction SWPPP will be prepared and implemented in accordance with the General Permit for Construction Activities. With implementation of Project design elements, and mitigation measures proposed in Section 5.14.4.2, the impacts to surface water quality will be less than significant.

The CO_2 pipeline will leave the southwestern portion of the Project Site, and HDD will be used to pass under the Outlet Canal, the KRFCC, and the California Aqueduct. BMPs for HDD would include silt fencing around the drill sites, energy dissipation devices for discharging water from hydrostatic testing of the pipeline, selecting drilling fluids for environmental compatibility, and removing spent fluids from the areas immediately adjacent to the aqueduct and canals for safe disposal and to prevent potential discharge of pollutants into the waterways. In addition, soil erosion control measures to prevent runoff and impacts to water quality would be implemented. The depth of HDD under water bodies will comply with all applicable state and federal regulations (including CDFG). The clay soils expected to be present in the areas where HDD will be used have a low likelihood of causing frac-outs. If a frac-out occurred, the area would be restored and monitored. A draft HDD frac-out plan, based on plans that have been used for major directional drills with the Southern California Gas Company and consistent with the level of detail to satisfy CDFG requirements was previously submitted in response to Data Request 106. A more comprehensive HDD Plan that addressed additional risks associated with HDD activities, such as soil heaving/settlement from drilling, water disposal from dewatering, erosion from work at entrance/exit pits, and damage/injury from inadvertently boring through existing utilities was prepared and submitted in response to Data Request 209. In addition, the Project will comply with and obtain encroachment permits from appropriate federal, state, and local agencies, which include the Department of Water Resources, Caltrans, Buena Vista Water Storage District, and any other appropriate agencies. Therefore, the Project's impacts to surface waters will be less than significant.

Portions of the potable water pipeline and the natural gas pipeline will cross the East Side Canal and other small irrigation canals. The Project proposes to perform an assessment of the site conditions where the pipeline routes cross the canals. The assessment will consider the canal-specific hydrologic conditions at the time of crossing, along with the landscape terrain features. When feasible, crossing of the canals will be performed when the canal is dry, using dry-ditch techniques. If water is present at the time of crossing a canal, sites will be evaluated on a case-by-case basis to determine if conventional open cut, flume variation of open-cut, or dam and pump variation of open-cut will be used. BMPs to be implemented with conventional open- cut waterbody crossings include, but are not limited to the following: material excavated from the trench will be stockpiled above the canal banks; excavated trench material will generally be used as backfill; and the canal will be returned to its pre-construction contours to the extent practicable.

Where the pipeline alignment crosses sensitive areas underground pipeline installation methods such as pipe ramming, auger boring or microtunnelling, could be used to avoid direct impacts to the bed, channel, and banks of the drainage channel and minimize disruption to irrigation operations. These construction methods allow the pipeline to be constructed beneath the irrigation canal, roads, railway tracks, and other obstacles without causing surface disturbance. As the method requires the excavation of an entrance and exit pit at each end of the boring area, these will be located at least 10 feet from the ditch or canal to avoid disturbance to the bed or banks. Spoils will be reused as fill wherever possible.

Construction of the transmission line will require installing approximately 26 (15 off-site and 11 on-site) tubular-steel transmission structures and the supporting foundations. Construction will also involve stringing the conductor and the optical ground wires. Temporary access roads will need to be constructed within the transmission line ROW, except where the line runs parallel to existing roads. A small area around each structure site will need to be disturbed temporarily during the construction period. The approximate area that may be temporarily disturbed is quantified in Section 4.8.3. Roadway matting may be used on the road and around the area of each structure to minimize the effects of the construction vehicles and the construction activity. The time to construct the entire transmission line is estimated to be approximately 3 months. Construction of the above-ground electrical transmission line will result in minor, mostly temporary soils impacts. Project construction-related soil erosion will be minimized through implementation of BMPs and erosion control measures described in Section 5.9.4 and Section 5.14.5. The transmission line will cross the East Side Canal. The poles will be placed outside of the canal and the transmission line will span the canal. Construction activities for the new transmission line poles and footings will not occur in the canal. BMPs similar to those used during the gas line construction will be implemented to minimize erosion and discharge of pollutants. New foundations will not substantially increase impervious surfaces. Therefore, impacts to water quality due to construction and operation of the transmission line will be less than significant.

Alternative 1 for the transportation of coal to the Project Site is an approximately 5 mile new railroad spur. Construction of the railroad spur will use earthwork and track construction equipment typically used on similar rail projects throughout California and the United States. Since the majority of the alignment is traversing previously disturbed agricultural areas, minimal clearing and grubbing of the proposed right-of-way will be required to remove vegetation. Once the right-of-way is cleared, rough grading work will begin. Earth moving equipment will create a track embankment and drainage ditches using standard equipment consisting of bulldozers, scrapers, dump trucks, roadway graders, and vibratory compactors. Utility relocation work will also be performed as part of this initial grading work. Existing local service power lines and underground irrigation piping will be relocated or protected in place. The proposed route crosses the East Side Canal managed by BVWSD. HECA will work with BVWSD and secure the appropriate approvals. In addition, BMPS will be implemented during construction of the railroad spur to prevent discharge of construction materials or pollutants into the canal. Project construction-related soil erosion will be minimized through implementation of erosion control measures described in Section 5.9.4 and 5.14.5. Because the spur alignment will be covered in ballast material to support the tracks, soil erosion during operation of the spur will be reduced. The rail and truck unloading systems, feedstock reclaiming and blending system, and pre-crushing system will have dust collection systems to minimize particulate emissions. The transfer conveyor will be fully enclosed for weather protection and to control fugitive dust. Therefore, impacts to water resources are expected to be less than significant.

Alternative 2 for the transportation of coal to the Project Site is truck transport via existing roads from an existing coal transloading facility located in Wasco northeast of the Project Site. Therefore, there are no construction activities associated with this alternative that would impact water resources. During operations, feedstock will be delivered to the Project Site via trucks. At the Project Site, feedstock will be unloaded at the truck dump unloading station. The truck dump has a single hopper located below each unloading station. Feedstock from these hoppers is sent to the storage barn via belt feeders, unloading conveyor, and transfer conveyors. The concrete floor under the truck unloading system slopes to a sump. This sump is equipped with an installed sump pump to recycle water back to the wash down system or to forward it to the IGCC water reclaim system. Once trucks have unloaded the feedstock, each vehicle exits and passes through a truck wash system. This truck wash system sprays the entire truck with wash-down water (no soap added) and a specific spray system cleans the wheels. This is done to minimize or eliminate any dust and debris from being deposited on the roads both inside the Project Site and on the public highway system. The wastewater collected under the truck wash is routed to a sump that sends the wastewater back to the IGCC water reclaim system. Therefore, impacts to water resources are expected to be less than significant.

Hydrotest water will be reused to test various Project equipment and piping features to the extent practicable. The source of the water to be used for hydrostatic testing of the pipelines will be water from WKWD. WKWD obtains its potable water from groundwater wells located within the Kern River groundwater basin, and supplements it with water from State Water Project water deliveries and agreements with various Kern County water agencies. The expected characteristics of the water to be supplied through the on-site irrigation supply well are summarized in Table 5.14-4. The expected characteristics of the water to be supplied by WKWD are summarized in Table 5.14-7. The hydrostatic testing will be performed on new pipelines and no chemicals will be added to the test water. As such, the expected quality of the test water will be similar to the quality of the source water. After all testing has been complete; the test water will be discharged to upland areas, to canals, or returned back to the source from which it was obtained. The water would be sampled prior to discharge and dispersed by an energy dissipation device to minimize erosion. Water discharged over land will be directed through containment structures such as hay bale structures and filter bags. The discharge rate will be regulated using valves and energy dissipation devices to prevent erosion, and the discharge will be monitored for residual materials being flushed from the tested pipe. Tie-in locations will be cleaned and restored after hydrostatic testing. The hydrotest water will not be stored in the pipes or tanks for an extended period of time. As such, no chemicals will be added to the test water during hydrostatic testing; therefore, it is expected that the quality of the test water will be similar to the quality of the source water. Therefore, impacts to surface waters will be less than significant.

The Central Valley Regional Water Quality Control Board Resolution No. R5-2008-0182 waives WDRs and Reports of Waste Discharge (RWDs) for specific types of discharges that pose a low threat to the quality of waters of the state. The waiver covers discharge to land of hydrostatic test water when the discharges occur for no more than a few weeks. The waiver is only applicable when the source water for the hydrostatic test is local (i.e., the same or better quality than the underlying groundwater), and the only expected waste constituents in the test water discharge are picked up from the structure being tested (i.e., no chemicals are introduced). If the duration of the discharge of the hydrostatic test water is more than a few weeks, then the HECA Project will comply with the State Water Resources Control Board's General Order No. 2003-0003-DWQ, which includes low threat discharges to land from hydrostatic testing. Alternatively, the hydrostatic test water could be discharged to one of the local canals in accordance with the Central Valley Regional Water Quality Control Board's General Order No. R5-2008-081, which includes low threat discharges to surface water from hydrostatic testing. This general permit allows discharges of up to 4 months in duration or up to 0.25 mgd. In response to Data Request 108, HECA prepared and submitted a draft Notice of Intent (NOI) to comply with General Order No. 2003-0003-DWQ (to land) and Attachment 108-2 for the draft NOI to comply with General Order No. R5-2008-0081 (to surface water). Once the design and construction details have been developed and the quantity, duration, and method of discharge have been determined, the appropriate NOI will be prepared and submitted to the Central Valley Regional Water Quality Control Board, along with the appropriate fees, prior to the start of construction.

The Regional Water Quality Control Board's requirements (i.e., Reports of Waste Discharge [ROWDs] or Engineering Reports) are specifically for discharges of waste that could affect the quality of the waters of the state, other than into a community sewer system (see California Water Code Section 13260). The HECA Project has been designed as a project that will have zero liquid discharge (ZLD) off site. No wastes of any type will be disposed to waters of the state. As such, a ROWD would not be required for the on-site material storage or "disposal systems" of the HECA Project.

As described in Section 2.5.16 and Section 5.14.1.8, storm water management for the Project is designed to avoid direct discharge to surface waters. Clean storm water runoff from process areas will be routed to on-site storm water retention basins before it is used as makeup water to the cooling towers. Potentially contaminated storm water will be routed to lined retention basins and then tested to determine an appropriate destination for reuse. Depending on the water quality, it may be used for cooling tower makeup or disposed in the ZLD system. All hazardous materials will be properly stored to prevent contact with storm water. Feedstock will be stored in an on-site holding barn with a concrete divider separating the storage piles. Gasification solids will be retained in on-site storage bins or containers. All urea handling buildings are fully enclosed.

The Project will be constructed such that storm water runoff will be contained in retention basins and reused at the Project Site. As there will not be any storm water discharges from industrial activities to waters of the United States, the Project will not be required to obtain coverage under the General Industrial Activity Storm Water Permit. Wastewaters will be discharged to the ZLD unit. Therefore, there will be no discharges to surface waters and no impacts to surface water quality.

5.14.2.5 Flooding

The Project Site is not located in a designated floodplain. The Project Site will be graded, as shown on Figure 2-50, Preliminary Grading Plan, to promote drainage to prevent on-site flooding. Storm water runoff from on-site areas will be retained and reused; therefore, the volume of runoff leaving the site will be less than for existing conditions. No significant impacts related to flooding are expected as a result of the Project.

The CO_2 pipeline, will cross through a FEMA-designated floodplain area. This pipeline will be buried and installed at the canal crossings using the HDD method. Therefore, there will be no impacts to floodplains.

Portions of the Project Site will be graded and pads will be constructed a few feet above existing grade.

5.14.2.6 *OEHI Project*

According to the analysis contained in Appendix A-1, Section 4.8, Hydrology and Water Quality, construction and operation of the OEHI Project will not result in significant adverse impacts to groundwater or surface water supplies or quality. Nor will the OEHI Project expose people or structures to a significant risk of loss, injury, or death involving flooding, or inundation by seiche, tsunami, or mudflow.

5.14.3 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines Section 15130). A "cumulative impact" consists of an impact which is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines Section 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines Section 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065 [a][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines Section 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines Section 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines Section 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines Section 15130[b]).

A cumulative impact analysis may be conducted by analyzing the impacts of the project under consideration with those of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines Section 15130[b]). Alternatively, the impacts of the project under consideration can be evaluated in the context of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or areawide conditions contributing to the cumulative impact (CEQA Guidelines Section 15130[b]).

Groundwater

The proposed water supply is consistent with the industrial beneficial use established for groundwater in the Kern River Valley in the Basin Plan adopted by the Central Valley Regional Water Quality Control Board (CVRWQCB, 2004). Withdrawal of impaired quality groundwater to alleviate impacts on agriculture is consistent with the Drainage Control and Irrigation Conservation Programs described in the BVWSD Groundwater Management Plan (Boyle Engineering 2002) and is part of BVWSD's BGRP, which provides benefits for BVWSD's Buttonwillow Service Area. BVWSD's BGRP was analyzed in the Final Environmental Impact Report for the Buena Vista Water Storage District Buena Vista Water Management Program, dated December 2009 (Krieger and Stewart, Incorporated, 2009).

The process water supply for the Project will consist of groundwater of impaired quality. Drawdown (lowered water levels) in response to pumping at the proposed water supply well field area will be localized around the well field itself and normal BVWSD recharge activities would offset Project-specific pumping.

Overall Project-specific pumping is seen as a benefit to BVWSD in that it impedes eastward flow of poor quality groundwater, enhances westward flow of good quality groundwater, and removes a significant volume of TDS/salts from the local aquifer system. The Project also would use groundwater that other users do not want and find objectionable for their needs. As such there is no cumulative impact expected, but rather a regional benefit.

Groundwater used for construction water supply from an on-site irrigation well would not affect water balance, would have minimal drawdown, would not affect water levels in any nearby wells (simulated drawdown estimated at 0.002 foot at a distance of one-half mile, and would have no effect on water quality, with expected maximum net movement of groundwater induced by pumping to be approximately 210 feet (i.e., radial movement towards the well) over the construction period.

Surface Water

Other reasonably foreseeable development projects could also result in temporary and permanent impacts to water quality and potentially exceed applicable water quality standards. Temporary impacts may result from land clearing, site disturbance, and grading associated with construction activities. Typical construction impacts include increased erosion, sediment transport, siltation, and on-site storage and use of lubricants and fuels. Temporary construction impacts could be minimized through use of Project-specific BMPs and applicable federal, state, and local construction mitigation guidelines. Permanent water quality impacts could result from storm water runoff from newly constructed impervious surfaces associated with agricultural, commercial and residential developments. Each development project would be expected to comply with applicable state regulations that require on-site attenuation and treatment of storm water.

In summary, the cumulative development projects have potential to generate water quality impacts. However, it is expected that existing programs, policies, and regulatory requirements would prevent and/or minimize the potential water quality impacts to a level below a substantial impact. The limited water quality impacts associated with construction activities for the Project, when compared to potential impacts of other development projects, are not expected to lead to substantial cumulative water quality impacts.

OEHI Project

According to the analysis contained in Appendix A-1, Section 4.8, Hydrology and Water Quality, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts to water resources.

5.14.4 Mitigation Measures

This section discusses mitigation measures proposed by the Applicant that will be implemented to ensure that Project-related impacts to water resources are less than significant.

5.14.4.1 Groundwater

As discussed above, the evaluation of water resources impacts considered both the occurrence and the quality of water in the area. For the occurrence of groundwater in the Project Site area and the proposed water supply well field area, the Project will have no significant impact on the depth to water in the aquifer, or water resources as a result of the drawdown caused by pumping of the aquifer system. Furthermore, the Project will not have any negative effect on the quality of groundwater in the area. In fact, the Project will have a net positive effect on groundwater quality and agricultural activity. The process water supply to the Project will consist of brackish groundwater. The BVWSD is a local water district with shallow brackish groundwater sources that are less than ideal for agricultural or drinking use without treatment. The brackish groundwater is found in the local aquifer and causes negative impacts on agriculture. Project consumption of the brackish groundwater will beneficially affect local groundwater quality and agriculture consistent with the BVWSD Groundwater Management Plan.

Thus, no mitigation is required for groundwater resources other than monitoring and operating plans that BVWSD will require to ensure that groundwater of low quality would be used for the HECA process water supply.

WR-1: Annual Groundwater Use Report

The Applicant will prepare an annual summary of the amount of water pumped from the BVWSD well field and used for process water needs.

Verification

As part of the Annual Compliance Report, the Applicant will submit to the CPM the annual summary of water pumped from the BVWSD well field.

5.14.4.2 Surface Water

As discussed above in Section 5.14.2.4, no impacts to surface waters are anticipated due to the Project. However, the Project will implement the following best management practices to ensure that impacts to surface water are less than significant.

WR-2: Soil and Water 2: General Construction Activity Storm Water Permit

Prior to beginning any clearing, grading, or excavating activities associated with Project construction, and as required by the General Construction Activity Storm Water Permit, the Project will develop and implement an SWPPP prepared under the requirements of the General Construction Activity Storm Water Permit.

Verification

At least 30 days prior to the start of construction, the Applicant will submit a draft Construction Phase SWPPP to the Compliance Project Manager (CPM) for review and comment. Two weeks prior to the start of construction, the Applicant will submit to the CPM a copy of the final Construction Phase SWPPP for review and approval. The final SWPPP shall contain all the elements of the draft plan with changes made to address staff comments and the final design of the Project. Approval of the plan by the CPM must be received prior to the initiation of any clearing, grading, or excavation activities associated with Project construction.

WR-3: Erosion Control and Revegetation Plan

Prior to beginning clearing, grading, or excavation activities associated with Project construction, the Applicant shall submit an Erosion Control and Revegetation Plan to the CPM for approval. The final plan shall contain all the elements of the draft plan with changes made to address the final design of the Project.

Verification

One month prior to the initiation of any clearing, grading, or excavation activities associated with Project construction, the Applicant will submit the final Erosion Control and Revegetation Plan to the CPM for review and approval. Approval of the plan by the CPM must be received prior to the initiation of any clearing, grading, or excavation activities associated with Project construction.

5.14.5 Laws, Ordinances, Regulations, and Standards

The construction and operation of the Project will be in accordance with all applicable LORS relating to water resources. Applicable LORS are discussed in this section and are summarized in the following Table 5.14-7, Summary of LORS – Water Resources.

5.14.5.1 Federal Authorities and Administering Agencies

Clean Water Act of 1977 (including 1987 amendments) §402; 33 United States Code §1342; 40 Code of Federal Regulations Parts 122 – 136

The Clean Water Act (CWA) requires a National Pollutant Discharge Elimination System (NPDES) permit for any discharge of pollutants from a point source to Waters of the United States. This law and its regulations apply to storm water and other discharges into Waters of the United States. The CWA requires compliance with a general construction activities permit for the discharge of storm water from construction sites disturbing 1 acre or more. This federal permit requirement is administered by the State Water Resources Control Board (SWRCB), but designated to the Regional Water Quality Control Board (RWQCB).

Construction activities at the Project Site will be performed in accordance with a Construction Phase SWPPP and associated monitoring plan that is required in accordance with the NPDES General Permit for Storm Water Discharges Associated with Construction Activities issued by the SWRCB. The SWPPP will include control measures including BMPs to reduce erosion and sedimentation as well as other pollutants associated with vehicle maintenance, material storage and handling, and other activities occurring at the Project Site.

Clean Water Act §311; 33 United States Code §1342; 40 Code of Federal Regulations Parts 122–136

This portion of the CWA requires reporting of any prohibited discharge of oil or hazardous substance. The Project will conform by proper management of oils and hazardous materials both during construction and operation. The administering agency is the Central Valley RWQCB and the California Department of Toxic Substances Control (DTSC).

5.14.5.2 State Authorities and Administering Agencies

Water Code Section 13552.6

This portion of the California Water Code (CWC) relates to the use of potable domestic water for cooling towers. Use of potable domestic water for cooling towers is unreasonable if a suitable non-potable source, including recycled water or brackish groundwater, is available. The Project will use a brackish groundwater supply in compliance with this requirement. SWRCB Resolution No. 75-58 addresses this issue; the administering agency is the Central Valley RWQCB (see Table 5.14-9, Summary of LORS—Water Resources). State Water Resources Control Board, Resolution No. 75-58 (18 June 1975).

SWRCB prescribes state water policy on the use and disposal of inland water used for power plant cooling. A discussion of this resolution as it applies to the Project is presented in the Chapter 6 Alternatives of this AFC Amendment. The administering agencies for this resolution are the SWRCB and the Central Valley RWQCB.

California Porter-Cologne Water Quality Control Act 1998; California Water Code § 13000–14957; Division 7, Water Quality

The Porter-Cologne Water Quality Control Act authorizes the state to develop and implement a statewide program for the control of the quality of all waters of the state. The Act establishes the SWRCB and nine RWQCBs as the principal state agencies with primary responsibility for the coordination and control of water quality. Under §13172, siting, operation, and closure of waste disposal sites are regulated. The SWRCB requires classification of the waste and the disposal site. Discharges of waste must comply with the groundwater protection and monitoring requirements of RCRA of 1976, as amended (42 United States Code [USC] Section 6901 *et seq.*), and any federal acts which amend or supplement RCRA, together with any more stringent requirements necessary to implement this revision or Article 9.5 (commencing with Section 25208) of Chapter 6.5 of Division 20 of the Health and Safety Code. The Project will comply with the regulations set forth in this Act.

The administering agencies for the above authority are CEC, SWRCB, and the Central Valley RWQCB.

Title 22, California Code of Regulations Division 4, Chapter 3.

This regulation requires maximum use of reclaimed water in the satisfaction of requirements for beneficial uses of water. The Project satisfies this requirement in that it complies with the Central Valley Region Basin Plan's designated beneficial uses for local groundwater. It also meets this requirement as it relates to SWRCB Resolution No. 75-58. The administering agency is the Central Valley RWQCB.

California Public Resources Code §25523(a); 20 California Code of Regulations §§1752, 1752.5, 2300 –2309 and Chapter 2 Subchapter 5 Article 1, Appendix B, Part (1)

The code provides for the inclusion of requirements in the CEC's decision on an AFC to assure protection of environmental quality and requires submission of information to the CEC concerning proposed water resources and water quality protection. The administering agency for the above authority is the CEC.

California Water Code §§13271 – 13272; 23 CCR §§2250 – 2260

These code sections require reporting of releases of specified reportable quantities of hazardous substances or sewage (§13272), when the release is into, or where it will likely discharge into, waters of the state. For releases into or threatening surface waters, a "hazardous substance" and its reportable quantities are those specified at 40 Code of Federal Regulations (CFR) §116.5, pursuant to §311(b)(2) of the CWA, 33 USC §1321(b)(2). For releases into or threatening groundwater, a "hazardous substance" and its reportable quantities are those specified at 40 CFR

§116.5, pursuant to §311(b)(2) of the CWA, 33 USC §1321(b)(2). For releases into or threatening groundwater, a "hazardous substance" is any material listed as hazardous pursuant to the California Hazardous Waste Control Act, Health and Safety Code §§25100 – 2520.24, and the reportable quantities are those specified at 40 CFR Part 302. Although such releases are not anticipated, the Project will comply with the reporting requirements.

The administering agencies for the above authority are the Central Valley RWQCB and the California Office of Emergency Services.

California Water Code §13260 –13269; 23 California Code of Regulations Chapter 9

The code requires the filing of a Report of Waste Discharge (ROWD) and provides for the issuance of WDRs with respect to the discharge of any waste that can affect the quality of the waters of the state. The WDRs will serve to enforce the relevant water quality protection objectives of the Central Valley Region Basin Plan and federal technology-based effluent standards applicable to the Project. With respect to potential water pollution from construction activities, the WDRs may incorporate requirements based on the CWA §402(p) and implementing regulations at 40 CFR Parts 122 *et seq*., as administered by the Central Valley RWQCB. The administering agency for the above authority is the Central Valley RWQCB.

California Environmental Quality Act, Public Resources Code §21000 et seq.; CEQA Guidelines, 14 California Code of Regulations §15000 et seq.*; Appendix G*

The California Environmental Quality Act (CEQA) Guidelines (Appendix G) contain definitions of projects that can be considered to cause significant unmitigated impacts to water resources. The Project is not expected to cause significant impacts to water resources, as described in Section 5.14.2, Environmental Consequences. The administering agency of the above authority is the CEC.

5.14.5.3 Local Authorities and Administering Agencies

The primary source of water supply will be provided by the BVWSD. This supply will be provided in accordance with the terms and conditions of the water supply agreement provided in Appendix N-1, Water Resources Information.

Kern County General Plan

The Kern County General Plan provides guidance on the types of development activity and allowable uses within the county limits. In particular the Land Use element pertains to the protection and management of groundwater and surface water resources within the county (Kern County Planning Department 2007). The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 14 Utilities, Chapter 14.08 Water Supply Wells

Provides standards and requirements for the design, construction, reconstruction, abandonment, and destruction of wells. The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 17 Building and Construction, Chapter 17.28 Grading Code

Sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments; establishes the administrative procedure for issuance of permits; and provides for approval of plans and inspection of grading construction. The administering agency for the above authority is Kern County.

Kern County Zoning Ordinance Title 17 Building and Construction, Chapter 17.48 Floodplain Management

Restricts or prohibits uses which are dangerous to health, safety, and property loss due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities; requires that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; controls the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; controls filling, grading, dredging, and other development which may increase flood damage; and prevents or regulates the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas. The administering agency for the above authority is Kern County.

5.14.5.4 Industry Codes and Standards

With regards to water resources and the related Project facilities, including pipelines, sewers, and other facilities, all construction will be in compliance with LORS mentioned in this report section or state and local building codes.

5.14.5.5 Involved Agencies and Agency Contacts

See the following Table 5.14-10, Agency Contacts, for agency contacts.

5.14.6 Permits Required and Permit Schedule

The water-related permits that are required for the Project are identified in Table 5.14-9, Agency Contacts, Summary of LORS—Water Resources. The timing for the preparation of each permit is noted in Table 5.14-9. These permits include:

- General Construction Activity Storm Water Permit. Notice of Intent (NOI) to comply with this general permit to be prepared and submitted to the SWRCB at least 2 weeks prior to the start of Project construction.
- Draft of Construction Activity SWPPP to be prepared and submitted to CPM at least 30 days prior to the start of construction for review and comment. A final plan to be submitted to the CPM no later than 2 weeks prior to the start of construction.

5.14.7 References

Belitz, K. and F.J. Heimes, 1990. Character and Evolution of the Ground-Water Flow System in the Central Part of the Western San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 2348.

Bertoldi, G. L., R. H. Johnston, and K. D. Evenson, 1991. Ground Water in the Central Valley, California – A Summary Report. U.S. Geological Survey Professional Paper 1401-A.

Boyle Engineering Corporation, 2002. Groundwater Status and Management Plan for Buena Vista Water Storage District.

Buena Vista Water Storage District, 2009. Personal communication with URS. May.

California Department of Water Resources, 1961, Report on Proposed Bellridge Water Storage District.

California Department of Water Resources, 2000-2006. Kern Groundwater Basin Spring 2000-2006, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer [available at http://www.sjd.water.ca.gov/groundwater/basin_maps/index.cfm].

California Department of Water Resources, 2003. California's Groundwater. Department of Water Resources Bulletin 118-203.

California Department of Water Resources, 2006. Supplemental Information to Bulletin 118-2003 – Individual Basin Descriptions. www.groundwater.water.ca.gov/bulletin118.

California Regional Water Quality Control Board, Central Valley Region, 2004. Water Quality Control Plan for the Tulare Lake Basin, Second Edition. January 2004.

California State Water Resources Control Board, 1975, State Water Resources Control Board Resolution No. 75-58, Water Quality Control Policy on the Use and Disposal of Inland Waters for Power Plant Cooling. June 19, 1975

California State Water Resources Control Board, 2002. Update to Resolution 75-58: Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling. May.

California Storm Water Quality Association, 2003. California Storm Water Best Management Practice Handbook – Industrial and Commercial, January.

CIMIS (California Irrigation Management Information System), 2010. Reference Evapotranspiration Zones, Zone 15 [available at EvapZones.pdf].

Croft, M.G., 1972. Subsurface Geology of the Late Tertiary and Quaternary Water-Bearing Deposits of the Southern Part of the San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 1999-H.

Davis, G. H., J.H. Green, F.H. Olmsted, and D.W. Brown, 1959. Ground-Water Conditions and Storage Capacity in the San Joaquin Valley, California. U.S. Geological Survey Water-Supply Paper 1469.

Dibblee, T.W., Jr., 2005. Geologic Map of the East Elk Hills And Tupman Quadrangles, Kern County, California. 1:24,000. Dibblee Geology Center Map #DF-103. August.

DOGGR (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources), 1998. California Oil and Gas Fields.

Environmental Data Resources, Inc. (EDR), 2009. Data Map Well Search Report, April 3, 2009.

ESA, 2010. Groundwater Banking Project Environmental Impact Report. Prepared for West Kern Water District. March.

FEMA (Federal Emergency Management Agency), 2008. Flood Insurance Rate Map, Kern County, California and Incorporated Areas, Community Panel Numbers 06029C2225E and 06029C2250E, Effective Date September 26, 2008 Website accessed on February 24, 2009: http://msc.fema.gov

Fetter, C.W., 1994. Applied Hydrogeology. Macmillan. New York. 691 p.

Galloway, D.R., and F.S. Riley, 1999. Subsidence in the San Joaquin Valley, California, USGS Circular 1182.

Gilliom, R.J., et al., 1989. Preliminary Assessment of Sources, Distribution, and Mobility of Selenium in the San Joaquin Valley, California. U.S. Geological Survey Water Resources Investigation 88-4186.

Kern County Environmental Health Services Department, 2008. Standards and Rules and Regulations for Land Development, Sewage Disposal, Water Supply and Preservation of Environmental Health. November 17. [Document available at www.co.kern.ca.us/eh]

Kern County Planning Department, 2007. Kern County General Plan. March 13.

Kern County Planning Department, 2004. Recirculated Draft Program Environmental Impact Report, Volume I, SCH# 2002071027. January.

KCWA (Kern County Water Agency), 1991. Study of the Regional Geologic Structure Related to Groundwater Aquifers in the Southern San Joaquin Valley Groundwater Basin, Kern County, California. September 20.

KWBA (Kern Water Bank Authority), 2009. http://kwb.org/main.htm. website accessed March 2009.

KWBA (Kern Water Bank Authority), 2007. Petition to Revise Declaration of Fully Appropriated Stream Systems for the Kern River and Application to Appropriate Water. September 26.

Krieger and Stewart, Incorporated, 2009. Final Environmental Impact Report for the Buena Vista Water Storage District Buena Vista Water Management Program. December.

NRCS (Natural Resources Conservation Service), 1988. Soil Survey of Kern County, California, Northwestern Part. Website accessed on February 19, 2009: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Page, R.W., 1973. Base of Fresh Ground Water (Approximately 3,000 Micromhos) in the San Joaquin Valley, California. U.S. Geological Survey Hydrologic Investigations Atlas HA-459.

Page, R.W., 1986. Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Maps and Sections. U.S. Geological Survey Professional Paper 1401-C.

Poland, J.F., Lofgren, B.E., Ireland, R.L., and Pugh, R.G., 1975. Land Subsidence in the San Joaquin Valley, California, as of 1972, USGS Professional Paper 437-H.

Ranger, M.J., S.G. Pemberton, and R.J. Sharpe, 1988. Lower Cretaceous example of a shoreface-attached marine bar complex: the Wabiskaw “C” sand of northeastern Alberta. In “Sequences, Stratigraphy, Sedimentology: Surface and Subsurface.” Edited by D. P. James and D. Leckie. Canadian Society of Petroleum Geologists Memoir.

Sawyer, E., 1991. Log Correlation Techniques: Southern Louisiana and Gulf of Mexico shelf. Houston: Exxon Company.

Sierra Scientific Services, 2003. Determination of Aquifer Storage Capacity for the Rosedale - Rio Bravo Water Storage District, Bakersfield, California. January 20.

Sierra Scientific Services, 2004. An Evaluation of Well Placements and Potential Impacts of the ID4/Kern Tulare/Rosedale—Rio Bravo Aquifer Storage and Recovery Project. July 20.

Sierra Scientific Services, 2007a. A Water Quality Evaluation of the Strand Ranch Aquifer Storage and Recovery Project, Kern County, CA., *in:* Rosedale—Rio Bravo Water Storage District Strand Ranch Integrated Banking Project Environmental Impact Report, January, 2008, prepared by ESA, Los Angeles, California. December 19.

Sierra Scientific Services, 2007b. An Evaluation of Well Placements and Potential Impacts of the proposed Strand Ranch Well Field, Kern County, California. In “Rosedale—Rio Bravo Water Storage District Strand Ranch Integrated Banking Project Environmental Impact Report,” January 2008, prepared by ESA, Los Angeles, California. December 20.

Sierra Scientific Services, 2009. An Evaluation of the Geology, Hydrology, Well Placements and Potential Impacts of the Buena Vista Water Storage District’s proposed Brackish Groundwater Remediation Project. In prep.

URS, 2009a. Preliminary Geotechnical Investigation for Proposed Hydrogen Energy California Project (HECA), Kern County, California.

URS 2009b. Responses to CEC Data Requests Set One: Nos. 1 through 132, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California. November 2009.

URS, 2010a. Draft Hydrogeologic Data Acquisition Report—Groundwater Monitoring and Process Water Well Field Development Project for Proposed Hydrogen Energy California Project (HECA), Kern County, California. March 2010.

URS 2010b. Draft Addendum to the Draft Hydrogeologic Data Acquisition Report for Proposed Hydrogen Energy California Project (HECA), Kern County, California. April 2010.

URS 2010c. Linear Modifications to the Revised Application for Certification for Hydrogen Energy California, Kern County, California. August 2010.

URS 2010d. Responses to CEC Data Requests Set Three: Nos. 153 through 218, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California. November 2010.

URS 2010e. Responses to CEC Data Requests Set Three: Nos. 153–157, 160–167, 182–185, and 187–190, Revised Application for Certification (08-AFC-8) for Hydrogen Energy California, Kern County, California, Confidential. November 2010.

West Kern Water District, 2007. West Kern Water District Consumer Confidence Report 2007. Available at http://www.wkwd.org

West Kern Water District, 1997. Groundwater Management Plan. February (as cited in CEC's April 7 1999 FSA for the La Paloma Project).

Williamson, A. K., D.E. Prudic, and L.A. Swain, 1989. Ground-Water Flow in the Central Valley, California. U.S. Geological Survey Professional Paper 1401-D.

Williamson, A. K., D.E. Prudic, and L.A. Swain, 1985. Ground-Water Flow in the Central Valley, California. U.S. Geological Survey Open-File Report 85-345.

Table 5.14-1
Monthly Temperature Data for Bakersfield, California (°F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	82	87	92	101	107	114	115	112	112	103	91	83
Mean	47.8	53.3	57.4	63.0	71.0	78.2	84.1	82.6	76.8	67.8	55.8	47.5
Minimum	20	25	31	34	37	45	52	52	45	29	28	19

Source: Western Regional Climatic Center; Bakersfield WSO Airport, Station Number 040442, Period of Record October 1, 1937 to December 31, 2006.

Notes:
ºF = degrees Fahrenheit
WSO = Weather Service Office

Table 5.14-2
Average Monthly Precipitation
Bakersfield, California (Inches)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.08	1.17	1.16	0.68	0.22	0.07	0.01	0.04	0.11	0.30	0.60	0.79

Source: Western Regional Climatic Center; Bakersfield WSO Airport, Station Number 040442, Period of Record October 1, 1937 to December 31, 2006.

Notes:
WSO = Weather Service Office

Table 5.14-3
Aquifer Parameters

Aquifer Parameter	Assumed Value for Model[1]
Hydraulic Conductivity, K	57 feet/day
Specific Yield, Sy	0.18 for unconfined zone
Specific Storage, (Ss)	0.000055 for semi-confined zone
Anisotropic Ratio	30
Aquifer Thickness	2,000 feet
Sand Percentage	75 percent

Notes:
1 See Groundwater Model Documentation in Appendix N-2, Groundwater Model Documentation for additional information on the aquifer parameter assumptions used in the groundwater model.

Table 5.14-4
Ackerman Well Groundwater Quality

General	Units	Value	Maximum Contaminant Level (MCL)
Conductivity	µS/cm	1,200	No standard
pH		7.8	No standard
Total Suspended Solids	Ppm	N/A	Not listed
TDS	Ppm	960	No standard
Total Alkalinity	mg/L	73	No standard
Hardness (as $CaCO_3$)	mg/L	360	No standard
Calcium	mg/L	140	No standard
Magnesium	mg/L	0.42	No standard
Sodium	mg/L	130	No standard
Potassium	mg/L	1.1	Not listed
Bicarbonate	mg/L	73	No standard
Sulfate	mg/L	420	No standard
Chloride	mg/L	94	No standard
Nitrate-Nitrite	mg/L	<1	10 (sum as Nitrogen)
Arsenic	mg/L	<0.002	0.010
Boron	mg/L	N/A	Not listed
Fluoride	mg/L	<0.1	2.0
Silica	mg/L	N/A	Not listed

Source: Zalco Laboratories, Inc., 2010, California Department of Public Health, 2007.

Notes:
This table is not a complete list of all of the analytes tested.
µS/cm = microSiemens per centimeter
< = less than
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
N/A = not available
pH = value indicating acidity or alkalinity of a liquid
ppm = parts per million
TDS = total dissolved solids

Table 5.14-5
Daily and Annual Water Flows

	Maximum Daily[2] (1000 gal/day)	Average Daily[3] (1000 gal/day)	Average Annual (acre-ft/year)[5]
Available Water Supply			
Plant Water	8,800[1]	6,700	7,500
Water Requirements			
Inflows			
BVWSD Brackish Groundwater	7,392	6,630	7,427
Recycled Water:[4]			
• Boiler blowdown	36	48	53
• Gasification wastewater	11	11	13
• Sour Water Blowdown	180	180	202
• Wastewater from Acid Gas Removal Unit	7	7	8
• Wastewater from SO_2 Scrubber Unit	3	3	3
• Wastewater from Urea Plant	258	258	289
• Storm water	0	0	0
Subtotal Recycled Water	495	507	568
Total Inflow	7,887	7,137	7,995
Consumptive Uses			
• Power Block Cooling Tower (evaporation)	2,721	2,391	2,679
• Process Block Cooling Tower (evaporation)	2,721	2,391	2,678
• ASU Cooling Tower (evaporation)	819	724	812
• Evaporative Cooler (evaporation)	75	0	0
• Demineralized Water (to Users)	1,535	1,616	1,810
• Softener Filter Cake (solid waste removal)	4	3	3
• ZLD Filter Cake (solid waste removal)	12	12	13
Total Consumptive Use	**7,887**	**7,137**	**7,995**

Source: HECA Project, 2012.

Notes:

1 Current will serve letter as provided in Appendix N-1, Water Resources Information, provides documentation for the supply of 6,700,000 gpd on an annual basis with capacity to peak to 8,800,000 gpd.

2 The maximum daily use is based on 24 hours of full load operation during the design hottest day (115ºF day/ 80ºF night, 97 ºF average).

3 The average daily use is 24 hours of the average of the full load use at the average monthly temperatures for every month (65 ºF average).

4 Reject water volumes listed are captured and recycled by the Project. Storm water from the site will be used when available and are thus shown as zero values on this table.

5 The average annual use is based on 8,760 hours/year at the average daily rate, corresponding to the maximum plant capacity factor of 100 percent.

ASU = Air Separation Unit
ºF = degrees Fahrenheit
ft = feet
gal = gallon(s)
ZLD = Zero Liquid Discharge

Table 5.14-6
BVWSD Supply Water Quality

General	Units	Projected Average	Projected Maximum
pH	N/A	7.25	7.25
TDS	Ppm	2000	4000
Total Alkalinity	mg/L	238	328
Hardness	mg/L	897	1,561
Calcium	mg/L	300	500
Magnesium	mg/L	35	75
Sodium	mg/L	278	726
Potassium	mg/L	2	3
Bicarbonate	mg/L	250	400
Sulfate	mg/L	700	1,000
Chloride	mg/L	381	1,237
Nitrate-Nitrite	mg/L	0.2	0.2
Arsenic	mg/L	0.025	0.025
Boron	mg/L	2.5	5
Fluoride	mg/L	0.4	1
Silica	mg/L	30	35

Source: Values for the BVWSD source water represent a composite of historical laboratory test results on elevated TDS wells provided by BVWSD (BVWSD, 2009).
Notes:
Average of the water sample data provided by BVWSD
mg/L = milligrams per liter
N/A = not applicable
pH = value indicating acidity or alkalinity of a liquid
TDS = total dissolved solids

Table 5.14-7
WKWD Supply Water Quality

General	Units	WKWD Well Field South of Project Site[1] Value	WKWD Well #1 East of Project Site[2] Value	WKWD Well #2 East of Project Site[3] Value
Conductivity	µS/cm	444	N/A	N/A
pH		7.98	8.4	8.1
Total Suspended Solids	ppm	N/A	N/A	N/A
TDS	ppm	294	380	459
Total Alkalinity	mg/L	N/A	N/A	N/A
Hardness	mg/L	90	86	154
Calcium	mg/L	33	N/A	N/A
Magnesium	mg/L	1.9	N/A	N/A
Sodium	mg/L	48	N/A	N/A
Potassium	mg/L	N/A	N/A	N/A
Bicarbonate	mg/L	135	N/A	N/A
Sulfate	mg/L	39	155	185
Chloride	mg/L	35	41	55
Nitrate–Nitrite	mg/L	1.59	13.4	18.2
Arsenic	mg/L	0.00121	0.002	0.002
Boron	mg/L	0.00014	N/A	N/A
Fluoride	mg/L	0.15	N/A	N/A
Silica	mg/L	N/A	N/A	N/A

Notes:
1 Represents average water quality from WKWD's eight groundwater wells located south of the Project Site (WKWD, 2007).
2 Represents average water quality from existing Well #1 (ESA, 2010).
3 Represents average water quality from existing Well #2 (ESA, 2010).
µS/cm = microSiemens per centimeter
< = less than
$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
N/A = not available
ppm = parts per million
pH = value indicating acidity or alkalinity of a liquid
TDS = total dissolved solids

Table 5.14-8
Estimated Construction Water Use

Activity	Estimated Daily Average Use by Construction Phase (gpd)	Estimated Construction Phase Duration (months)	Daily Average Over Construction Period (gpd)	Estimated Water Use (acre-feet)	
				12-Month Period Maximum Use	Monthly Average Over Construction Period
Project Site (453 acres)					
Early Works • Initial Grading of Entire Site • Dust Control	24,000	2	11,800[1]	12	10
Site Preparation • Underground • Excavation/Backfill/Compaction • Dust Control	14,000	5			
Ongoing Day-to-Day Construction • Foundations • Backfill • Compaction • Dust Control • Road Cleaning	12,000	26			
Finishing Stage • Finish Grading and Paving • Landscaping • Construction Cleanup • Demobilization Dust Control	8,000	4			
Hydrotest—Plant Equipment and Piping	5,600	5			
Linear Construction					
Trenching	900	6	2,000	1.5	N/A
Horizontal Directional Drilling	2,300	3			
Hydrotest – Linears	2,000	6			

Source: HECA Project, 2012.
Notes:
[1] Daily average use after the first 12 months of construction, including construction of linears, is estimated at 10,000 gpd.
gpd = gallons per day
N/A = not applicable

Table 5.14-9
Summary of LORS—Water Resources

LORS	Applicability	Conformance and Timing
Federal		
CWA §402; 33 USC §1342; 40 CFR Parts 110, 112, 116	Requires NPDES permits for construction and industrial storm water discharges. Requires preparation of an SWPPP and Monitoring Program.	Project proposes to retain and re-use industrial storm water discharge. As such, the Project would comply with the zero discharge exemption under the NPDES industrial storm water permit. NOI for coverage under NPDES construction storm water permit will be filed prior to construction and Project operation. An SWPPP will also be prepared for construction activity.
CWA §311; 33 USC §1342; 40 CFR Parts 122–136	Requires reporting of any prohibited discharge of oil or hazardous substance.	The Project will conform by proper management of oils and hazardous substances both during construction and operation.
State		
CWC §13552.6	Use of potable domestic water for cooling towers is unreasonable use if suitable recycled water is available.	Project has determined that brackish groundwater is feasibly available in the vicinity of the Project Site at this time and will be used for cooling tower make-up.
California Constitution Article 10 §2	Avoid the waste or unreasonable uses of water. Regulates methods of use and diversion of water.	Project includes appropriate water conservation measures, both during construction and operation (e.g., ZLD). The Project will comply with this requirement as well as SWRCB Resolution No. 75-58.
SWRCB, Resolution No. 75-58	Addresses sources and use of cooling water supplies for power plants which depend on inland waters for cooling and in areas subject to general water shortages.	Project has determined that brackish water is feasibly available at the site at this time and will be used for cooling water supply.
Porter-Cologne Water Quality Act of 1972; CWC §13000–14957, Division 7, Water Quality	Requires state and RWQCBs to adopt water quality initiatives to protect state waters. Those criteria include identification of beneficial uses, and narrative and numerical water quality standards.	Project will conform to applicable state water standards, both qualitative and quantitative, prior to Project operation. Use of brackish groundwater for industrial supply is consistent with designated beneficial use.

Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Title 22, CCR	Addresses the use of recycled water for cooling equipment.	Project proposes to use treated brackish groundwater for cooling tower make-up. Sufficient quantities of recycled water supply are not available. Project proposes to recycle cooling tower circulation water and process condensate from gasification to the maximum extent practicable. The Project uses ZLD technology to recycle plant wastewater to the maximum extent possible.
The Safe Drinking Water and Toxic Enforcement Act of 1986 (proposition 65), Health and Safety Code 25241.5 *et seq.*	Prohibits the discharge or release of chemicals known to cause cancer or reproductive toxicity into drinking water sources.	Project will conform to all state water quality standards, both qualitative and quantitative.
CWC Section 461	Encourages the conservation of water resources and the maximum reuse of wastewater, particularly in areas where water is in short supply.	Project proposes to use treated brackish groundwater for cooling tower make-up. The Project uses ZLD technology to recycle plant wastewater to the maximum extent possible. Project proposes to recycle cooling tower circulation water and process condensate from gasification to the maximum extent practicable.
California Public Resources Code §25523(a); 20 CCR §§1752, 1752.5, 2300–2309, and Chapter 2 Subchapter 5, Article 1, Appendix B, Part (1)	The code provides for the inclusion of requirements in the CEC's decision on an AFC to assure protection of environmental quality and requires submission of information to the CEC concerning proposed water resources and water quality protection.	The Project will comply with the requirements of the CEC to assure protection of water resources.
CWC §§13271–13272; 23 CCR §§2250–2260	Reporting of releases of reportable quantities of hazardous substances or sewage and releases of specified quantities of oil or petroleum products.	Project will conform to all state water quality standards, both qualitative and quantitative.
CWC § 13260–13269; 23 CCR Chapter 9	Requires the filing of a Report of Waste Discharge (ROWD) and provides for the issuance of WDRs with respect to the discharge of any waste that can affect the quality of the waters of the state.	An NOI will be filed for coverage under the NPDES General Construction Permit. Otherwise, there will be no discharges to waters of the state.
CEQA, Public Resources Code §21000 *et seq.*; CEQA Guidelines, 14 CCR §15000 *et seq.*; Appendix G	The CEQA Guidelines (Appendix G) contain definitions of projects which can be considered to cause significant impacts to water resources.	The Project will comply with the requirements of the CEC to assure protection of water resources.

Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Local		
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.9.11	Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition through use of grading and flood protection ordinances.	The Project will implement BMPs, including erosion control measures and will comply with the Kern County Grading Ordinance 17.28.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.9.20	Areas along rivers and streams will be conserved where feasible to enhance drainage, flood control, recreation, and other beneficial uses while acknowledging existing land use patterns.	The Project will not impact canal levees and will not discharge into the canals. The Project Site is not located in a floodplain. The Project will not increase storm water runoff off site and therefore will not contribute to off-site flooding.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy LU 1.10.6.34	Ensure that adequate water storage, treatment, and transmission facilities are constructed concurrently with Plan.	The Project includes water supply pipelines, storage tanks and water treatment facilities.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy Public Facilities and Services-Policy 1.4.5	Ensure that adequate supplies of quality (appropriate for intended use) water are available to industrial users.	BVWSD will provide the Project with brackish water for process uses.
Kern County General Plan—Land Use Element: Resource Goals, Objectives, and Policies Policy Public Facilities and Services-Policy 1.4.6	Provide a healthful and sanitary means of collecting, treating, and disposing of sewage and refuse.	The Project will have an on-site septic system constructed, designed and operated in accordance with Kern County and RWQCB requirements.
Kern County Zoning Ordinance 14.08	Provides standards and requirements for the design, construction, reconstruction, abandonment, and destruction of wells. The administering agency for the above authority is Kern County.	Any existing on-site wells will be abandoned or destroyed in accordance with Kern County requirements.

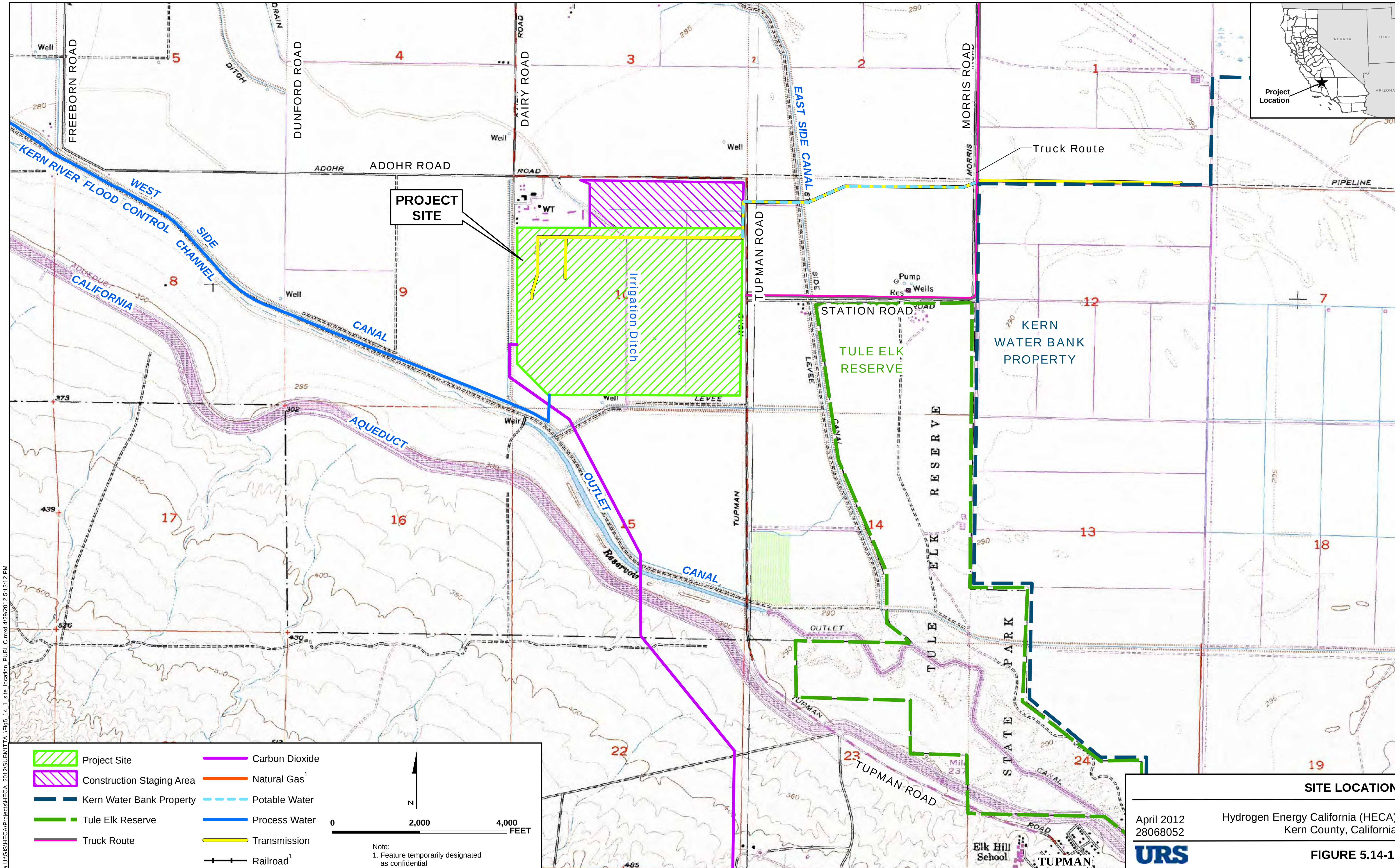
Table 5.14-9
Summary of LORS—Water Resources (Continued)

LORS	Applicability	Conformance and Timing
Kern County Zoning Ordinance 17.28	Sets forth rules and regulations to control excavation, grading and earthwork construction, including fills and embankments; establishes the administrative procedure for issuance of permits; and provides for approval of plans and inspection of grading construction.	The Project will obtain a grading permit.
Kern County Zoning Ordinance 17.48	Restricts or prohibits uses which are dangerous to health, safety, and property loss due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities; requires that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; controls the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; controls filling, grading, dredging, and other development which may increase flood damage; and prevents or regulates the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.	The Project is not in a floodplain and will not increase storm water discharges off site. The CO_2 pipeline crossing at the Kern River Flood Channel will be constructed using the HDD method and will not impede flood flows or impact floodplains.

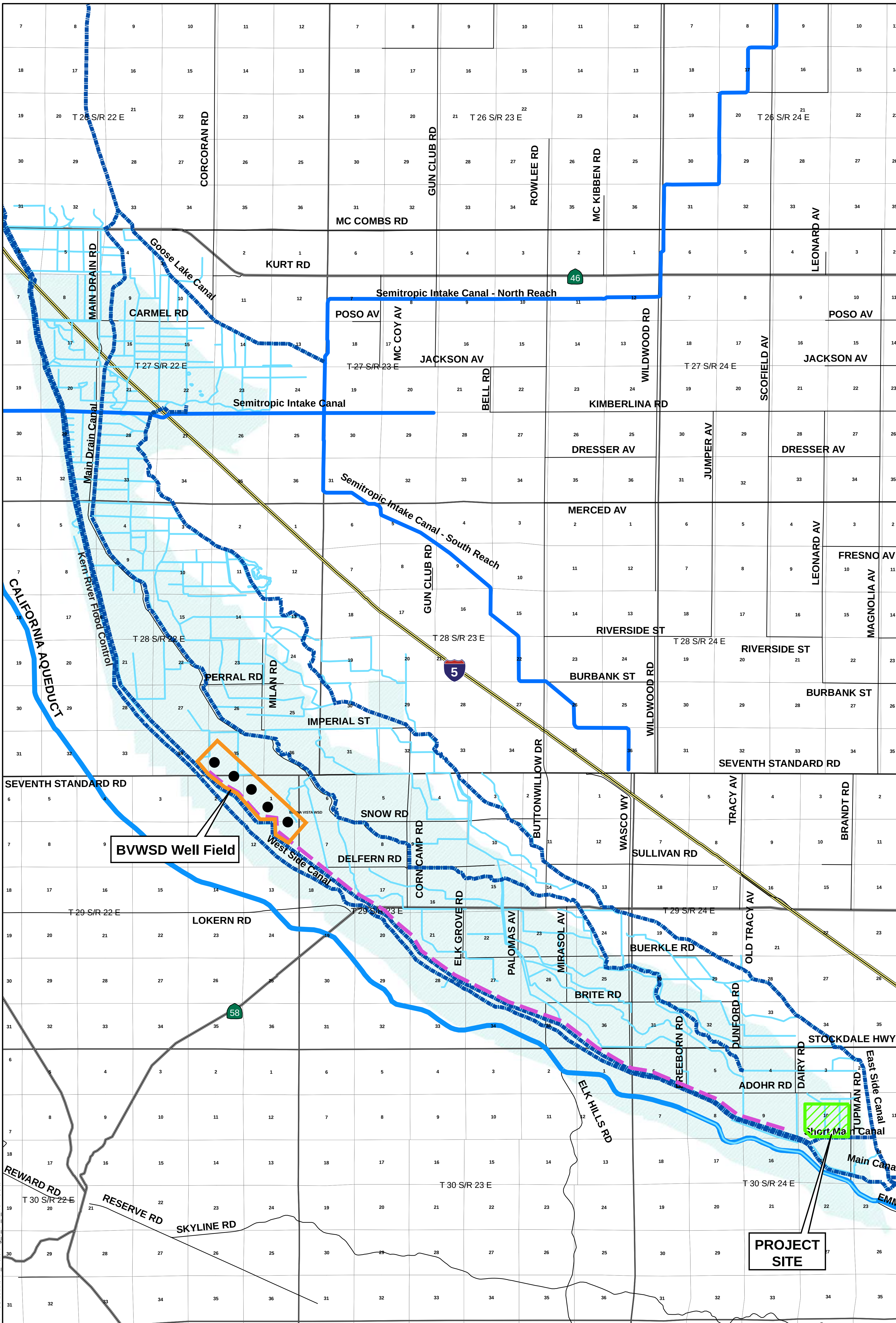
Notes:
CCR = California Code of Regulations
CEC = California Energy Commission
CEQA = California Environmental Quality Act of 1970
CFR = Code of Federal Regulations
CO_2 = carbon dioxide
CWA = Clean Water Act
CWC = California Water Code
HECA = Hydrogen Energy California
LORS = laws, ordinances, regulations, and standards
N/A = not applicable
NOI = Notice of Intent
NPDES = National Pollutant Discharge Elimination System
RWQCB = Regional Water Quality Control Board
SWPPP = storm water pollution prevention plan
SWRCB = State Water Resources Control Board
USC = United States Code

Table 5.14-10
Agency Contacts

Agency	Contact	Title	Telephone
California Regional Water Quality Control Board, Central Valley Region 1685 E Street Fresno, CA 93706	Doug Patteson	Senior Water Resource Control Engineer	(559) 445-5146
West Kern Water District 800 Kern Street PB Box 1105 Taft, CA 93268	J.D. Bramlet	Director of Operations	(661) 763-3151
Buena Vista Water Storage District 525 North Main Street PO Box 756 Buttonwillow, CA 93206	Dan Bartel	District Manager	(661) 324-1101



Sources: USGS (7.5' quads: Buttonwillow 1976, East Elk Hills 1977, Tupman 1977, Stevens, 1977). Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. Created using TOPO!, ©2006 National Geographic Maps, All Rights Reserved. HECA Project Team (Traffic Data, 2009).



Project Site

BVWSD Buttonwillow Service Area

Production Wells (3 pumping, 2 redundant)

BVWSD Water Ways

Water Supply Pipeline

BVWSD Well Field

N

0 1 2 MILE

PROCESS WATER SUPPLY WELL FIELD LOCATION

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

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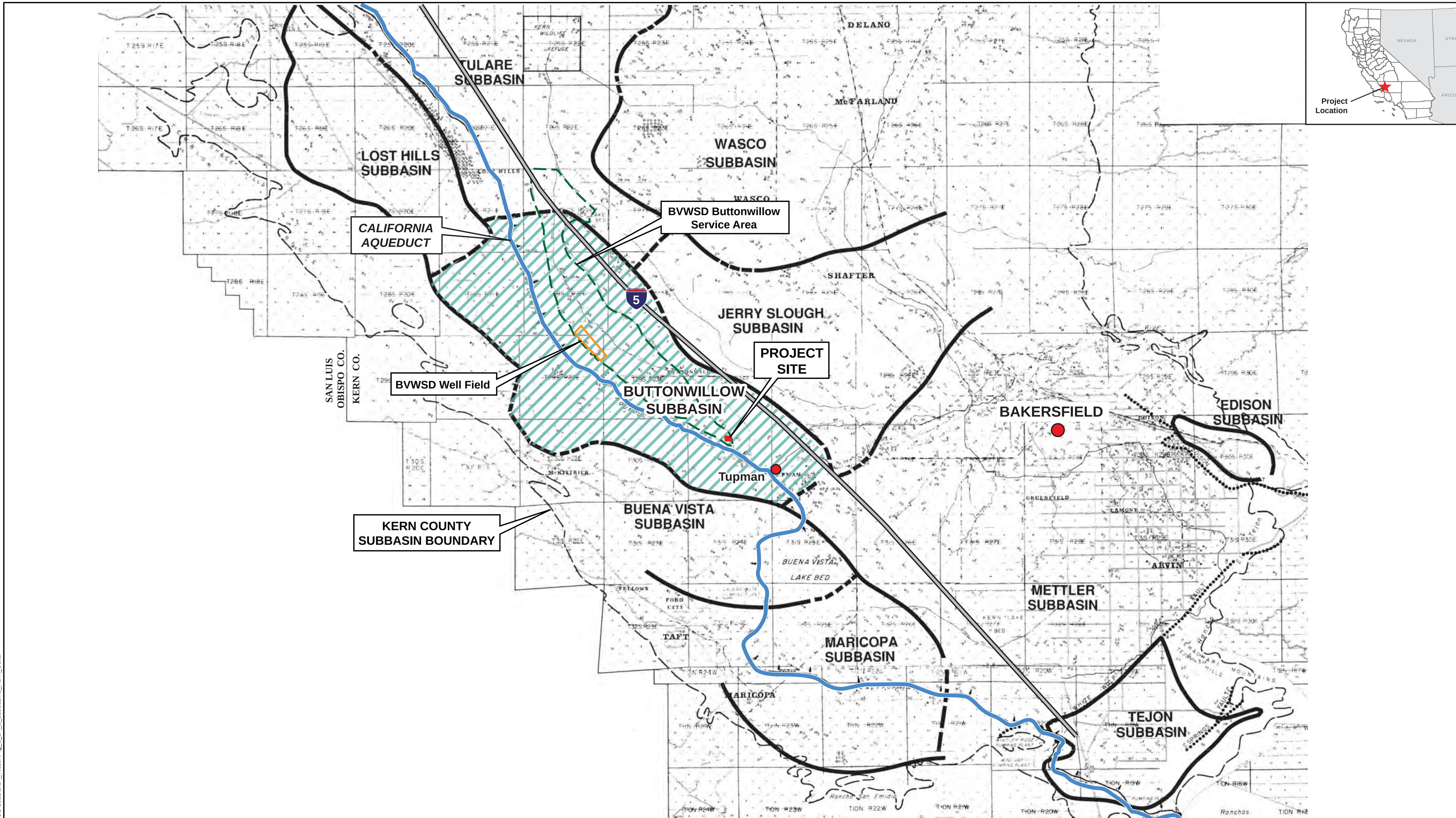
FIGURE 5.14-2



Note:
The subbasins shown are bounded by distinct structural highs due to folding and faulting as developed by KCWA (1991). These subbasins may contain isolated or partially isolated hydrologeologic systems.

Source: Kern County Water Agency, 1991

BVWSD Buttonwillow Service Area
Kern County Subbasin Boundary

Subbasin Boundaries:
Prominent, continuous structural highs
Low areas, along boundaries (where communication between subbasins is more likely)

N
0 7 MILE (APPROX.)

GROUNDWATER SUBBASINS IN KERN COUNTY

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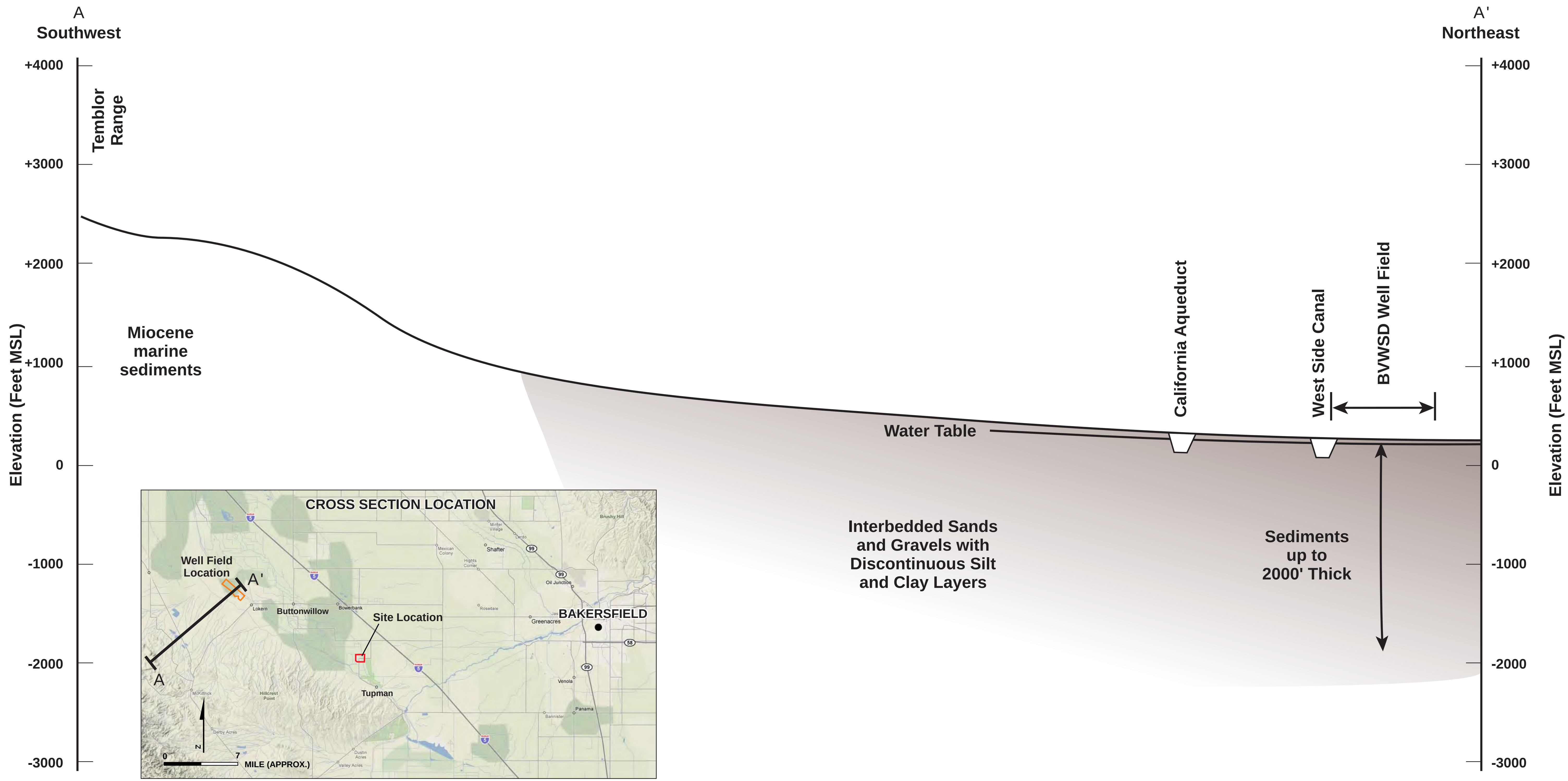
URS

FIGURE 5.14-3

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_3_subbasins_Kern_Co.ai



Note:
High TDS, high SO_4, lateral recharge water from west blends with low TDS, mixed anion, lateral recharge water from east, under BVWSD

0 2
APPROXIMATE HORIZONTAL SCALE, MILES

GENERALIZED HYDROGEOLOGIC CROSS SECTION

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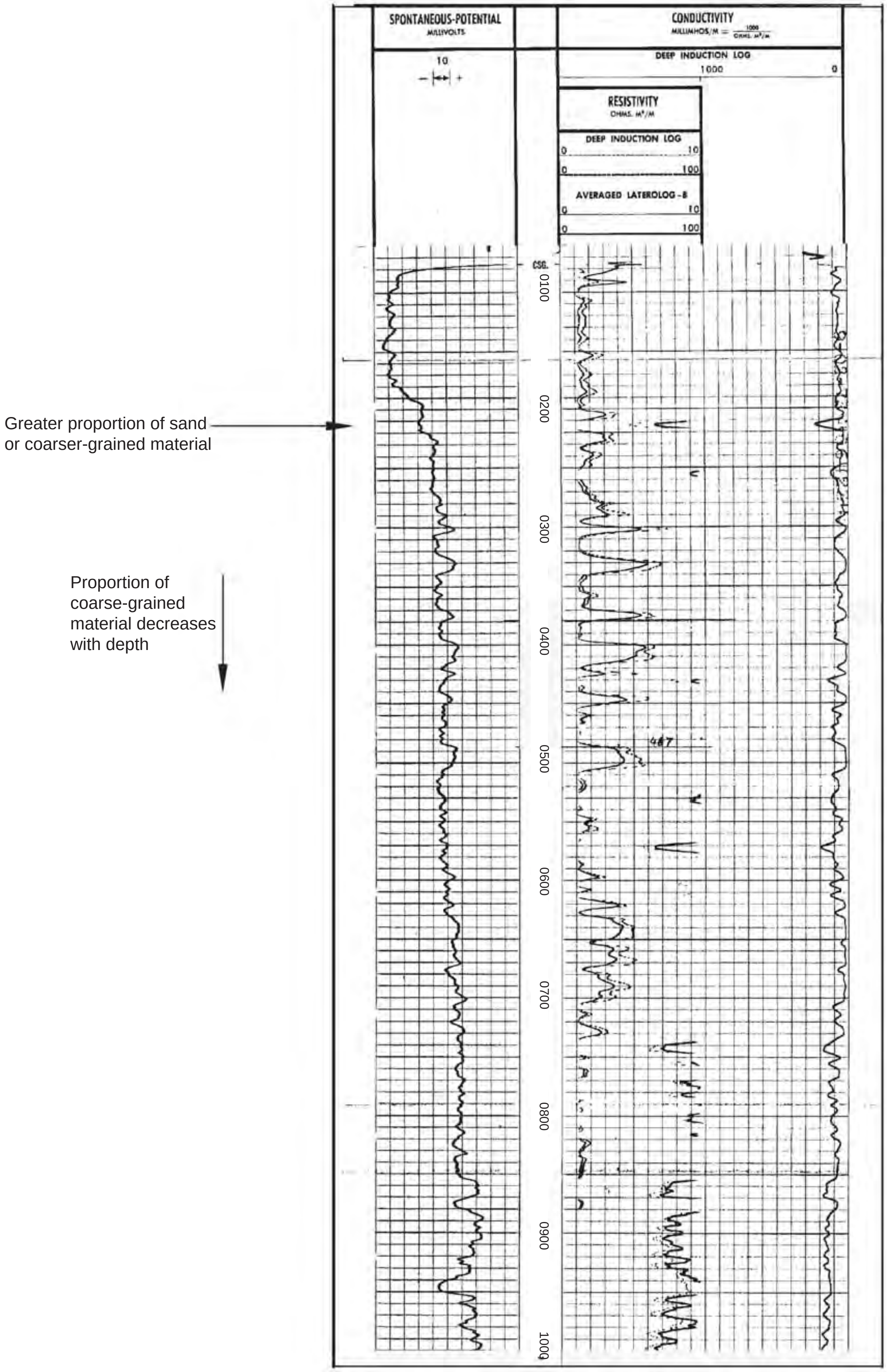
FIGURE 5.14-4

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_4_gen_crosssectoin_AA.ai



Notes:

1. Well log is for Mobil-Gulf-Tupman-USL #1-10 located in T28S-R23E-10N.
2. Depths are in feet below ground surface.

EXAMPLE GEOPHYSICAL LOG

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Kern County, California

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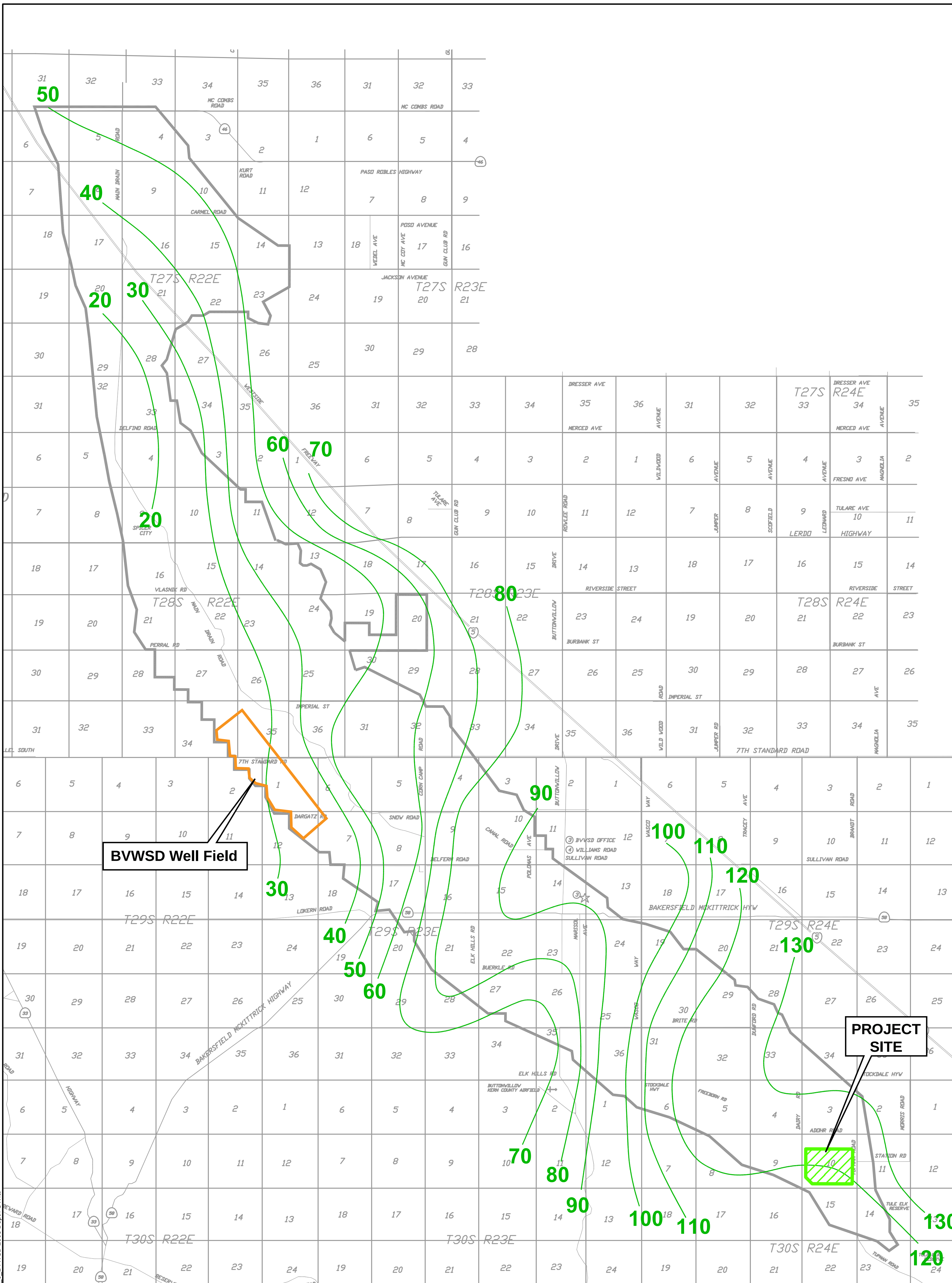
FIGURE 5.14-5

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_5_example log.ai



Project Site

BVWSD Buttonwillow Service Area

40 2008 Depth to Groundwater, feet

N

0 1 2 MILE

2008 DEPTH TO GROUNDWATER

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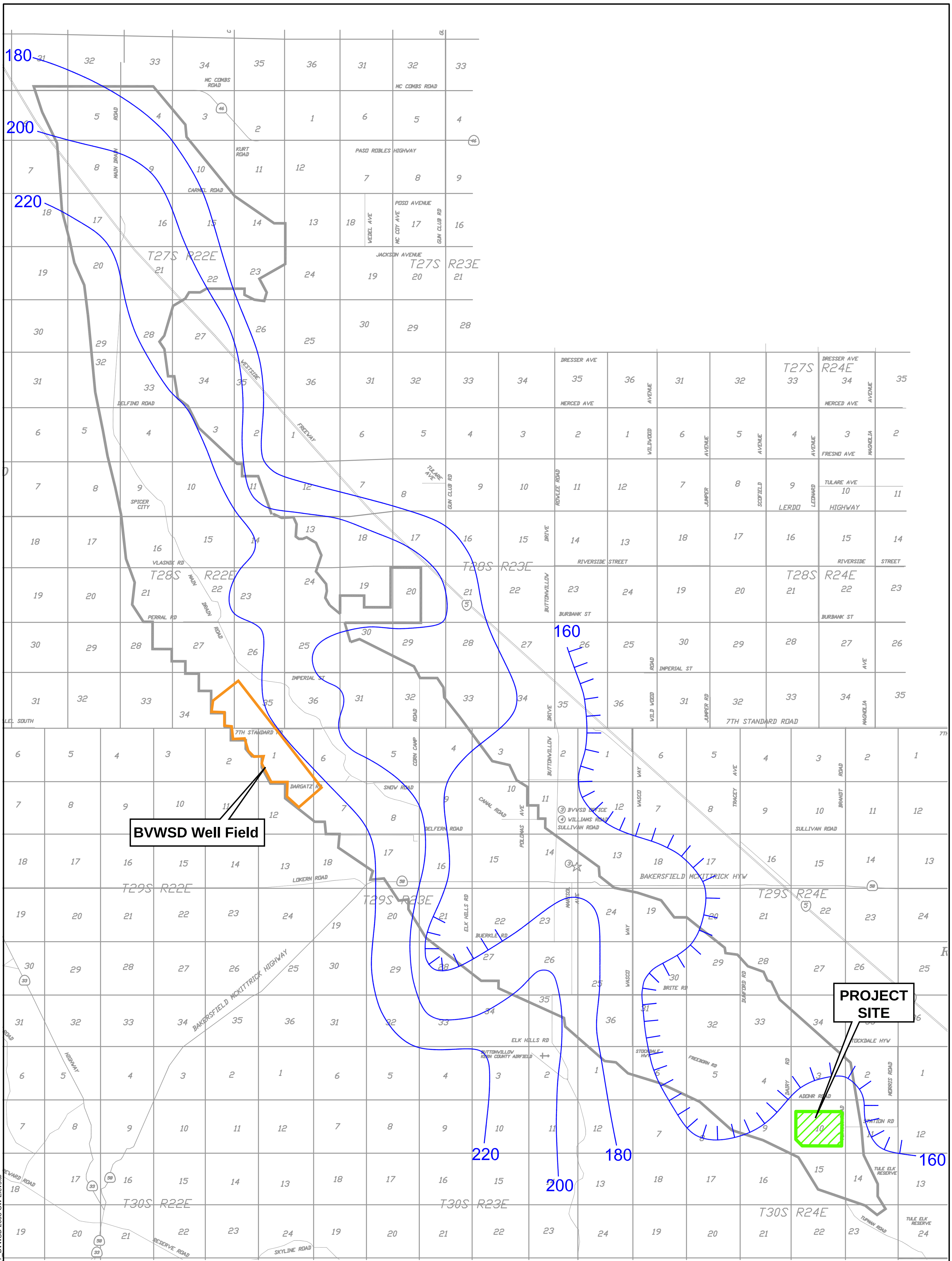
Kern County, California

URS

FIGURE 5.14-6

4/29/12 vsa/rhk..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_6_BVWSD 2008 Depth GW.ai

Source: Buena Vista Water Storage District



Project Site

BVWSD Buttonwillow Service Area

200 2008 Groundwater Elevation, feet, msl

N

0 1 2 MILE

2008 GROUNDWATER ELEVATIONS

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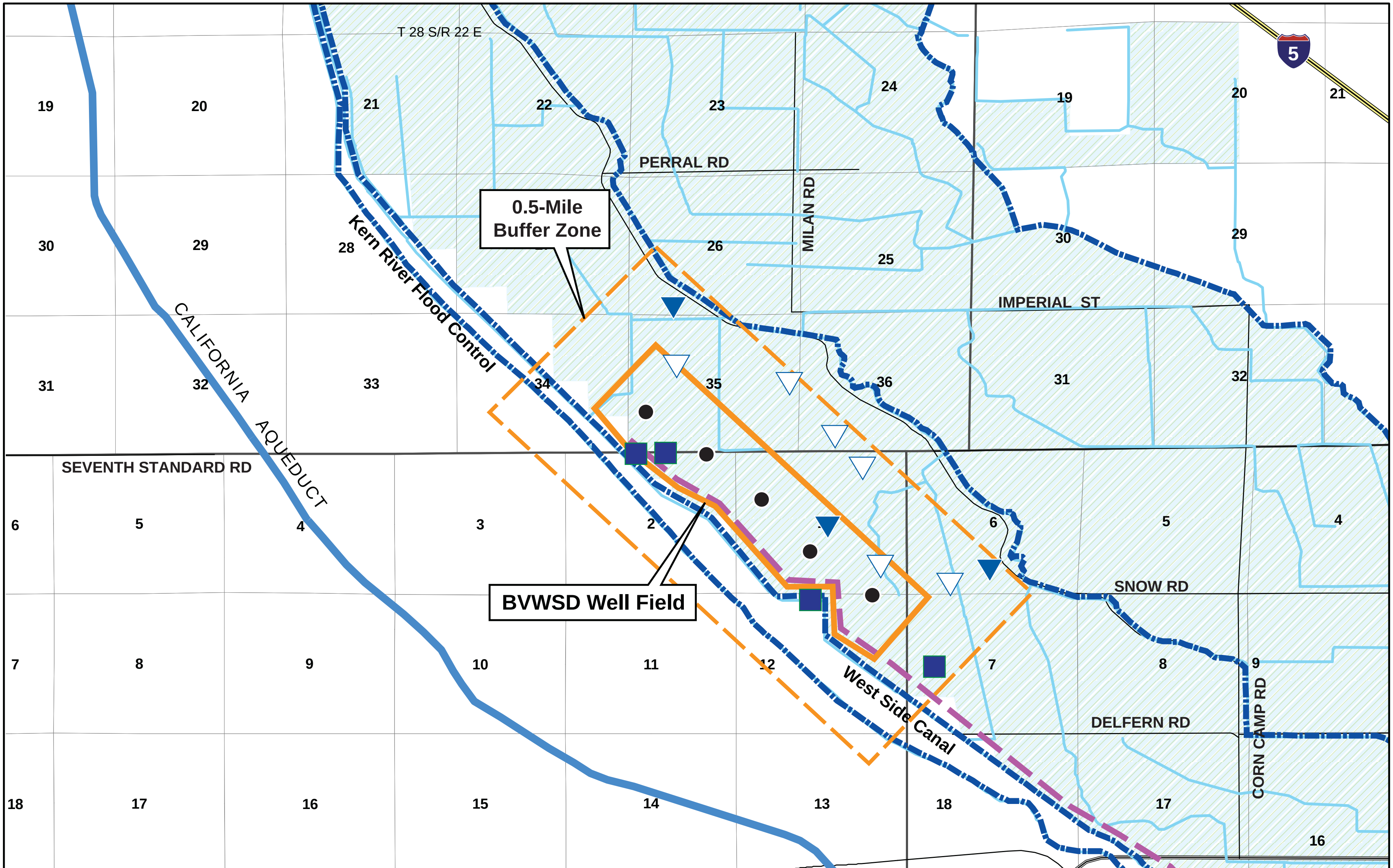
Kern County, California

URS

FIGURE 5.14-7

Source: Buena Vista Water Storage District

4/29/12 vsa/hk..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_7_BVWSD 2008 GW Elevs.ai



BVWSD Buttonwillow Service Area

BVWSD Water Ways

Process Water Supply Pipeline

BVWSD Well Field

0.5-Mile Buffer Zone

Production Wells
(3 pumping, 2 redundant)

Private Water Well (Source: BVWSD)

Private Water Well
(Source: BVWSD and EDR)

Private Water Well (Source: EDR)

N

0 1 MILE

WELL LOCATION MAP

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Kern County, California

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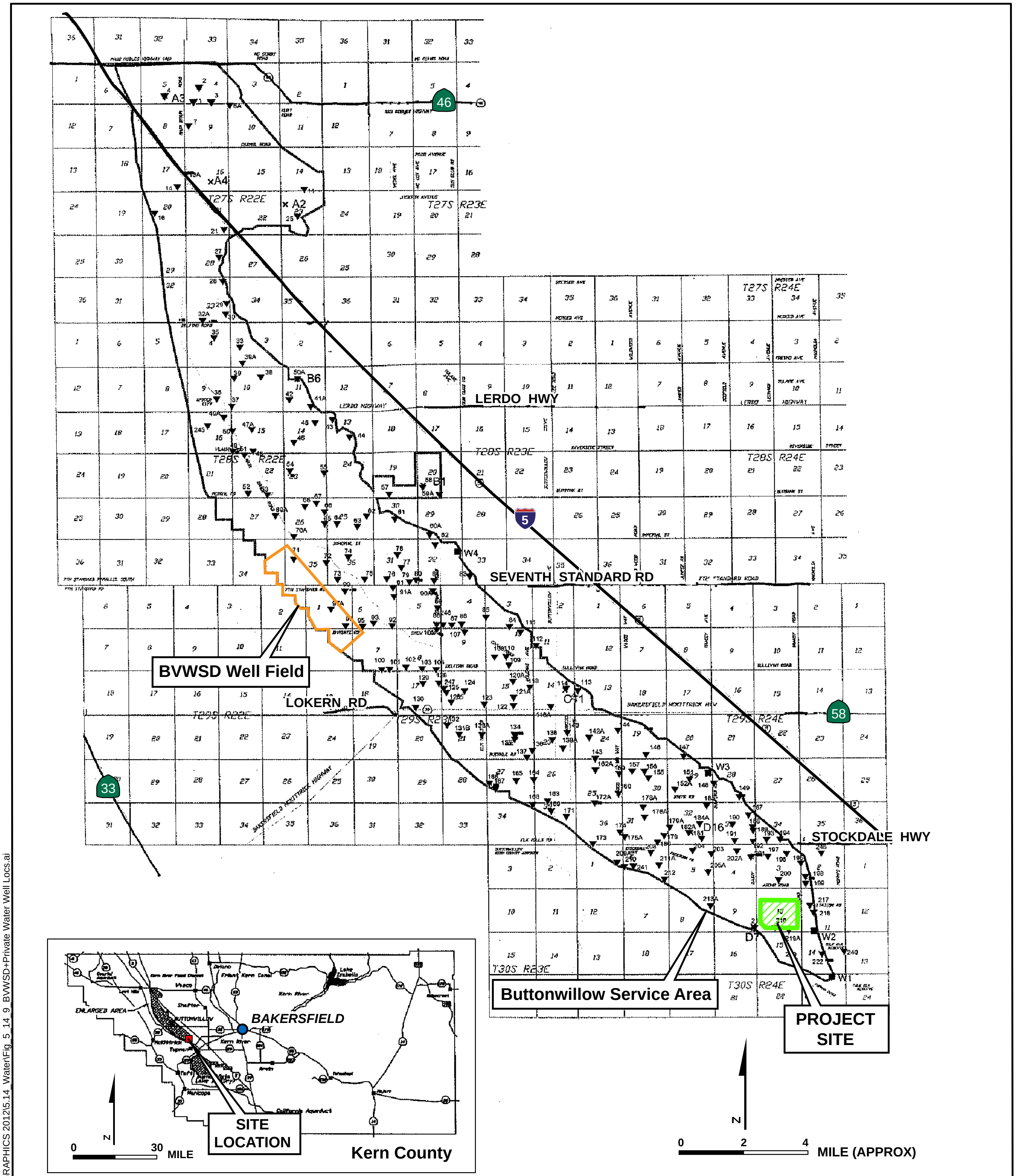
FIGURE 5.14-8

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_8_well loc map.ai



Project Site	▼ Landowner Supply Well
BVWSD Buttonwillow Service Area	■ District Supply Well
BVWSD Well Field	

BVWSD AND PRIVATE WATER WELL LOCATION MAP

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Kern County, California

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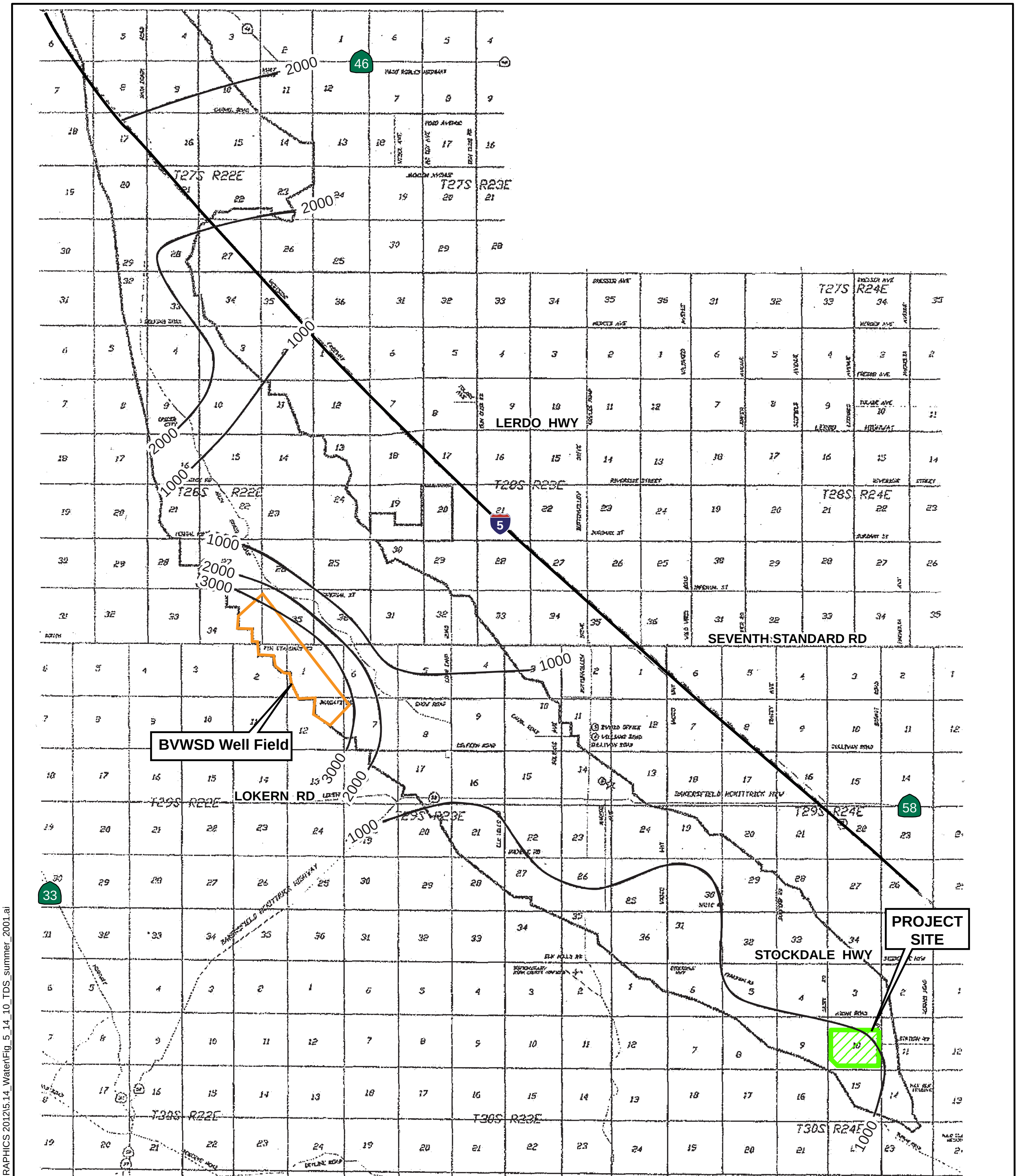
FIGURE 5.14-9

4/29/12 vsa/hk. T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_9_BVWSD+Private Water Well Locs.ai

Source: Buena Vista Water Storage District



Project Site

BVWSD Buttonwillow Service Area

BVWSD Well Field

1000 TDS (mg/L) Summer 2001

N

0 1 2 MILE (APPROX)

TOTAL DISSOLVED SOLIDS – SUMMER 2001

April 2012
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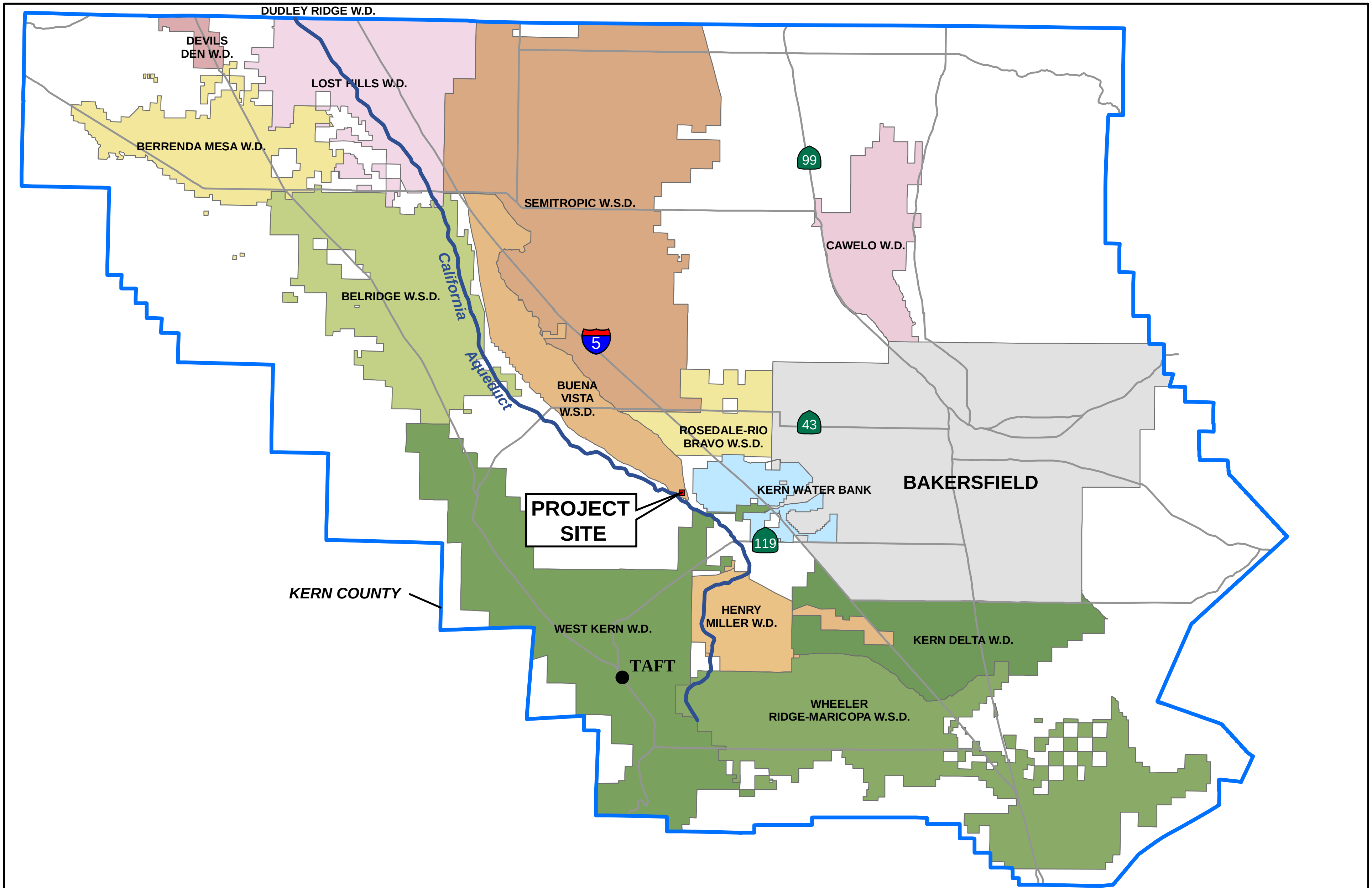
Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-10

Source: Buena Vista Water Storage District

4/29/12 vsa/hk..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_10_TDS_summer_2001.ai



W.D.	Water District
W.S.D	Water Storage District
	Kern County
	California Aqueduct

N

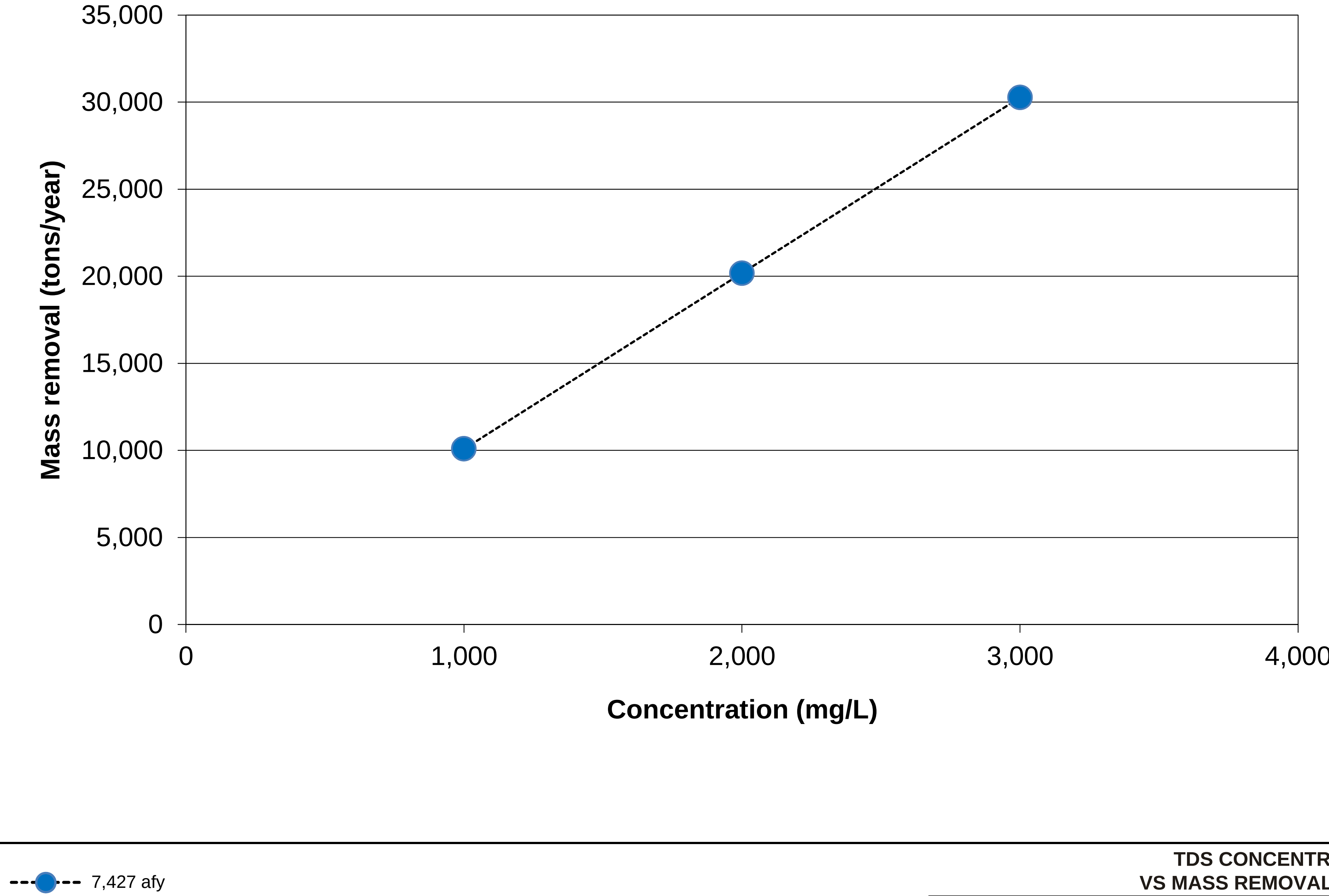
0 1 MILE

WATER DISTRICTS IN VICINITY OF PROJECT

April 2012 Hydrogen Energy California (HECA)
28068052 Kern County, California

URS

FIGURE 5.14-11



TDS CONCENTRATION
VS MASS REMOVAL RATE

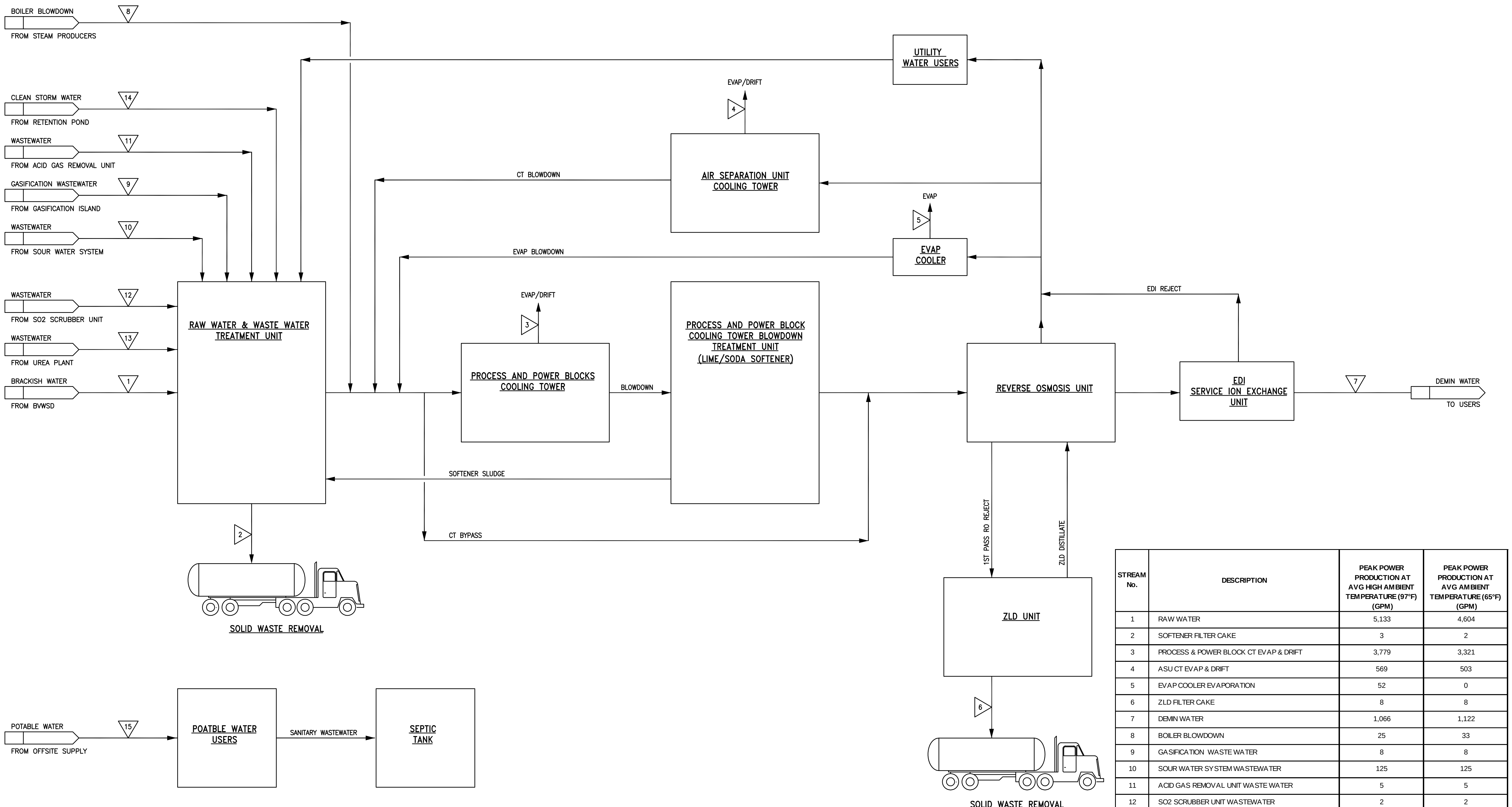
April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-12

4/25/12 vsa..T:\HECA-SCS 2012\GRAPHICS 2012\5.14_Water\Fig_5_14_12-TDS_conc_vs_mass.ai



STREAM No.	DESCRIPTION	PEAK POWER PRODUCTION AT AVG HIGH AMBIENT TEMPERATURE (97°F) (GPM)	PEAK POWER PRODUCTION AT AVG AMBIENT TEMPERATURE (65°F) (GPM)
1	RAW WATER	5,133	4,604
2	SOFTENER FILTER CAKE	3	2
3	PROCESS & POWER BLOCK CT EVAP & DRIFT	3,779	3,321
4	ASU CT EVAP & DRIFT	569	503
5	EVAP COOLER EVAPORATION	52	0
6	ZLD FILTER CAKE	8	8
7	DEMIN WATER	1,066	1,122
8	BOILER BLOWDOWN	25	33
9	GASIFICATION WASTE WATER	8	8
10	SOUR WATER SYSTEM WASTEWATER	125	125
11	ACID GAS REMOVAL UNIT WASTE WATER	5	5
12	SO2 SCRUBBER UNIT WASTEWATER	2	2
13	UREA UNIT WASTEWATER	179	179
14	CLEAN STORM WATER	NNF	NNF
15	POTABLE WATER	75	75

MASS WATER BALANCE
PEAK FLOWS FOR AVERAGE HIGH TEMPERATURE AND AVERAGE AMBIENT TEMPERATURE

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.14-13

Source:
Fluor; HECA-SCS, 2012 AFC Update; Mass Water Balance Peak Flows for Avg High Temperature and Avg Ambient Temperature; Drawing No: A4UV-090-25-SK-0002, Rev. 1 (4/12/12)

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5.15 GEOLOGICAL HAZARDS AND RESOURCES

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.

- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.

- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration.

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  — **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  — **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

Identification of geologic hazards and mineral resources is based on published literature and the Project Site geotechnical investigation (URS, 2009). Regarding geologic resources, evaluations of impact significance are based on the type and the proximity of the resource to the Project. Recommendations are provided for mitigation of geologic hazards and geotechnical issues at the Project. Figures are located at the end of this section.

The information provided in this section is based on a review of published geologic and mineral resource references.

Additional information related specifically to the OEHI Project is contained Appendix A-1 to this AFC Amendment, Section 4.6, Geology and Soils.

5.15.1 Affected Environment

5.15.1.1 Regional Stratigraphy

The Project is located in the Great Valley Geomorphic Province of California (CGS, 2002a). The Great Valley is an alluvial plain about 50 miles wide and 400 miles long in the central part of California. Its northern part is the Sacramento Valley, drained by the Sacramento River; and its southern part is the San Joaquin Valley, drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic period (about 160 million years ago).

The southern portion of the Great Valley Province is characterized as being a nearly flat-surfaced, north-trending, asymmetric trough bounded by the Coast Range to the west and Sierra Nevada Mountains to the east. Tertiary rocks, which were deposited nearly continuously from Cretaceous to Pleistocene time (1.6 to 65 million years ago), are largely of marine origin and underlie a relatively thin cover of Quaternary alluvium. The Tertiary rocks overlie Jurassic-Cretaceous marine sedimentary rocks along the western side of the valley. Northwest-trending anticlines in the Tertiary strata are reflected by the gas and oil fields and by low hills in the valleys.

5.15.1.2 Local Geology

The Project is located along the northeastern face of the Elk Hills, which are the surface manifestation of an anticlinal uplift along the western side of the San Joaquin Valley. The Elk Hills are composed of sands, conglomerates, mudstones, and shales derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the eroded materials on an apron of small coalescing fans along the northeastern flank of the hills, which abut the much larger Kern River fan to the north.

As shown on Figure 5.15-1, Regional Geologic Map of Project, and Figure 5.15-2, Project Site Geologic Map, surficial deposits at the Project and Project Site have been described as Quaternary age (less than 1.6 million years old) alluvial gravel and sand of valley areas (Q); and bedrock at the surface and underlying alluvium consisting of Pliocene- to Pleistocene-age (11,000 to 5.3 million years old) Tulare Formation (QPc) that consists of alternating beds of sandstone and mudstone (Dibblee, 2005). According to Dibblee (2005) these deposits are stream-laid, weakly indurated pebble gravels, sands, and clays; they are light gray in color. The pebbles are composed chiefly of Monterey siliceous shale and debris from bedrock in the adjacent Temblor Range to the west.

The Project is located in the Kern County subbasin (DWR Subbasin No. 5-22.14) of the San Joaquin Valley Groundwater Basin. Groundwater was not encountered within 60 to 100 feet of the ground surface, based on the geotechnical borings drilled and cone penetration tests performed at the Project Site during the subsurface investigations (URS, 2009). In the vicinity of the Project Site, spring-time groundwater elevations based on regional data from the California Department of Water Resources (DWR) have ranged from approximately elevation 180 to 250 above mean sea level in recent years, which corresponds to approximately 40 to 110 feet below grade (DWR, n.d.). For additional information regarding groundwater conditions, see Section 5.14, Water Resources.

The linear facilities (electrical transmission line, natural gas pipeline, water supply pipelines, and railroad spur) will be underlain by earth materials that are similar to those at the Project Site.

5.15.1.3 Tectonic Framework

The Project, like most of California, is in a seismically active region. A review of geologic literature did not identify the presence of any known active or potentially active faults at the Project Site, or crossing the Project linears. Except for an inactive fault crossed by the CO_2 pipeline, Figure 5.15-1, Regional Geologic Map of Project, does not show any faults mapped within the Project.

The closest known faults classified as active by the State of California Geological Survey (CGS) are the San Andreas Fault, located, using Blake (2000), approximately 21 miles to the west; the White Wolf Fault, located approximately 23 miles to the southeast; and the Pleito Thrust, located approximately 27 miles south of the Project Site. These faults are shown on Figure 5.15-3, Regional Fault Map—Major Faults of Southern California.

5.15.1.4 Historic Seismic Events—Southern California

The most significant recorded seismic events of Southern California in terms of their location and magnitude (relative to the Project Site) are summarized in Table 5.15-1, Significant Recorded Seismic Events in Southern California.

The largest-magnitude earthquake recorded in Southern California was a magnitude 7.9 along the San Andreas Fault at Fort Tejon on January 9, 1857. Figure 5.15-4, Epicentral Location of Major Earthquakes in Southern California, presents the location of the epicenters of recorded seismic events greater than magnitude 3.0 since 1735.

Naturally occurring seismic events on the order of magnitude 6 and smaller, even if located in the immediate area of the field, should not cause significant damage to the Project or wells in EHOF.

There is no history of induced seismicity at EHOF, and the chance of Project-induced seismicity is viewed as remote. In the unlikely event of Project-induced seismicity, the magnitude of the seismic event would be less than a magnitude 4, considering the geologic setting, areal extent, and depth of proposed operations, as well as anticipated pressure and stress changes (Terralog Technologies, 2008). Seismic events of magnitude 4 may be felt in the immediate area but would not cause structural damage to buildings or facilities.

Any potential induced seismicity is at least an order of magnitude smaller than natural seismicity hazards for the area.

5.15.1.5 Geologic Hazards

Geologic hazards that are known to be present in portions of California and that could potentially affect the Project Site or the linear facilities are described in the following paragraphs. The primary geologic hazards at the Project (Project Site and linear facilities) include ground motion from a seismic event and the potential for expansive soils due to high clay content in surface soils. The identified geologic hazards are considered less than significant with the proposed mitigation. A complete listing of potential geologic hazards, likelihood of occurrence, and potential impacts at the Project are discussed in further detail below.

Surface Rupture

Primary ground rupture is defined as the surface displacement that occurs along the surface trace of the causative fault during an earthquake. Ground rupture can occur along known pre-existing faults, unknown pre-existing faults, or new faults that develop as a result of a seismic event.

According to the California Department of Conservation, Division of Mines and Geology (CDMG, 1997; Hart and Bryant, 1997), the Project is not located in an Alquist–Priolo Earthquake Fault Zone. Based on a review of available geologic data, no surface traces of active faults pass through the Project. Therefore, the potential for primary ground rupture at the Project is considered to be low. Consequently, potential impacts from a primary ground rupture will be less than significant.

Seismic Ground Shaking

The Project Site as well as off-site linears are susceptible to ground shaking generated during earthquakes on nearby faults. The intensity of ground shaking, or strong ground motion, is dependent upon the distance of the fault to the Project, the magnitude of the earthquake, and the underlying soil conditions. This hazard can be mitigated by designing and constructing structures and buildings in conformance with current building codes and engineering practices. With the implementation of Geo-1, discussed in Section 5.15.4.1, Seismic Shaking, potential impacts from seismic shaking will be less than significant.

Liquefaction

Liquefaction is a process in which soil grains in a saturated sandy deposit lose contact because of earthquakes or other sources of ground shaking. The soil deposit temporarily behaves as a viscous fluid; pore pressures rise; and the strength of the deposit is greatly diminished. Liquefaction is often accompanied by sand boils, lateral spreading, and post-liquefaction settlement as the pore pressures dissipate. Liquefiable soils typically consist of cohesionless sands and silts that are loose to medium-dense, and saturated.

Based upon the findings of the URS (2009) geotechnical investigation, the potential for liquefaction to occur and impact the Project Site is low to nil. As a result, impacts will be less than significant. The Project linears may require additional evaluation during detailed design.

Seismically Induced Dry Sand Settlement

The presence of loose, unsaturated granular soil layers could result in some seismically induced settlement that will need to be taken into account during foundation design. The potential for seismically induced settlement for the Project Site was evaluated by URS (2009). In general, seismically induced settlement could occur within the susceptible native, loose to medium-dense sandy soils in the upper 50 feet. However, remedial grading and design can reduce the impact of seismically induced dry sand settlement to less than significant. The Project linears may require additional evaluation during detailed design. With the implementation of Geo-2, discussed in Section 5.15.4.3, Seismically Induced Dry Sand Settlement, impacts will be less than significant.

Subsidence

Subsidence ground failure can be aggravated by several causes, including ground shaking and withdrawal of large volumes of fluids from underground reservoirs, and also by the addition of surface water to certain types of soils (hydro-compaction). According to the Kern County General Plan Safety Element (2009), the Project Site, as well as the linears, is not in an area mapped as having measured land subsidence or hydro-compaction; therefore, it is unlikely that subsidence will occur at the Project Site or along the linears. As a result, potential impacts will be less than significant.

Flooding

According to Figure 14 of the Kern County General Plan Safety Element (Kern County, 2009), the Project Site is not in an area identified as having flood hazards or shallow groundwater. The CO_2 pipeline extending to the south of the Project Site will cross a flood hazard zone associated with the Kern River Flood Control Canal. None of the other Project linears crosses through designated flood hazard zones.

Provided with proper drainage design, the Project Site is not likely to experience flooding. As a result, impacts will be less than significant.

Tsunamis

A tsunami is a great sea wave, commonly called a tidal wave, produced by a significant undersea disturbance such as tectonic displacement of the sea floor associated with large, shallow earthquakes. The Project is situated more than 200 feet above sea level. As such, the Project Site and associated linears are not subject to tsunamis. As a result, impacts will be less than significant.

Seiches

A wave created by an earthquake shaking in an enclosed body of water is called a seiche. The potential for a seiche to occur is related to the natural frequency of vibration of the body of water, as well as to the predominant frequencies of vibration in the seismic event. Seiches at the Project are highly unlikely due to the absence of lakes or large bodies of water in the immediate area. As a result, impacts will be less than significant.

Volcanic Hazards

No centers of potential volcanic activity occur within hundreds of miles of the Project. Volcanic hazards, such as lava flows and ash falls, are therefore not anticipated to present a hazard. As a result, impacts will be less than significant.

Landslides and Lateral Spreading

Landsliding and lateral spreading are often triggered by earthquakes and usually occur in areas of moderate to high relief, weak soil or rock strength, and high groundwater. The Project Site is in an area of low relief. Therefore, the potential for localized landslides or lateral spreading to or occurring within the Project Site is generally low. However, man-made excavations and fills to construct the Project's existing drainage system consist of un-engineered soils with weak soil strength. These un-engineered fill slopes have a medium potential for landsliding and lateral spreading. The CO_2 pipeline that will extend south of the Project Site will traverse areas of moderate relief. The Project slopes and CO_2 pipeline will require slope stability evaluation, which will be provided by a design-level geotechnical investigation. With the implementation of Geo-3, discussed in Section 5.15.4.7, Landslides and Lateral-Spreading Hazards, impacts will be less than significant.

Expansive Soils

Expansive soils are fine-grained soils (generally high-plasticity clays) that can undergo a significant increase in volume with an increase in water content, and a significant decrease in volume with a decrease in water content. Changes in the water content of a highly expansive soil can result in severe distress to structures constructed upon the soil.

The subsurface investigation (URS, 2009) indicates that the surficial soils at the Project Site are fine-grained soils comprised predominantly of clays and silty clays. The Project Site clays have high plasticity and highly organic soils with remnants of vegetations from past and current agricultural use. In general, these upper soils possess relatively high moisture contents and are unsuitable for direct support of shallow foundations or new engineered fills. With the implementation of Geo-4, discussed in Section 5.15.4.8, Expansive Soils, impacts will be less than significant.

5.15.1.6 Geologic Resources

Geologic resources of recreational, commercial, or scientific value in the Project vicinity that could be affected include oil and gas reserves. The Project is not located over mines, aggregate deposits, or mineral deposits; no known scientific or recreational geologic resources were identified in the vicinity of the Project, based on published information (CDMG, 1962, Mines and Mineral Resources of Kern County California, Plate 1). Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) Map 421 identifies a plugged and abandoned dry hole (Quintana Production Co. "Union-Gamay" 56X-10) drilled at the Project Site (DOGGR, n.d.). The well drilled on the Project Site did not encounter petroleum. Therefore, the likelihood of petroleum reserves below the Project Site is unlikely.

The CO_2 pipeline passes through the Elk Hills, North Coles Levee, South Coles Levee petroleum fields; and the Bowerbank natural gas field. Construction of the pipeline through these petroleum fields is not likely to prevent recovery of the resources, and injection of CO_2 into the EHOF is designed to enhance recovery of those deposits while sequestering the CO_2.

As a result, the negative impacts on geologic resources will be less than significant.

5.15.2 Environmental Consequences

Potential impacts of the Project on the geologic or mineral resources and potential impacts of geologic hazards can be divided into those related to construction activities and those related to Project operation.

5.15.2.1 Construction-Related Impacts

Construction-related impacts on the geologic or mineral resources primarily involve grading operations and operations for foundation support. The Project Site slopes and temporary construction slopes and excavations should be properly designed to be stable. Project development is not anticipated to result in significant adverse impacts on geologic or mineral resources. Potentially significant impacts by geologic conditions on construction are not anticipated. With implementation of the mitigation measures outlined in Section 5.15.4, Mitigation Measures, impacts on Project construction by the geologic environment will be reduced to less-than-significant levels. There will be no significant impacts on the geologic environment resulting from construction of the Project linears.

5.15.2.2 Operation-Related Impacts

No significant adverse impacts on geologic resources have been identified as a result of operation. Potential impacts of geologic hazards on the Project and ancillary facility operations include seismic shaking. With implementation of the measures outlined in Section 5.15.4, Mitigation Measures, impacts on Project operations from geologic hazards will be reduced to a less-than-significant level.

There will be no significant impacts on the geologic environment resulting from operation of the Project linears.

5.15.2.3 OEHI Project Impacts

According to the analysis contained in Appendix A-1, Section 4.6, Geology and Soils, with implementation of identified mitigation measures, construction and operation of the OEHI Project would not result in significant adverse impacts on geologic resources and impacts on OEHI Project operations from geologic hazards will be reduced to a less-than-significant level.

5.15.3 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project's cumulative impacts (CEQA Guidelines Section 15130). A "cumulative impact" consists of an impact which is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines Section 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines Section 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065 [b][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines Section 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines Section 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines Section 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines Section 15130[b]).

A cumulative impact analysis starts with a list of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines Section 15130[b]). Factors to consider when determining whether to include a related project include the nature of the environmental resource being examined, the location of the project, and its type (CEQA Guidelines Section 15130[b]). For purposes of this AFC Amendment, Kern County was contacted to obtain a list of related projects, which is contained in Appendix I. Depending on its location and type, not every project on this list is necessarily relevant to the cumulative impact analysis for each environmental topic.

For purposes of geological hazards and resources, it was determined that none of the projects was relevant for the cumulative impact analysis.

Cumulative impacts on the geologic resources at the Project are considered to be negligible.

According to the analysis contained in Appendix A-1, Section 4.6, Geology and Soils, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts to geologic resources.

5.15.4 Mitigation Measures

5.15.4.1 Seismic Shaking

The potential exists for ground shaking from a variety of nearby sources, including the San Andreas Fault.

- **Geo-1.** Project facilities will be designed in accordance with the seismic design criteria of applicable building codes. Seismic design criteria will be provided either by codes or a design-level geotechnical investigation.

5.15.4.2 Liquefaction

No liquefaction hazard exists at the Project Site, and no mitigations are suggested. In general, mitigation of liquefaction on Project linears will be accomplished in the design of the specific structures.

5.15.4.3 Seismically Induced Dry Sand Settlement

- **Geo-2.** To reduce the potential for adverse differential settlement beneath heavily loaded, settlement-sensitive structures, removal of the susceptible soils and replacement with engineered fill have been recommended for structures that will be founded on shallow foundations. Alternatively, deep foundations (driven piles) have been recommended. Settlement design criteria can be provided by a design-level geotechnical investigation.

5.15.4.4 Subsidence

Subsidence at the Project Site is not considered to be a significant hazard, and no mitigations are needed.

5.15.4.5 Flooding

Flooding at the Project Site is not considered to be a significant hazard, and no mitigations are needed.

5.15.4.6 Tsunamis, Seiches, and Volcanic Hazards

Tsunamis, seiches, and volcanic hazards are not present in the Project area, and no mitigations are needed.

5.15.4.7 Landslides and Lateral-Spreading Hazards

- **Geo-3.** To reduce the potential for landslides and lateral spreading, Project Site slopes that may be susceptible will be designed to mitigate these potential hazards. Mitigation will include removal of the susceptible soils and replacement with engineered fill or reducing the hazard by elimination of Project Site slopes. Slope stability design criteria will be provided by a design-level geotechnical investigation.

5.15.4.8 Expansive Soils

- **Geo-4.** To reduce the potential for adverse expansion potential beneath Project Site improvements, removal of the susceptible soils and replacement with engineered fill have been recommended, as appropriate. Expansive soil design criteria can be provided by a design-level geotechnical investigation.

5.15.4.9 Geologic Resources

There are no significant adverse impacts on geologic resources; therefore, no mitigations are needed.

5.15.5 Laws, Ordinances, Regulations, and Standards

The Project will be constructed and operated in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to geologic hazards and resources discussed below and summarized in Table 5.15-2, Summary of LORS—Geological Hazards.

5.15.5.1 Federal

There are no federal LORS for geological hazards and resources or for grading and erosion control.

5.15.5.2 State

California Public Resources Code *(PRC)* 25523(a), 20 CCR § 1252 (b) and (c)

None of the Project components are located in or cross an Alquist–Priolo earthquake zone; therefore, the Project will not be subject to requirements for construction within an earthquake fault zone.

California Building Code

The 2010 edition of the California Building Code (CBC) is based on the International Building Code (IBC) 2009 edition**,** with revisions specifically tailored to geologic hazards in California.

- Chapter 16: Structural Design Requirements, Division IV Earthquake Design

  This section requires that structural designs be based on geologic information for seismic parameters, soil characteristics, and site geology.

- Chapter 18: Foundations and Retaining Walls, Division I and III

  Division I sets requirements for excavations and fills, foundations, and retaining structures with regard to expansive soils, subgrade bearing capacity, and seismic parameters. It also addresses waterproofing and damp-proofing foundations. In Seismic Zones 3 and 4, as defined by the Uniform Building Code (UBC), liquefaction potential at the site should be evaluated. Division III contains requirements for mitigating effects of expansive soils for slab-on-grade foundations.

- Chapter 33: Site Work, Demolition and Construction

  These sections establish rules and regulations for construction of cut-and-fill slopes, fill placement for structural support, and slope setbacks for foundations.

California Environmental Quality Act of 1970

The California Energy Commission (CEC) will be the lead agency for rules and regulations to implement the California Environmental Quality Act (CEQA). Appendix G, Section VI, of the CEQA guidelines contains the geologic hazards and resources related to the Project.

5.15.5.3 Local

Kern County General Plan, Chapter 4, Safety Element

The Safety Element of the Kern County General Plan provides an implementation program to reduce the threat of seismic and public safety hazards in unincorporated areas of Kern County.

The Project will comply with all Seismic/Geologic Hazard Elements of the Kern County General Plan. No active faults will be crossed by the Project linears.

The county will review the geologic information and geotechnical recommendations presented in design-level geotechnical reports.

5.15.6 Involved Agencies and Agency Contacts

Agencies with jurisdiction to enforce LORS related to geologic hazards and resources and the appropriate contact person are summarized in Table 15.5-3, Involved Agencies and Agency Contacts.

5.15.7 Permits Required and Permit Schedule

There are no applicable permits required for geologic hazards.

5.15.8 References

Blake, T.F., 2000. EQFAULT, EQSEARCH, and FRISKSP. Computer Programs for the Estimation of Peak Horizontal Acceleration from Southern California Earthquakes.

CDMG (California Department of Conservation, Division of Mines and Geology), 1962. Mines and Mineral Resources of Kern County California, County Report 1.

CDMG (California Department of Conservation, Division of Mines and Geology), 1997. Fault Rupture Hazard Zones in California, Special Publication 42, 26 p.

CGS (California Geological Survey), 2002a. California Geological Survey, Note 36, California Geomorphic Provinces.

CGS (California Geological Survey), 2002b. Appendix A 2002 California Fault Parameters.

CGS (California Geological Survey), 2007. "Significant California Earthquakes (M > 6.5 or that caused loss of life or more than $200,000 in damage)," edited June 17, 2005. http://www.consrv.ca.gov/cgs/rghm/quakes/Pages/eq_chron.aspx.

Dibblee, T.W., 2005. Geologic Map of the East Elk Hills and Tupman Quadrangles, Kern County, California.

DOGGR (State of California—Department of Conservation, Division of Oil, Gas, and Geothermal Resources), n.d. Map 421, Field: Elk Hills (East), Kern County, Draft. ftp://ftp.consrv.ca.gov/pub/oil/maps/dist4/421/Map421.pdf.

DWR (California Department of Water Resources), n.d. Kern Groundwater Basin Spring 2000-2006, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer. http://www.sjd.water.ca.gov/groundwater/basin_maps/index.cfm.

Hart, E.W., and W.A. Bryant, 1997. *Fault-Rupture Hazard Zones in California, Alquist–Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps.* California Department of Conservation Division of Mines and Geology Special Publication 42, 38 p.

Kern County, 2009. "Chapter 4, Safety Element," *Kern County General Plan*..

Sadigh, K., C.Y. Chang, J.A. Egan, F. Makdisi, and R.R. Youngs, 1997. "Attenuation Relationships for Shallow Crustal Earthquakes Based on California Strong Ground Motion Data." Seismological Research Letters, Vol. 68, pp. 180–189.

Terralog Technologies USA, Inc., 2008. "Potential for Induced Seismicity from CO_2 Injection Operations at Elk Hills." HEI Internal Report. 30 pp.

URS Corporation, 2009. Preliminary Geotechnical Investigation, Proposed Hydrogen Energy California Project (HECA), Kern County, California, URS Job No. 289067571.

Table 5.15-1
Significant Recorded Seismic Events in Southern California

Date	Location/Event	Approximate Distance to Project Site[1] (miles [km])	Earthquake Moment Magnitude[2] (M_w)	Approximate Site Acceleration at Project Site[3] (g)
Jan 09, 1857	Fort Tejon	23.5 [37.8]	7.9	0.242
Jul 21, 1952	Kern County	30.9 [49.8]	7.3	0.169
Jun 28, 1992	Landers	184.6 [297.0]	7.3	0.015
Oct 16, 1999	Hector Mine	183.4 [295.1]	7.1	0.010
May 19, 1940	Imperial County	285.7 [459.7]	7.0	0.003
Jan 17, 1994	Northridge	91.0 [146.5]	6.7	0.020
Feb 09, 1971	San Fernando	84.6 [136.1]	6.6	0.017

Sources: Blake, 2000; CGS, 2002a and 2007.

Notes:

[1] Site coordinates for Blake analysis: latitude 35.3327, longitude 119.3845.

[2] CGS, 2002b, Appendix A, 2002 California Fault Parameters.

[3] Attenuation relation for Blake analysis: Sadigh *et al*., 1997.

Acronyms and Abbreviations:

CGS = California Geological Survey

g = unit of acceleration

km = kilometers

M_w = moment magnitude scale

Table 5.15-2
Summary of LORS—Geological Hazards

LORS	Requirements	Conformance Section	Administering Agency
Federal Jurisdiction			
No federal LORS are applicable			
State Jurisdiction			
Cal PRC 25523(a), Alquist–Priolo Earthquake Fault Zone	N/A	5.15.5.2, State	California Energy Commission Facilities Siting Division Siting Office, California Energy Commission Facilities Siting Division Engineering Office, and Kern County Building Inspection Division
Local Jurisdiction			
Kern County General Plan/Safety Element	Minimize injuries and loss of life and reduce property damage. Reduce economic and social disruption resulting from earthquakes, fire, flooding, and other geologic hazards by assuring the continuity of vital emergency public services and functions.	5.15.5.3, Local	Kern County Planning Department
CBC, Chapters 16, 18, and 33	Codes address excavation, grading, and earthwork construction, including construction applicable to earthquake safety and seismic activity.	5.15.5.3, Local	Kern County Planning Department

Notes:
CBC = California Building Code
LORS = laws, ordinances, regulations, and standards
N/A = Not applicable
PRC = Public Resources Code

Table 5.15-3
Involved Agencies and Agency Contacts

Agency		Contact/Title	Telephone
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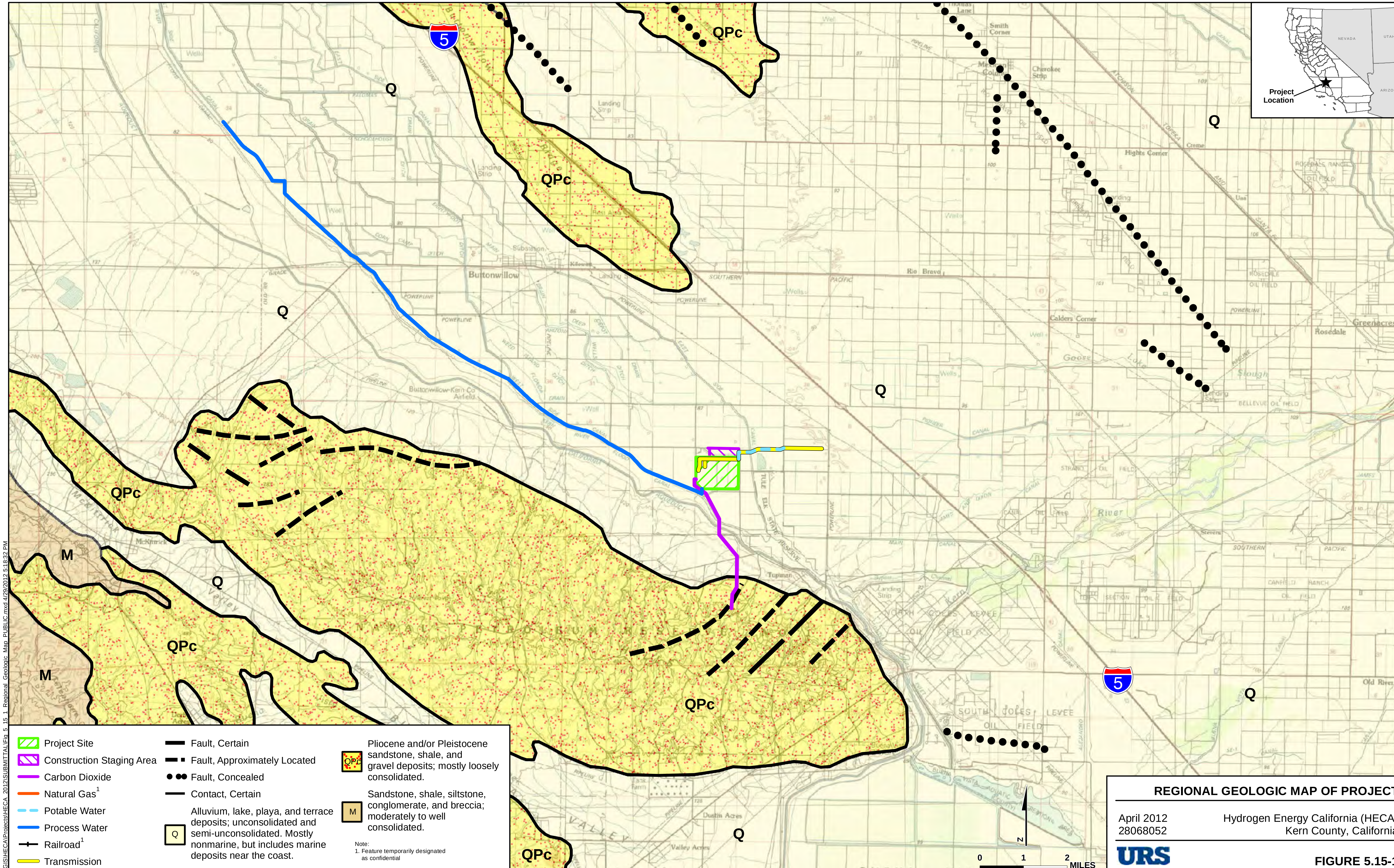
	Kern County Building Inspection Division 2700 “M” Street, Suite 100 Bakersfield, CA 93301	Charles Lackey, Director	(661) 862-8650



REGIONAL GEOLOGIC MAP OF PROJECT

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 5.15-1

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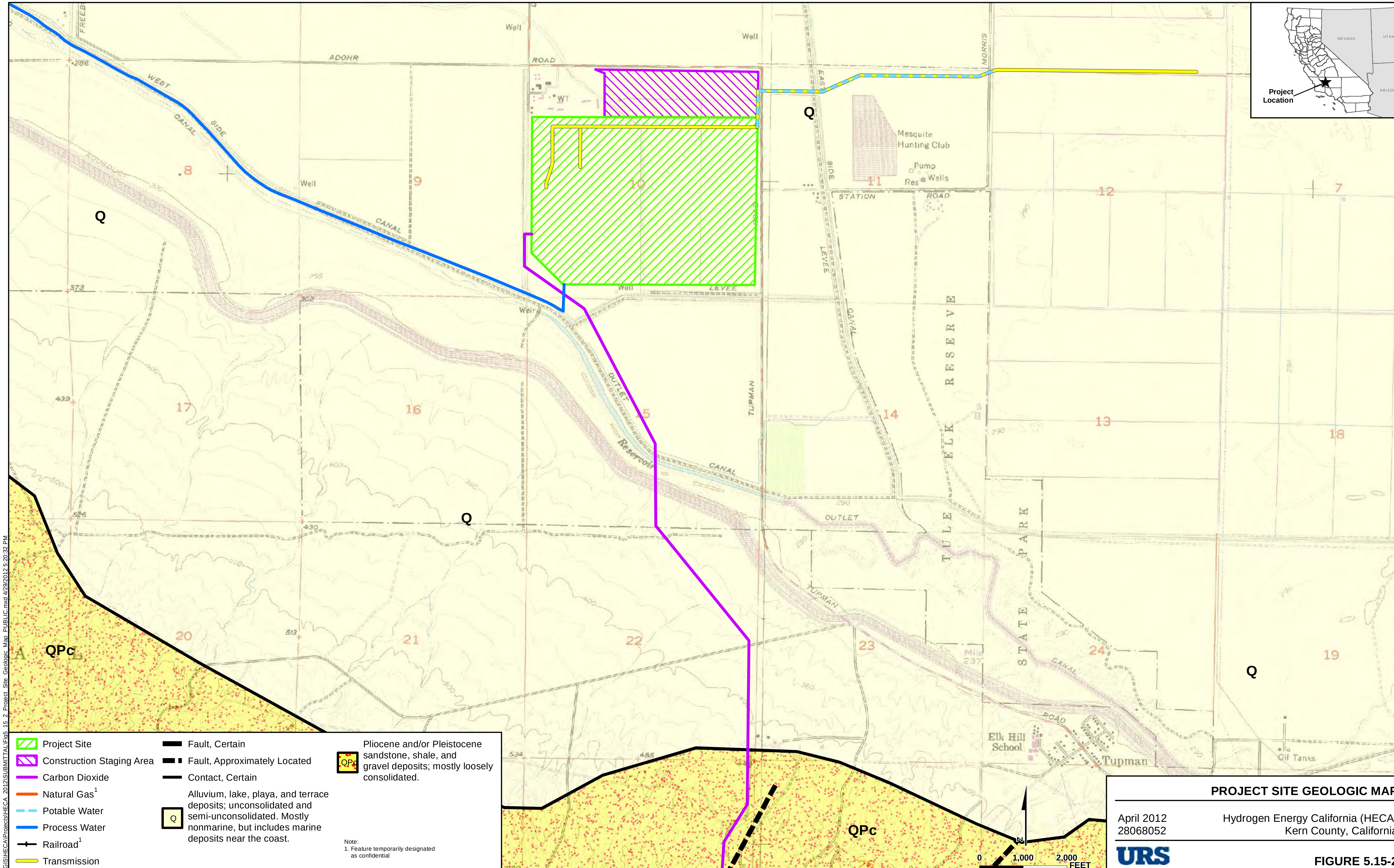
Sources: USGS (30'x60' quads: Taft 1982, Delano 1982). Jennings, C. W., 1977, Geologic Map of California, 1:750,000-Scale (Geology).



Sources: USGS (7.5' quads: East Elk Hills 1977, Tupman 1977). Jennings, C. W., 1977, Geologic Map of California, 1:750,000-Scale (Geology).

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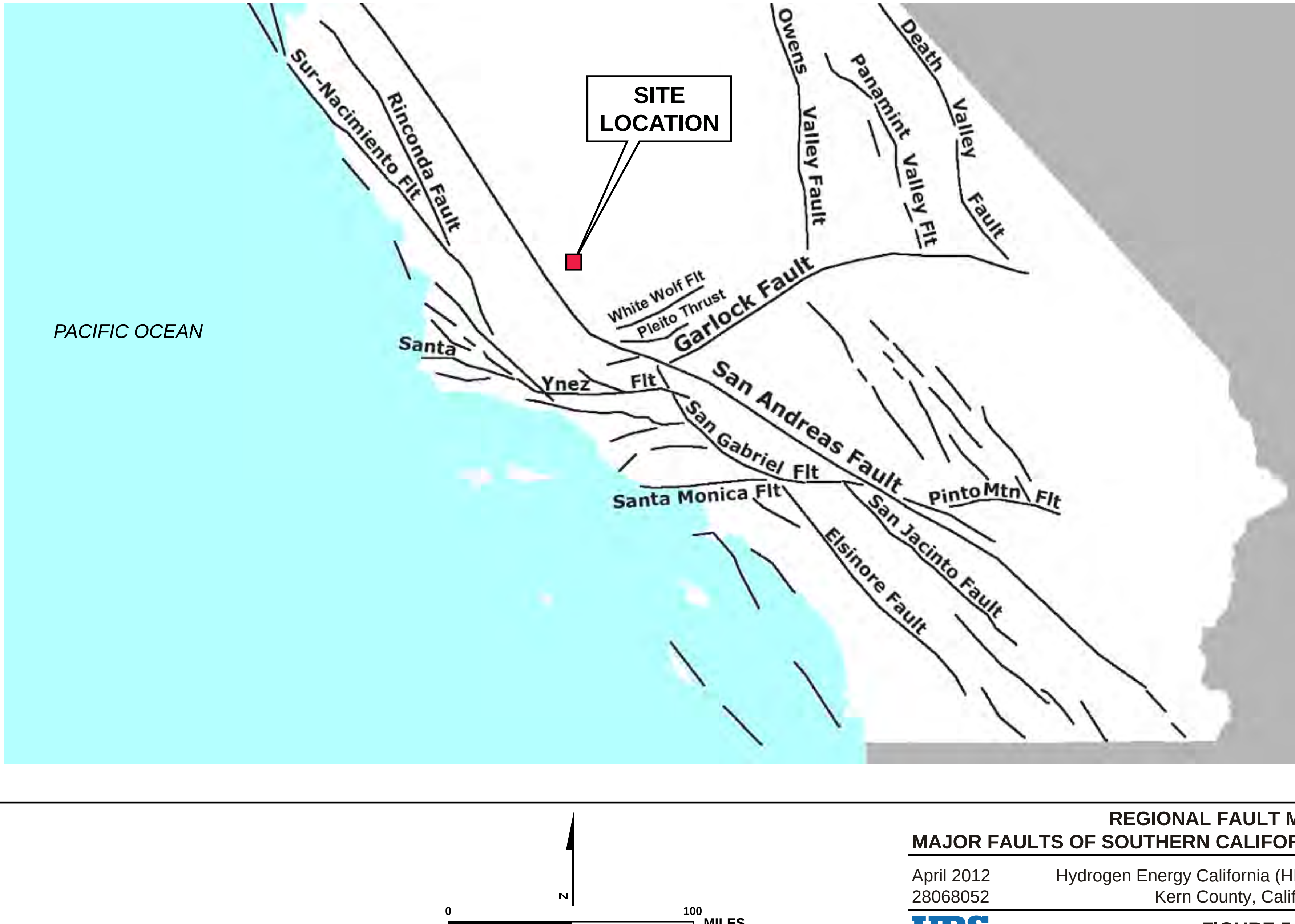


REGIONAL FAULT MAP:
MAJOR FAULTS OF SOUTHERN CALIFORNIA

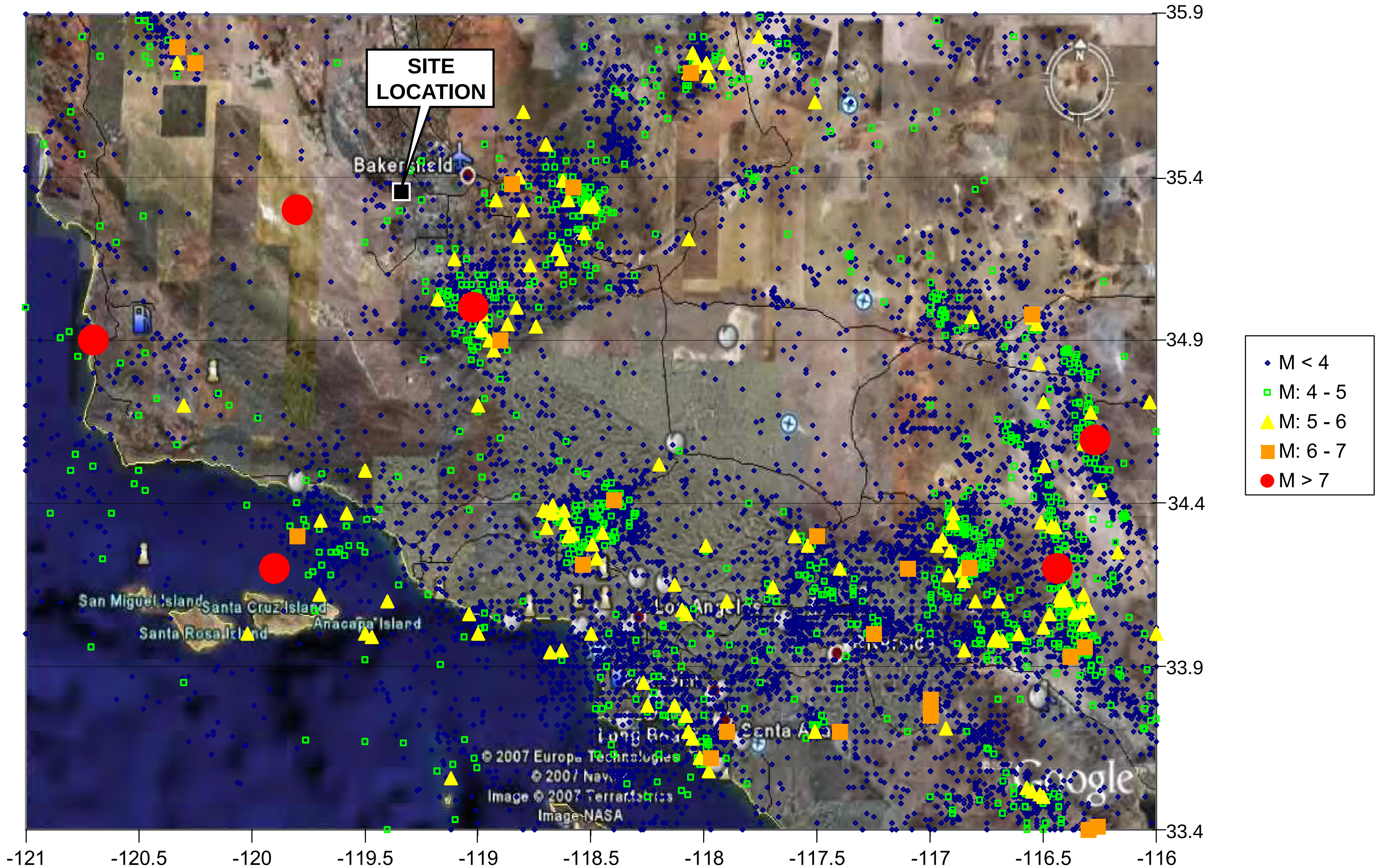
April 2012	Hydrogen Energy California (HECA)
28068052	Kern County, California

URS

FIGURE 5.15-3

Source: United Stated Geological Survey: http://earthquake.usgs.gov

vsa_4/04/12...U:\GIS\HECA\Projects\HECA_2012\Geology\AI\Fig5_15_3_regional fault.ai



N

EPICENTRAL LOCATION OF MAJOR EARTHQUAKES IN SOUTHERN CALIFORNIA

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

FIGURE 5.15-4

vsa_4/04/12...U:\GIS\HECA\Projects\HECA_2012\Geology\AI\Fig5_15_4_Epicentral Locs.ai

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Tables

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5.16 PALEONTOLOGICAL RESOURCES

Hydrogen Energy California LLC (HECA LLC) is proposing an Integrated Gasification Combined Cycle (IGCC) polygeneration project (HECA or Project). The Project will gasify a fuel blend of 75 percent coal and 25 percent petroleum coke (petcoke) to produce synthesis gas (syngas). Syngas produced via gasification will be purified to hydrogen-rich fuel, and used to generate a nominal 300 megawatts (MW) of low-carbon baseload electricity in a Combined Cycle Power Block, low-carbon nitrogen-based products in an integrated Manufacturing Complex, and carbon dioxide (CO_2) for use in enhanced oil recovery (EOR). CO_2 from HECA will be transported by pipeline for use in EOR in the adjacent Elk Hills Oil Field (EHOF), which is owned and operated by Occidental of Elk Hills, Inc. (OEHI). The EOR process results in sequestration (storage) of the CO_2.

Terms used throughout this section are defined as follows:

- **Project or HECA.** The HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located.

- **OEHI Project.** The use of CO_2 for EOR at the EHOF and resulting sequestration, including the CO_2 pipeline, EOR processing facility, and associated equipment.

- **OEHI Project Site.** The portion of land within the EHOF on which the OEHI Project will be located and where the CO_2 produced by HECA will be used for EOR and resulting sequestration.

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

This introduction provides brief descriptions of both the Project and the OEHI Project. Additional HECA Project description details are provided in Section 2.0. Additional OEHI Project description details are provided in Appendix A of this Application for Certification (AFC) Amendment.

5.16.1 HECA Project Linear Facilities

The HECA Project includes the following linear facilities, which extend off the Project Site (see Figure 2-7, Project Location Map):

- **Electrical transmission line.** An approximately 2-mile-long electrical transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station east of the Project Site.

- **Natural gas supply pipeline.** An approximately 13-mile-long natural gas interconnection will be made with PG&E natural gas pipelines located north of the Project Site.

- **Water supply pipelines and wells.** An approximately 15-mile-long process water supply line and up to five new groundwater wells will be installed by the Buena Vista Water Storage District (BVWSD) to supply brackish groundwater from northwest of the Project Site. An approximately 1-mile-long water supply line from the West Kern Water District (WKWD) east of the Project Site will provide potable water.

- **Coal transportation.** HECA is considering two alternatives for transporting coal to the Project Site:

  - **Alternative 1, rail transportation.** An approximately 5-mile-long new industrial railroad spur that will connect the Project Site to the existing San Joaquin Valley Railroad (SJVRR) Buttonwillow railroad line, north of the Project Site. This railroad spur will also be used to transport some HECA products to market.

  - **Alternative 2, truck transportation.** An approximately 27-mile-long truck transport route via existing roads from an existing coal transloading facility northeast of the Project Site. This alternative was presented in the 2009 Revised AFC.

5.16.2 OEHI Project

OEHI will be installing the CO_2 pipeline from the Project Site to the EHOF, as well as installing the EOR Processing Facility, including any associated wells and pipelines needed in the EHOF for CO_2 EOR and sequestration. The following is a brief description of the OEHI Project, which is described in more detail in Appendix A of this AFC Amendment:

- **CO_2 EOR Processing Facility.** The CO_2 EOR Processing Facility and 13 satellites are expected to occupy approximately 136 acres within the EHOF. The facility will use 720 producing and injection wells: 570 existing wells and 150 new well installations. Approximately 652 miles of new pipeline will also be installed in the EHOF.

- **CO_2 pipeline.** An approximately 3-mile-long CO_2 pipeline will transfer the CO_2 from the HECA Project Site south to the OEHI CO_2 EOR Processing Facility.

5.16.3 Paleontological Resources Study Area

The Paleontological Resources Study Area (PRSA) evaluated in this section consists of the area within a 1-mile radius of the 453-acre HECA Project Site, HECA linear facilities and the OEHI CO_2 pipeline north of the California Aqueduct. All of the proposed HECA linear facilities, as well as the OEHI CO_2 pipeline north of the California Aqueduct, were surveyed by PaleoResource Consultants (PRC) for paleontological resources. PRC's confidential technical report showing locations of fossil discoveries is provided in Appendix O. No impacts to paleontological resources related to coal transportation Alternative 2 (truck transportation) are expected because the coal transloading facility is an existing use and trucks would use existing roads. Therefore, coal transportation Alternative 2 (truck transportation) is not further evaluated in this section. This section does address potential impacts associated with Alternative 1 (rail transportation).

OEHI conducted the surveys for the area south of the California Aqueduct along the current CO_2 pipeline alignment, as well as for the CO_2 EOR Processing Facility. The results of those surveys are presented in Appendix A-1 of this AFC Amendment, Section 4.5.

5.16.4 Introduction

Paleontological resources (fossils) are the remains or traces of prehistoric animals and plants. Fossils are important scientific and educational resources because of their use in (1) documenting the presence and evolutionary history of particular groups of now extinct organisms, (2) reconstructing the environments in which these organisms lived, (3) determining the relative ages of the strata in which they occur, and (4) determining the geologic events that resulted in the deposition of the sediments in which they were buried.

This section of the AFC Amendment summarizes the potential environmental impacts on paleontological resources that could result from construction of the Project. This paleontological resources inventory and impact assessment was prepared by Dr. Lanny H. Fisk, Ph.D., a California-licensed professional geologist (PG) and Principal Paleontologist, and by Stephen J. Blakely, Project Manager and Staff Paleontologist, both with PaleoResource Consultants (PRC). It meets all requirements of the California Energy Commission (CEC) regulations (CEC, 2007) and the standard measures for mitigating adverse construction-related environmental impacts on significant paleontological resources established by the Society of Vertebrate Paleontology (SVP, 1996 and 2010).

5.16.5 Affected Environment

5.16.5.1 Geographic Location

The Project Site is located near the unincorporated community of Tupman in western Kern County, California (Figure 2-7) within Section 10 of Township 30 South, Range 24 East. The site is located approximately 7 miles west of Bakersfield, California, and is near the EHOF Unit. The center of the site is at approximately latitude 35°19'41" north and longitude 119°23'08" west.

At present, the majority of the Project Site is used for agricultural purposes, including cultivation of cotton, alfalfa, and onions. Existing surface elevations vary from about 288 feet above mean sea level (msl) in the southeast corner to about 285 feet above msl in the northwest corner. Elevation along the right-of-way (ROW) of linear facilities varies greatly, from less than 300 feet to over 900 feet.

The PRSA is located near the northern edge of the Elk Hills, which are near the western border of the San Joaquin Valley. The San Joaquin Valley comprises roughly the southern two-thirds of the major north-northwest-oriented synclinorium called either the Valle Grande (Clark, 1929), Great Valley (Fenneman, 1931; Hackel, 1966), Great Interior Valley (Harradine, 1950), Great San Joaquin Valley (Piper *et al.*, 1939; Davis *et al.*, 1957), or California Trough (Piper *et al.*, 1939). The Great Valley Physiographic Province is located between the Sierra Nevada Physiographic Province on the east and the Coast Ranges Physiographic Province on the west

(Jahns, 1954). The Elk Hills are approximately 17 miles long and 7 miles wide; they reach an elevation of 1,551 feet, which is approximately 1,200 feet above the floor of the San Joaquin Valley (Berryman, 1973).

5.16.5.2 Regional Geologic Setting

The general geology of the San Joaquin Valley has been described in some detail by Mendenhall (1908), Mendenhall *et al.* (1916), Piper *et al.* (1939), 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, 1991), Beyer and Bartow (1988), Callaway and Rennie (1991), and Lettis and Unruh (1991), among others.

Only a few authors have specifically described the geology in the vicinity of the unincorporated community of Tupman or the Elk Hills, including Woodring *et al.* (1932), Porter (1943), Wells (1952), Adkison (1973), Berryman (1973), Dibblee (1973), and Maher *et al.* (1975). Surficial geologic mapping of the Project vicinity has been provided at a scale of 1:1,000,000 by Wahrhaftig *et al.* (1993); at a scale of 1:750,000 by Jennings (1977); at a scale of 1:500,000 by Mendenhall *et al.* (1916), Jenkins (1938), and Bartow (1987, 1991); at a scale of approximately 1:320,000 by Morton and Troxel (1962); at a scale of 1:250,000 by Smith (1964); at a scale of 1:62,500 by Dibblee (1972); at a scale of 1:31,680 by Woodring *et al.* (1932); and at a scale of 1:24,000 by Dibblee (2005a-f).

The information in these geologic maps and published and unpublished reports form the basis of the following discussion. Individual maps and publications are incorporated into this section and referenced where appropriate. For obtaining the older geological literature, the exhaustive compilation entitled Geological Literature on the San Joaquin Valley of California by Maher *et al.* (1973) was particularly helpful. The aspects of geology pertinent to this report are the types, distribution, and age of sediments immediately underlying the Project area and their probability of producing fossils during construction. The site-specific geology in the vicinity of the Project is discussed separately below.

The San Joaquin Valley is a great structural depression between the westerly tilted Sierra Nevada block on the east and the complexly folded and faulted Coast Ranges on the west. The San Joaquin Valley is filled with a thick sequence of Mesozoic and Tertiary marine and non-marine sediments covered by a relatively thin veneer of Quaternary alluvial sediments (Bailey, 1966). The Elk Hills are located along the western edge of the San Joaquin Valley, where they rise above the surrounding, relatively flat valley. The Elk Hills are the topographic expression of the Elk Hills Anticline, which is part of the *en echelon* folding of the Tertiary and Quaternary sedimentary strata along the western side of the San Joaquin Valley (White, 1987). The axes of these folds trend generally northwest-southeast, and are associated with strain caused by movement along the San Andreas Fault (White, 1987).

5.16.5.3 Resource Inventory Methods

To develop a baseline paleontological resource inventory of the Project Site and surrounding geographical and geological area, and to assess the potential paleontological productivity of each stratigraphic unit present, the published as well as available unpublished geological and paleontological literature was reviewed. Stratigraphic and paleontologic inventories were compiled, synthesized, and evaluated (see below). These methods are consistent with CEC (2007) and SVP (2010) procedures for assessing the importance of paleontological resources in areas of potential environmental effect.

Geologic maps and reports covering the bedrock and surficial geology of the Project vicinity were reviewed to determine the exposed and subsurface rock units, to assess the potential paleontological productivity of each rock unit, and to delineate their respective areal distribution in the Project area. Museum records searches were conducted at the University of California Museum of Paleontology (UCMP) at Berkeley, the Los Angeles County Natural History Museum (LACM), and the San Bernardino County Museum of Natural History (SBMNH) to determine whether any of the stratigraphic units found within the Project vicinity had previously yielded significant paleontological resources. In addition, aerial photographs of the area were examined to aid in determining the areal distribution of distinctive sediment and soil types. No subsurface exploration was conducted for this assessment. However, a PRC field paleontologist was present during augering for geotechnical boreholes at the former HECA Project Site, which was approximately 1 mile south of the current Project Site, and did observe subsurface stratigraphy and fossils (see the discussion below).

A field survey, which included visual inspection of exposures of potentially fossiliferous strata in the Paleontological Resources Study Area, was conducted to document the presence of sediments suitable for containing fossil remains and the presence of any previously unrecorded fossil sites. All of the proposed HECA linear facilities as well as the OEHI CO_2 pipeline north of the California Aqueduct were surveyed by PRC for paleontological resources. The field survey for this assessment was conducted over several site visits from March 2008 through April 2010.

- Dr. Lanny H. Fisk, PhD, PG, the principal paleontologist with PRC, surveyed on March 4, and March 12, 2008; from May 14 through May 15, 2008; and from May 20 to May 21, 2008.

- Dr. Hugh M. Wagner, PhD, a senior paleontologist with PRC, surveyed from March 4 to March 8, 2008; from March 9 to March 12, 2008; and on April 29, 2008.

- Mr. Patrick W. Riseley, PG, a field paleontologist with PRC, surveyed from March 2 to March 7, March 9 to March 13, March 19 to March 21, and on March 31, 2008; on April 4 and from April 6 to April 7, 2008; and from May 20 to May 22, 2008.

- David M. Maloney, a field supervisor with PRC, surveyed the site on March 5 and March 6, 2008; from May 20 to May 22, 2008; from March 17 to March 20, 2009; on December 8, 2009; and on April 6, 2010.

- Stephen J. Blakely, staff paleontologist with PRC, surveyed from January 22 to January 23, 2009, and from March 17 to March 20, 2009.

- Levi R. Pratt, a field paleontologist with PRC, surveyed from January 22 to January 23, 2009.

- John N. Adrian, a field paleontologist with PRC, surveyed on March 31 and from April 1 to April 4, 2008.

- Phil R. Peck, a field paleontologist with PRC, surveyed May 8 to May 9, May 12 to May 15, May 20 to May 23, and on May 28, 2008.

- Richard J. Serrano, a field paleontologist with PRC, surveyed from May 8 to May 10, May 12 to May 15, May 20 to May 24, and May 28 to May 29, 2008. During the field survey, stratigraphy was observed in arroyos, hillslopes, badlands, and road cuts. Exposed sediments up to approximately 30 feet were observed in locations in the vicinity of the Project.

5.16.5.4 Paleontological Resource Assessment Criteria

The SVP (2010), in common with other environmental disciplines such as archaeology and biology (specifically in regard to listed species), considers any fossil specimen significant, unless demonstrated otherwise, and protected by environmental statutes. This position is held because fossils are uncommon and only rarely will a fossil locality yield a statistically significant number of specimens representing the same species. In fact, vertebrate fossils are so uncommon that, in most cases, each fossil specimen found will provide additional important information about the characteristics or distribution of the species it represents.

A stratigraphic unit (such as a formation, member, or bed) known to contain significant fossils is considered to be “sensitive” to adverse impacts if there is a high potential that earth-moving or ground-disturbing activities in that rock unit will either disturb or destroy fossil remains. This definition of potential differs fundamentally from that for archaeological resources:

> It is extremely important to distinguish between archaeological and paleontological resources (see “definitions” section in this document) when discussing the paleontological potential of rock units. The boundaries of an archaeological resource site define the areal/geographic extent of an archaeological resource, which is generally independent from the rock unit on which it sits. However, paleontological sites indicate that the containing sedimentary rock unit or formation is fossiliferous. Therefore, the limits of the entire rock formation, both areal and stratigraphic, define the extent of paleontologic potential (SVP, 2010).

This distinction between archaeological and paleontological sites is important. Most archaeological sites have a surface expression that allows for their geographic location. Fossils, on the other hand, are an integral component of the rock unit below the ground surface; therefore, they are not observable unless exposed by erosion or human activity. Thus, 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. The paleontologist can only make conclusions on potential-to-impact based upon what fossils have been found in the rock unit in the past, along with a judgment as to whether the depositional environment of the sediments that compose the rock unit is likely to have resulted in the burial and preservation of fossils.

Fossils are seldom uniformly distributed within a rock unit. Most of a rock unit may lack fossils, but at other locations within the same rock unit concentrations of fossils may exist. Even within a fossiliferous portion of the rock unit, fossils may occur in local concentrations. For example, Shipman (1977, 1981) excavated a fossiliferous site using a three-dimensional grid and removed blocks of matrix of a consistent size. The site chosen was known prior to excavation to be richly fossiliferous, yet only 17 percent of the blocks actually contained fossils. These studies demonstrate the physical basis for the difficulty in predicting the location and quantity of fossils in advance of Project-related ground disturbance.

Since it is unfortunately not possible to determine where fossils are located without actually disturbing a rock unit, monitoring of excavations by an experienced paleontologist during construction increases the probability that fossils will be discovered and preserved. Preconstruction mitigation measures such as surface prospecting and collecting will not prevent adverse impacts on fossils because many sites will be unknown in advance because of an absence of fossils at the surface.

The non-uniform distribution of fossils within a rock unit is typical. Many paleontological resource assessment and mitigation reports conducted in support of environmental impact documents and mitigation plan summary reports document similar findings (see Lander, 1989 and 1993; Reynolds, 1987 and 1990; Spencer, 1990; Fisk *et al.*, 1994; and references cited in each of these sources). In fact, most fossil sites recorded in reports of impact mitigation (where construction monitoring has been implemented) had no previous surface expression. Because the presence or location of fossils within a rock unit cannot be known without the exposure resulting from erosion or excavation, under SVP (2010) standard procedures, an entire rock unit is assigned the same level of potential based on recorded fossil occurrences.

Using SVP (2010) criteria, the paleontological importance or potential (high, undetermined, low, or no) of each rock unit exposed in a project site or surrounding area is the measure most amenable to assessing the significance of paleontological resources because the areal distribution of each rock unit can be delineated on a topographic or geologic map. The paleontological potential of a stratigraphic unit reflects (1) its potential paleontological productivity and (2) the scientific significance of the fossils it has produced. This method of paleontological resources assessment is the most appropriate because discrete levels of paleontological importance can be delineated on a topographic or geologic map.

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 that are similar both in quantity and density to those previously recorded from that stratigraphic unit in and near the project site.

An individual fossil specimen is considered scientifically important if it is:

- Identifiable
- Complete
- Well preserved
- Age diagnostic
- Useful in paleo-environmental reconstruction
- A type or topotypic specimen
- A member of a rare species
- A species that is part of a diverse assemblage
- A skeletal element different from or a specimen more complete than those now available for that species

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 indicators 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.

The following tasks were completed to establish the paleontological importance and potential of each stratigraphic unit exposed within the Paleontological Resources Study Area:

- The potential paleontological productivity of each rock unit was assessed based on previously recorded and newly documented fossil sites that the unit contains at and/or near the Project Site.

- The scientific importance of fossil remains recorded from a stratigraphic unit exposed at and/or near the Project Site were assessed.

- The paleontological importance of a rock unit was assessed based on its documented and/or potential fossil content in the area surrounding the Project Site.

Categories of Potential

In its standard procedures for assessment and mitigation of adverse impacts on paleontological resources, the SVP (2010) established four categories of potential for paleontological resources: high, undetermined, low, and no.

High Potential. Stratigraphic units in which significant fossils have been previously found have a high potential to produce additional fossils and are therefore considered to be highly sensitive. In the significance criteria of the SVP (2010), all identifiable vertebrate fossils and uncommon invertebrate, plant, and trace fossils are categorized as having significant scientific value, and all stratigraphic units in which these fossils have previously been found have high potential. In areas of high potential, full-time monitoring is recommended during any project-related ground disturbance.

Undetermined Potential. Stratigraphic units that have not had any previous paleontological resource surveys or any fossil finds are considered to have undetermined potential. After reconnaissance surveys, observation of artificial exposures (e.g., road cuts) and natural exposures (e.g., stream banks), and possible subsurface testing (e.g., augering or trenching), an experienced professional paleontologist can often determine whether the stratigraphic unit should be categorized as having high, low, or no potential.

Low Potential. Stratigraphic units that are not sedimentary in origin or that have not been known to produce fossils in the past are considered to have low potential. Monitoring is usually not recommended nor needed during excavation in a stratigraphic unit with low potential.

No Potential. Some rock units do not contain or preserve fossils (such as high-grade metamorphic or plutonic igneous rocks) and are considered to have no potential. Monitoring is not recommended nor needed during excavation in a rock unit with no potential.

Although no public lands will be directly impacted by the Project, Bureau of Land Management (BLM) classification systems are widely used as objective measures of significance. In the BLM (1998) Paleontological Resources Handbook H-8270-1 entitled *General Procedural Guidance for Paleontological Resource Management*, the BLM uses a slightly different classification system for ranking areas according to their potential to contain significant fossils. These rankings are used in land-use planning as well as to identify areas that may warrant special management and/or special designation, such as Areas of Critical Environmental Concern. Public lands may be classified based on their potential to contain such fossils, using the following criteria:

Condition 1. Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

Condition 2. Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

Condition 3. Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils based on their surficial geology; igneous or metamorphic rocks; extremely young alluvium, colluvium, or aeolian deposits; or the presence of deep soils.

In 2007, the BLM introduced the Potential Fossil Yield Classification (PFYC) System which is intended to classify geologic units by identifying the potential for the occurrence of significant paleontological resources in a geologic unit and the associated risk for impacts within that unit (BLM, 2007). The class rankings listed below attempt to classify geologic units based upon the relative abundance of paleontological resources found within, and therefore the risk of adversely impacting those resources. Geologic units are classified under the PFYC based upon the following criteria:

Class 1—Very Low. Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age.

Class 2—Low. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before the present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

Class 3—Moderate or Unknown. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence, or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.
  - *Class 3a—Moderate Potential*. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or to impact a significant fossil locality is low, but is somewhat higher for common fossils.
  - *Class 3b—Unknown Potential*. Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in Class 3b may eventually be placed in a different class when sufficient survey and research are performed. The unknown potential of the units in Class 3b should be carefully considered when developing any mitigation or management actions.

Class 4—High. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface-disturbing activities may adversely affect paleontological resources in many cases.

- *Class 4a*. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive, with exposed bedrock areas often larger than 2 acres. Paleontological resources may be susceptible to adverse impacts from surface-disturbing actions.

- *Class 4b*. These areas are underlain by geologic units with high potential, but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts on the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than 2 contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

Class 5—Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils and that are at risk of human-caused adverse impacts or natural degradation.

- *Class 5a*. Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive, with exposed bedrock areas often larger than 2 contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface-disturbing actions.
- *Class 5b*. These areas are underlain by geologic units with very high potential, but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than 2 contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

The previously described BLM criteria have been widely used by both lead agencies and professional mitigation paleontologists as objective measures of significance. In this paleontological resource impact assessment, the criteria of both the SVP (2010) and the BLM (1998, 2007) are applied. BLM lands will not be directly impacted by the proposed Project or by any of its associated linear facilities. However, BLM lands do occur within 1 mile of the PRSA (i.e., 1 mile from the Project Site and linear facilities), so the criteria will be considered.

5.16.5.5 Resource Inventory Results

The following inventory results pertain to the Paleontological Resources Study Area. As noted above, OEHI conducted the surveys south of the California Aqueduct along the current CO_2 pipeline alignment, as well as for the CO_2 EOR Processing Facility. The results of those surveys are presented in Appendix A-1 of this AFC Amendment, Section 4.5.

Stratigraphic Inventory

Regional geologic mapping in the vicinity of the HECA Project was provided by Jennings (1977; 1:750,000); Mendenhall *et al.* (1916; 1:500,000); Jenkins (1938; 1:500,000); Bartow (1987, 1991; 1:500,000); Morton and Troxel (1962; ~1:320,000); and Smith (1964; 1:250,000). Larger scale mapping of the Project Site was provided by Dibblee (1972; 1:62,500), Woodring *et al.* (1932; 1:31,680), and Dibblee (2005a-f; 1:24,000).

Project Geology

Based upon the available geologic literature, recent geologic maps, and field observations, two stratigraphic units will be potentially impacted during Project construction activities. In the discussion below, the stratigraphic nomenclature will follow that of Dibblee (2005a-f), the most detailed and also most recent geologic maps available. Dibblee (2005a-f) identified two stratigraphic units within the Project vicinity: Quaternary alluvium and Tulare Formation. Each of these stratigraphic units is described below.

In his geologic mapping, Dibblee (2005a-f) mapped the area in the vicinity of the Project Site and the linear ROWs as either Quaternary alluvium or Tulare Formation. The site of the main HECA facility is mapped as Quaternary alluvium, although the map indicates that this alluvium unconformably overlies sediments of the Tulare Formation (Dibblee, 2005f). Thus, although Quaternary alluvium is mapped as being present at the surface over the Project Site, the older Tulare Formation may still be encountered in the shallow subsurface. This was confirmed in a geotechnical investigation performed for a previous project at the site, which indicated that sediments of the Tulare Formation are present at approximately 10 feet below ground surface. Linear features associated with Project construction will also potentially impact sediments of the Tulare Formation. Many of the linear options will at some point pass through areas mapped as Tulare Formation or areas mapped as Quaternary alluvium overlying Tulare Formation (Dibblee, 2005a through f).

Tulare Formation. Late Pliocene to Pleistocene age Tulare Formation was named by Anderson (1905), who did not designate a type section. Woodring *et al.* (1940) later designated the Kettleman Hills North Dome as the type section for the Tulare Formation. 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 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 of up to approximately 2,000 feet, while Tulare sediments found elsewhere may be as much as 5,000 feet thick (Maher *et al.*, 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, although in other places throughout the San Joaquin Valley it unconformably overlies sediments of various formations and ages (Dibblee, 1973; Lettis, 1982). The age of the Tulare Formation has been determined based upon structural and stratigraphic relationships, paleontological correlations, radiometric dating methods, and paleomagnetic data. Most recently, White (1987) used measured magnetic polarities within the Tulare Formation from locations in the southern San Joaquin Valley to determine the age of the Tulare Formation to be between 2.48 and 0.90 million years.

Quaternary Alluvium. 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 is primarily composed of 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. Two drill sites located northeast of the unincorporated community of Buttonwillow produced fossil wood that was analyzed using radiometric dating methods (Manning, 1968). These samples, recovered at 20 and 35 feet below ground surface, produced a late Pleistocene radiocarbon age (14,060 ± 450 and 13.350 ± 450 years B.P.).

Paleontological Resource Inventory

An inventory of known paleontological resources previously discovered in the vicinity of the Project is presented below, and the paleontological importance of these resources is assessed. The literature review and UCMP, LACM, and SBMNH archival records search conducted for this inventory documented no previously recorded fossil sites within the HECA Project Site. Previously reported fossil sites do occur within 1 mile of HECA linear facilities or the OEHI CO_2 pipeline, and numerous previously unreported fossil sites were identified during the field survey for this Project. In addition, sediments of Quaternary alluvium and Plio-Pleistocene Tulare Formation have yielded fossilized remains of extinct species of continental vertebrates and other types of organisms at previously recorded fossil sites in the region (Jefferson, 1991a and 1991b; UCMP records; others described below).

Tulare Formation. The Tulare Formation has yielded fossil remains at numerous sites in the San Joaquin Valley. These remains include algal stromatolites (vertically layered mat-like algal growths); diatoms; petrified wood; shells of snails and clams; and the bones and teeth of bony fishes, amphibians, turtles, lizards, snakes, birds, and a diversity of extinct land mammals, including moles, ground sloths, rabbits, squirrels, gophers, pocket mice, kangaroo rats, pack rats, deer mice, cotton rats, grasshopper mice, canids, saber-tooth cats, horses, peccaries, camels, tapirs, and deer (Merriam, 1903, 1905, 1914, 1915a, 1915b, and 1917; Anderson and Pack, 1915; Arnold and Johnson, 1910; Gester, 1917; Woodring *et al.*, 1932; Stirton and VanderHoof, 1933;

Porter, 1943; Hoots *et al.*, 1954; Davis *et al.*, 1957 and 1959; Wood and Davis, 1959; Taylor, 1966; Foss and Blaisdell, 1968; Maher *et al.*, 1975; Repenning, 1980; Reynolds, 1987 and 1990; Lander, 1993; UCMP records). Anderson and Pack (1915) also reported recycled fossils from older beds in the Tulare Formation.

A number of previously recorded Tulare Formation fossil sites occur near the Paleontological Resources Study Area. Included among the previously reported fossil sites are several sites in the Elk Hills and several others from neighboring areas such as McKittrick (Woodring *et al.*, 1932; Jefferson, 1991a and 1991b; LACM records; UCMP records). A search of the UCMP online database yielded two localities in the vicinity of the Elk Hills. These localities have produced remains of horse, saber-tooth cat, and bone-crushing dog (*Borophagus*). The latter taxon represents the type specimen for its species (Merriam, 1903, Wang *et al.*, 1999). LACM reports no vertebrate localities from within the study area, but the museum has records of localities within the Elk Hills (LACM 3775) and near McKittrick (LACM 3720). These localities have produced fossil camels and rabbits. Woodring *et al.* (1932) reported several fossil localities from the Elk Hills that produced specimens of camel, horse, rabbit, wood rat, cotton rat, and silicified wood. Additionally, Woodring *et al.* (1932) described freshwater invertebrates from oil well "ditch samples" in the Elk Hills. Fish remains, ostracodes, pelecypods, gastropods, and reworked foraminifers have also been identified from oil wells within the Elk Hills (Maher *et al.*, 1975). Blakely and Fisk (2011) also reported a fossil horse tooth and ichnofossils from two separate sites in the Buena Vista Hills.

During the field survey for prospective fossil localities, many previously unrecorded sites were identified within one mile of the Project and its associated linear features. Fossils at these localities included vertebrate fossil bones and bone fragments, invertebrate shells, and fossilized wood. Numerous paleosols were also identified within the Tulare Formation, which contained ichnofossils.

In summary, sediments referable to the Tulare Formation have yielded an abundance of vertebrate, invertebrate, and plant fossils, plus microfossils and ichnofossils from numerous localities throughout Kern, Kings, Alameda, and San Joaquin counties. Moreover, several previously recorded (Jefferson, 1991b; LACM records; UCMP records) and previously unrecorded (this report) fossil localities are found near the PRSA, including several sites within the Elk Hills. Because this unit has in the past produced significant fossils, the Tulare Formation is judged to have high potential for impacts on paleontological resources during any future ground disturbance. Additional identifiable fossil remains recovered from the Tulare Formation during any excavation activities could be scientifically important and significant.

Quaternary Alluvium. No fossil localities have previously been reported from Quaternary alluvium at the Project Site. However, significant vertebrate fossils have been reported from Holocene and Pleistocene sediments in several areas of Kern County (Jefferson, 1991a and 1991b; UCMP records). Jefferson (1991a, 1991b) compiled a database of California Late Pleistocene (Rancholabrean NALMA) to earliest Holocene vertebrate fossils from published records, technical reports, unpublished manuscripts, information from colleagues, and inspection of museum paleontological collections at over 40 public and private institutions. He listed over 70 individual sites in Kern County that yielded vertebrate fossils of these ages. Many of these sites are not assigned to a specific formation, group, or member, and may be referable to sediment of unnamed Quaternary alluvium. Among these localities is a Rancholabrean vertebrate fossil locality discovered during construction of the Bakersfield Canal (UCMP V-65247). Fossils discovered during that construction project have been identified as an extinct species of horse. Additionally, Pleistocene fossil wood was recovered from well borings 10 to 15 miles northwest of the unincorporated community of Buttonwillow (Manning, 1968).

During the field survey performed for the HECA Project, previously unrecorded fossil localities were identified. Specimens identified during the field survey included freshwater invertebrate shells and ichnofossils.

Fossils occurring in Quaternary alluvium are valuable to the scientific community because they provide information about climatic conditions in the not too distant past. The occurrences 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 in Kern County, the Quaternary alluvium is also judged to have high potential based on SVP procedures (2010).

Summary

In summary, although no fossils were previously reported to directly underlie the Project Site, numerous fossil localities nearby within the Quaternary alluvium and the Tulare Formation have been reported in both the published scientific literature and museum records. In addition, numerous previously unrecorded fossil localities were identified during the field surveys of the Project Site and linear facility ROWs. Many of these previously reported and unreported localities occur within 1 mile of the HECA linear facilities and the OEHI CO_2 pipeline. The presence of fossils in sediments of Quaternary alluvium within 1 mile of the Project and elsewhere in Kern County, and of fossils in sediments of Plio-Pleistocene Tulare Formation within 1 mile of the Project and elsewhere in the Elk Hills suggests that there is a high potential for additional similar fossil remains to be uncovered by excavations during Project construction. Under SVP (2010) criteria, these stratigraphic units have a high potential for producing additional sensitive paleontological resources.

Identifiable fossil remains salvaged from Quaternary alluvium or the Plio-Pleistocene Tulare Formation during Project construction may be scientifically important and significant. Identifiable fossil remains discovered during construction may represent new taxa or new fossil records for the San Joaquin Valley, for the state of California, for the Quaternary/Tertiary, or for a stratigraphic unit. They may also represent geographic or temporal range extensions. Moreover, discovered fossil remains may make it possible to more accurately determine the age, paleo-climate, and depositional environment of the sediments from which they are salvaged. Finally, fossil remains salvaged during Project construction can provide a more comprehensive documentation of the diversity of animal and plant life that once existed in Kern County and may result in a more accurate reconstruction of the geologic and paleo-biologic history of the San Joaquin Valley and the Elk Hills area.

5.16.6 Environmental Consequences

Potential impacts on paleontological resources resulting from the Project can be divided into construction-related impacts and operation-related impacts. The potential environmental effects from construction and operation of the Project on paleontological resources are presented in the following subsections.

5.16.6.1 Potential Impacts from Project Construction

Construction-related impacts to paleontological resources primarily involve terrain modifications (excavations and drainage diversion measures). Paleontological resources, including an undetermined number of fossil remains and unrecorded fossil sites, associated specimen data and corresponding geologic and geographic site data, and the fossil-bearing strata, can be adversely affected by (i.e., will be sensitive to) ground disturbance and earth-moving associated with construction of the Project. Direct impacts could result from vegetation clearing; grading of roads and the Project Site; trenching for pipelines; augering for foundations for electrical towers or poles; and other earth-moving activities that disturb or bury previously undisturbed fossiliferous sediments, making those sediments and their paleontologic resources unavailable for future scientific investigation.

Clearing, grading, and excavations that encounter previously undisturbed sediment at the Project can result in significant adverse impacts on paleontological resources. At the Project Site, this may occur within 5 feet of the ground surface. At other locations along the linear ROWs, undisturbed sediment occurs at ground surface. In addition, the construction of supporting facilities, such as temporary construction offices, laydown areas, and parking areas, has the potential to cause adverse impacts on significant paleontological resources if the construction also involves new ground disturbance. Thus, any Project-related ground disturbance can have adverse impacts on significant paleontological resources. However, with a properly designed and implemented mitigation program, as has been proposed, these impacts will be reduced to less than significant.

5.16.6.2 Potential Impacts from Project Operation

No impacts on paleontological resources are expected to occur from the continuing operation of the Project or the linear facilities.

5.16.6.3 Potential Impacts from OEHI Project Construction and Operation

Information and analysis related to the paleontological impacts of the OEHI Project are contained in Appendix A to this AFC Amendment. According to the analysis contained in Section 4.5 of Appendix A-1 and Section 2.16 of Appendix A-2, construction and operation of the OEHI Project would not result in significant adverse impacts to paleontological resources.

5.16.7 Cumulative Impacts Analyses

Under certain circumstances, CEQA requires consideration of a project’s cumulative impacts (CEQA Guidelines § 15130). A “cumulative impact” consists of an impact which is created as a result of the combination of the project under review together with other projects causing related impacts (CEQA Guidelines § 15355). CEQA requires a discussion of the cumulative impacts of a project when the project's incremental effect is cumulatively considerable (CEQA Guidelines § 15130[a]). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines § 15065 [a][3]).

When the combined cumulative impact associated with a project's incremental effect and the effects of other projects is not significant, further discussion of the cumulative impact is not necessary (CEQA Guidelines § 15130[a]). It is also possible that a project's contribution to a significant cumulative impact is less than cumulatively considerable and thus not significant (CEQA Guidelines § 15130[a]).

The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great a level of detail as is provided for the effects attributable to the project under consideration (CEQA Guidelines § 15130[b]). The discussion should be guided by standards of practicality and reasonableness (CEQA Guidelines § 15130[b]).

A cumulative impact analysis starts with a list of past, present, and probable future projects within a defined geographical scope with the potential to produce related or cumulative impacts (CEQA Guidelines § 15130[b]). Factors to consider when determining whether to include a related project include the nature of the environmental resource being examined, the location of the project, and its type (CEQA Guidelines § 15130[b]). For purposes of this AFC Amendment, Kern County was contacted to obtain a list of related projects, which is contained in Appendix I. Depending on its location and type, not every project on this list is necessarily relevant to the cumulative impact analysis for each environmental topic. For purposes of paleontological resources, it was determined that none of the projects were relevant for the cumulative impact analysis.

If paleontological finds were to be encountered during Project construction, the potential for cumulative impacts will exist. The Elk Hills and PRSA are highly disturbed by a number of previous impacts. If mitigation measures were not implemented for this Project, Project construction could potentially add to the cumulative impact on paleontological resources. However, mitigation measures will be implemented to salvage such resources and reduce cumulative impacts to a level that is less than significant. The mitigation measures proposed in Section 5.16.4, Mitigation Measures, will effectively preserve the value to science of any significant fossils uncovered during Project-related excavations.

According to the analysis contained in Section 4.5 of Appendix A-1 and Section 2.16 of A-2, construction and operation of the OEHI Project would not result in significant cumulative adverse impacts to paleontological resources.

5.16.8 Mitigation Measures

This section describes mitigation measures that will be implemented to reduce potential adverse impacts on significant paleontological resources resulting from Project construction. Mitigation measures are necessary because of the potential adverse impacts of Project construction on significant paleontological resources within the Quaternary alluvium and the Plio-Pleistocene Tulare Formation. The paleontological resource impact mitigation program will reduce direct, indirect, and cumulative adverse environmental impacts on paleontological resources that could result from Project construction to a less-than-significant level. The mitigation measures summarized below are consistent with SVP standard procedures for mitigating adverse construction-related impacts on paleontological resources (SVP, 1996 and 2010), and they fulfill the requirements of the BLM (1998, 2007).

Implementation of these mitigation measures will reduce the potentially significant adverse environmental impact of Project-related ground disturbance and earth-moving on paleontological resources to a less-than-significant level by allowing for the salvage of fossil remains and associated specimen data and corresponding geologic and geographic site data that otherwise might be lost to earth-moving and to unauthorized fossil collecting.

With a well-designed and implemented paleontological resource monitoring and mitigation plan, Project construction could actually result in beneficial impacts on paleontological resources through the discovery of fossil remains that would not have been exposed without Project construction and, therefore, would not have been available for study. The salvage of fossil remains as part of Project construction could help answer important questions regarding the geographic distribution, stratigraphic position, and age of fossiliferous sediments in the Project area.

5.16.8.1 PALEO-1—Paleontological Monitoring

Prior to construction, a qualified paleontologist will be retained to both design and implement a monitoring and mitigation program. During construction, ground-disturbing activities will be monitored where these activities will potentially disturb previously undisturbed sediment. Monitoring will not be conducted in areas where the ground has been previously disturbed or in areas where exposed sediment will be buried, but not otherwise disturbed. Construction monitoring will be conducted to ensure that unanticipated discoveries are addressed in a timely manner.

5.16.8.2 PALEO-2—Paleontological Monitoring and Mitigation Program.

The paleontological resource monitoring and mitigation program will include preconstruction coordination; construction monitoring; emergency discovery procedures; sampling and data recovery, if needed; preparation, identification, analysis, and museum curation of any fossil specimens and data recovered; and reporting. This monitoring and mitigation plan will be consistent with SVP (2010) standard procedures for the mitigation of construction-related adverse impacts on paleontological resources, as well as the requirements of the designated museum repository for any fossils collected (SVP, 1996).

5.16.8.3 PALEO-3—Construction Personnel Education

Prior to start of Project construction, construction personnel involved with earth-moving activities will be informed: (1) that fossils may be discovered during excavating, (2) that these fossils are protected by laws, (3) on the appearance of common fossils, and, (4) on proper notification procedures. This worker training will be prepared and presented by a qualified paleontologist.

5.16.8.4 PALEO-4—Paleontological Monitoring

Prior to the start of construction, the paleontologist will conduct a field survey of exposures of sensitive stratigraphic units that will be disturbed and any fossils discovered should be salvaged. Earth-moving construction activities should be monitored wherever these activities will disturb previously undisturbed sediment. Monitoring will not need to be conducted in areas where sediments have been previously disturbed or in areas where exposed sediments will be buried, but not otherwise disturbed.

5.16.9 Laws, Ordinances, Regulations, and Standards

Paleontological resources are classified as non-renewable scientific resources and are protected by several federal and state statutes (California State Historic Preservation Office, 1983; Marshall, 1976; West, 1991; Fisk and Spencer, 1994; Gastaldo, 1999), most notably by the 1906 Federal Antiquities Act and Paleontological Resources Preservation Act (PRPA) and by the State of California's environmental regulations (California Environmental Quality Act [CEQA], Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the SVP (1996, 2010). . Table 5.16-1, Summary of LORS—Paleontological Resources, summarizes federal and state LORS applicable to paleontological resources; both federal and state LORS are discussed in the subsections following Table 5.16-1, together with county and city requirements and SVP professional standards.

5.16.9.1 Federal

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law [P.L.] 59-209; 16 United States Code [U.S.C.] 431 *et seq.*; 34 Statute 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal land. The Antiquities Act of 1906 forbids disturbance of any object of antiquity on federal land without a permit issued by the responsible managing agency. This act also establishes criminal sanctions for unauthorized appropriation or destruction of antiquities. The Federal Highways Act of 1958 clarified that the Antiquities Act applied to paleontological resources and authorized the use of funds appropriated under the Federal-Aid Highways Act of 1956 to be used for paleontological salvage in compliance with the Antiquities Act and any applicable state laws. Paleontological resources on federal lands are also explicitly protected under the PRPA (16 U.S.C. 470aaa). This act, signed into law on 30 March 2009, criminalizes the unauthorized removal of fossils from federal land.

In addition to the Antiquities Act and the PRPA, other federal statutes protect fossils. The Historic Sites Act of 1935 (P.L. 74-292; 49 Statute 666, 16 U.S.C. 461 *et seq.*) declares it national policy to preserve objects of historical significance for public use and gives the Secretary of the Interior broad powers to execute this policy, including criminal sanctions. The National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190, 31 Statute 852, 42 U.S.C. 4321-4327) requires that important natural aspects of our national heritage be considered in assessing the environmental consequences of any proposed project. The Federal

Land Policy Management Act (FLPMA) of 1976 (P.L. 94-579; 90 Statute 2743, U.S.C. 1701-1782) requires that public lands be managed in a manner that protects the quality of their scientific values. Paleontological resources are also afforded federal protection under 40 Code of Federal Regulations (CFR) 1508.27 as a subset of scientific resources.

5.16.9.2 State

The CEQA lead agency having jurisdiction over a project is responsible to ensure that paleontological resources are protected in compliance with CEQA and other applicable statutes. California Public Resources Code § 21081.6, entitled Mitigation Monitoring Compliance and Reporting, requires that the lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

Other state requirements for paleontological resources management are in Public Resources Code Chapter 1.7, § 5097.5 (Statute 1965, c. 1136, p. 2792), entitled Archaeological, Paleontological, and Historical Sites. This statute defines any unauthorized disturbance or removal of a fossil site or fossil remains on public land as a misdemeanor and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on state lands to preserve or record paleontological resources. This statute will apply to the Project if the Project will be built on city-owned or state managed lands.

5.16.9.3 Local

California Planning and Zoning Law requires each county and city jurisdiction to adopt a comprehensive, long-term general plan for its development. The general plan is a policy document designed to give long-range guidance to those making decisions affecting the future character of the planning area. It represents the official statement of the community’s physical development as well as its environmental goals. The general plan also acts to clarify and articulate the relationship and intentions of local government to the rights and expectations of the general public, property owners, and prospective investors. Through its general plan, the local jurisdiction informs these groups of its goals, policies, and development standards; thereby, communicating what must be done to meet the objectives of the general plan. State planning law requires each jurisdiction to identify environmental resources and to prepare and implement policies which relate to the utilization and management of these resources.

The Kern County General Plan addresses paleontological resources in the Land Use, Open Space, and Conservation Element under “General Provisions 1.10.3: Archaeological, Paleontological, Cultural, and Historical Preservation.” Under this heading, Policy 25 states that “the County will promote the preservation of cultural and historic resources which provide ties with the past and constitute a heritage value to residents and visitors.” Implementation Measure L for this Policy states that “the County shall address archaeological and historical resources for discretionary projects in accordance with CEQA.” Implementation Measure M for this Policy states that “in areas of known paleontological resources, the County should address the preservation of these resources where feasible.”

5.16.10 Involved Agencies and Agency Contacts

Other than CEC, no state or local agencies have specific jurisdiction over paleontological resources and therefore, no state or local agencies were contacted.

5.16.11 Permits Required and Permit Schedule

No state or local agency requires a paleontological-collecting permit to allow for the salvage of fossil remains discovered as a result of construction-related earth moving on non-federal public or private land in a project site.

5.16.12 References

Adkison, W.L., 1973. Lithological characteristics of Upper Oligocene and Miocene rocks drilled at Elk Hills, Kern County, California. U.S. Geological Survey Bulletin 1375, 113 p.

Anderson, F.M., 1905. A stratigraphic study in the Mount Diablo Range of California: California Academy of Science Proceedings, vol. 2, p. 155-248.

Anderson, R., and R.W. Pack, 1915. Geology and oil resources of the west border of the San Joaquin Valley, north of Coalinga, California: U.S. Geological Survey Bulletin 603, 220 p.

Arnold, R., and H.R. Johnson, 1910. Preliminary report on the McKittrick-Sunset oil region, Kern and San Luis Obispo Counties, California: U.S. Geological Survey Bulletin 406.

Bailey, E.H. (editor), 1966. Geology of northern California: California Division of Mines Bulletin 190, 508 p.

Bartow, J.A., 1987. The Cenozoic evolution of the San Joaquin Valley, California: U.S. Geological Survey, Open-File Report OF-87-581, scale 1:500,000.

Bartow, J.A., 1991. The Cenozoic evolution of the San Joaquin Valley, California: U.S. Geological Survey Professional Paper 1501, 40 p., scale 1:500,000.

Bartow, J.A., and D.E. Marchand, 1979. Preliminary geologic map of Cenozoic deposits of the Clay area, California: U.S. Geological Survey Open-File Report 79-667, scale 1:62,500).

Berryman, W.M., 1973. Lithological characteristics of Pliocene rocks cored at Elk Hills, Kern County, California: Contributions to economic geology, U.S. Geological Survey Bulletin 1332-D, 56 p.

Beyer, L.A., and A. Bartow, 1988. Summary of geology and petroleum plays to assess undiscovered recoverable petroleum resources, San Joaquin basin province, California: U.S. Geological Survey Open-File Report OF-87-450-Z, 80 p., scale 1:500,000.

Blakely, S.B, and L.H Fisk, 2011. Paleontological resource survey of Sections 5, 6, and 8, T32S R24E and Sections 25-26, T31S R23E, Buena Vista Hills, Kern County, California:

unpublished report prepared for the Department of the Interior Bureau of Land Management by PaleoResource Consultants, Auburn, CA, 44 p.

Bull, W.B., 1973. Geologic factors affecting compaction of deposits in a land-subsidence area [Fresno, Kings, and Merced counties, California]: Geological Society of America Bulletin, vol. 84, no. 12, p. 3783-3802.

Bureau of Land Management (BLM), 1998. General procedural guidance for paleontological resource management: BLM Manual H-8270-1.

Bureau of Land Management (BLM), 2007. The potential fossil yield classification (PFYC) system: BLM IM2008-009_att1.

California State Historic Preservation Office, 1983. Summary of state/federal laws protecting cultural resources: California State Historic Preservation Office, Sacramento, CA, 4 p.

Callaway, D.C., and E.W. Rennie, 1991. San Joaquin basin, California: Geological Society of America, The Geology of North America, vol. P-2, Chapter 26, p. 417-430.

California Energy Commission (CEC), 2007. Rules of practice and procedure and power plant site certification regulations, April 2007: California Energy Commission, Sacramento, CA, 148 p.

Clark, B.L., 1929. Tectonics of the Valle Grande of California: American Association of Petroleum Geologists Bulletin, vol. 13, p. 199-238.

Croft, M.G., and G.V. Gordon, 1968. Geology, hydrology, and quality of water in the Hanford – Visalia are, San Joaquin Valley, California: U.S. Geological Survey Open-File Report OF-68-67, 63 p., scale 1:125,000.

Croft, M.G., and C. Wahrhaftig, 1965. General geology of the San Joaquin Valley: International Association of Quaternary Research, 7th Congress Guidebook, Field Conference I, Northern Great Basin and California, Nebraska Academy of Sciences, Lincoln, p. 133-137.

Davis, G.H., and F.R. Hall, 1959. Water quality of eastern Stanislaus and northern Merced counties, California: Stanford University Publications, Geological Sciences, vol. 6, no. 1, p. 1-56.

Davis, G.H., J.H. Green, F.H. Olmsted, and D.W. Brown, 1957. Groundwater conditions and storage capacity in the San Joaquin Valley, California: U.S. Geological Survey Open-File Report, 559 p.

Davis, G.H., J.H. Green, F.H. Olmsted, and D.W. Brown, 1959. Groundwater conditions and storage capacity in the San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper 1469, 287 p.

Davis, G.H., B.E. Lofgren, and S. Mack, 1964. Use of ground-water reservoirs for storage of surface water in the San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper 1618, 125 p.

Dibblee, T.W., 1972. Geologic maps of fourteen 15-minute quadrangles along the San Andreas fault in the vicinity of Paso Robles and Cholame southeastward to Maricopa and Cuyama, California: U.S. Geological Survey Open-File Report OF-72-89, scale 1:62,500.

Dibblee, T.W., 1973. Stratigraphy of the southern Coast Ranges near the San Andreas fault from Cholame to Maricopa, California: U.S. Geological Survey Professional Paper 764, 45 p.

Dibblee, T.W., 2005a. Geologic map of the Taft and Mouth of Kern Quadrangles, Kern County, California: Dibblee Geological Foundation Map DF-95, scale 1:24,000.

Dibblee, T.W., 2005b. Geologic map of the Fellows Quadrangle, Kern County, California: Dibblee Geological Foundation Map DF-96, scale 1:24,000.

Dibblee, T.W., 2005c. Geologic map of the Panorama Hills Quadrangle, San Luis Obispo and Kern Counties, California: Dibblee Geological Foundation Map DF-97, scale 1:24,000.

Dibblee, T.W., 2005d. Geologic map of the Reward Quadrangle, San Luis Obispo and Kern Counties, California: Dibblee Geological Foundation Map DF-100, scale 1:24,000.

Dibblee, T.W., 2005e. Geologic map of the West Elk Hills Quadrangle, Kern County, California: Dibblee Geological Foundation Map DF-102, scale 1:24,000.

Dibblee, T.W., 2005f. Geologic map of the East Elk Hills and Tupman Quadrangles, Kern County, California: Dibblee Geological Foundation Map DF-103, scale 1:24,000.

Fenneman, N.M., 1931. Physiography of western United States: McGraw-Hill Book Company, New York, NY, 534 p.

Fisk, L.H., and L.A. Spencer, 1994. Highway construction projects have legal mandates requiring protection of paleontologic resources (fossils), p. 213-225, in Burns, S.F. (editor), Proceedings of the 45th Highway Geology Symposium, Portland, OR, 258 p.

Fisk, L.H., L.A. Spencer, and D.P. Whistler, 1994. Paleontologic resource impact mitigation on the PGT-PG&E Pipeline Expansion Project, Volume II: PG&E Section, California: unpublished report prepared for the Federal Energy Regulatory Commission, California Public Utilities Commission, Pacific Gas and Electric Company, and Bechtel Corporation by Paleo Environmental Associates, Inc., Altadena, CA, 123 p.

Foss, C.D., and R. Blaisdell, 1968. Stratigraphy of the west side southern San Joaquin Valley, p. 33-43, in Karp, S.E. (editor), Guidebook: Geology and oil fields, west side southern San Joaquin Valley, 43rd annual meeting, Pacific Sections, American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists.

Gastaldo, R.A., 1999. International laws: collecting, transporting and ownership of fossils – USA, p. 330-338 in Jones, T.P. and N.P. Rowe (editors), Fossil plants and spores, The Geological Society, London, England, 396 p.

Gester, G.C., 1917. Geology of a portion of the McKittrick district – a typical example of the west side San Joaquin Valley oil fields, and a correlation of the oil sands of the west side fields: California Academy of Sciences, 4th Series, vol. 7, no. 8, p. 207-227.

Hackel, O., 1966. Summary of the geology of the Great Valley: p. 217-238 in E.H. Bailey (editor), Geology of Northern California: California Division of Mines and Geology Bulletin 190, 508 p.

Harradine, F., 1950. Soils of western Fresno County, California: University of California, Agricultural Experiment Station, Division of Soils, Berkeley, CA, 86 p.

Hoffman, R.D., 1964. Geology of the northern San Joaquin Valley: San Joaquin Geological Society Selected Papers, vol. 2, p. 30-45.

Hoots, H.W., T.L. Bear, and W.D. Kleinpell, 1954. Geological summary of the San Joaquin Valley, California: p. 113-129 in Jahns, R.H. (editor), Geology of Southern California: California Division of Mines Bulletin 170, 289 p.

Jahns, R.H. (editor), 1954. Geology of Southern California: California Division of Mines Bulletin 170, 289 p.

Jefferson, G.T., 1991a. A catalogue of Late Quaternary vertebrates from California, part one, nonmarine lower vertebrate and avian taxa: Natural History Museum of Los Angeles County Technical Reports, no. 5, 60 p.

Jefferson, G.T., 1991b. A catalogue of Late Quaternary vertebrates from California, Part Two, mammals: Natural History Museum of Los Angeles County Technical Reports, no. 7, 129 p.

Jenkins, O.P., 1938. Geologic map of California: California Division of Mines and Geology, Sacramento, CA, 1:500,000 scale.

Jennings, C.W., 1977. Geologic map of California: California Division of Mines and Geology, 1:750,000 scale.

Lander, E.B., 1989. Interim paleontological resource technical report, Eastside Reservoir Project Study – Phase 1, Riverside County, California: unpublished report prepared for Metropolitan Water District of Southern California by Paleo Environmental Associates, Inc., Altadena, CA, 20 p.

Lander, E.B., 1993. Paleontologic/cultural resource impact mitigation program final report: unpublished report prepared for Midway Sunset Cogeneration Company, Mojave Natural Gas Pipeline, and Kern County, California by Paleo Environmental Associates, Inc., Altadena, CA, 57 p.

Lettis, W.R., 1982. Late Cenozoic stratigraphy and structure of the western margin of the central San Joaquin Valley, California: U.S. Geological Survey Open-File Report 82-526, 203 p.

Lettis, W.R., 1988. Quaternary geology of the northern San Joaquin Valley: p. 333-351 in Graham, S.A., editor, Studies of the geology of the San Joaquin Basin, Pacific Section, Society of Economic Paleontologists and Mineralogists, vol. 60, 351 p.

Lettis, W.R., and J.R. Unruh, 1991. Quaternary geology of the Great Valley, California: p. 164-176 in Dupré, W.R. and others, Quaternary geology of the Pacific margin, p. 141-213 in Morrison, R.B., editor, Quaternary nonglacial geology – conterminous U.S. Geological Society of America, Geology of North America, vol. K-2, 672 p.

Maher, J.C., R.D. Carter, and R.J. Lantz, 1975. Petroleum geology of Naval Petroleum Reserve No. 1, Elk Hills, Kern County, California: U.S. Geological Survey Professional Paper 912.

Maher, J.C., W.M. Trollman, and J.M. Denman, 1973. Geological literature on the San Joaquin Valley of California: Northern California Geological Society and Pacific Section of the American Association of Petroleum Geologists, Sacramento, CA, 582 p.

Manning, J.C., 1968. Two late Pleistocene radiocarbon dates near Buttonwillow, California, p. 98-99 in Karp, S.E. (editor), Guidebook: Geology and oil fields, west side southern San Joaquin Valley. 43rd annual meeting, Pacific Sections, American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, 142 p.

Marchand, D.E., 1977. The Cenozoic history of the San Joaquin Valley and the adjacent Sierra Nevada as inferred from the geology and soils of the eastern San Joaquin Valley: p. 39-50 in Singer, M.J. (editor), Soil development, geomorphology, and Cenozoic history of the northeastern San Joaquin Valley and adjacent areas, California: University of California Press, Guidebook for Joint Field Session, Soil Science Society of America and Geological Society of America, 328 p.

Marchand, D.E., and A. Allwardt, 1981. Late Cenozoic stratigraphic units, northeastern San Joaquin Valley, California: U.S. Geological Survey Bulletin 1470, 70 p.

Marshall, L.G., 1976. Paleontological salvage and federal legislation: Journal of Paleontology, vol. 50, p. 346-348.

Mendenhall, W.C., 1908. Preliminary report on the ground waters of San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper 222, 52 p.

Mendenhall, W.C., R.B. Dole, and H. Stabler, 1916. Ground water in San Joaquin Valley, California: U.S. Geological Survey Water-Supply Paper, 310 p.

Merriam, J.C., 1903. The Pliocene and Quaternary Canidae of the Great Valley of California: University of California Publications, Bulletin of the Department of Geology, vol. 3, no. 14, p. 277-290.

Merriam, J.C., 1905. A new sabre-tooth from California: University of California Publications, Bulletin of the Department of Geology, vol. 4, no. 9, p. 171-175.

Merriam, J.C., 1914. The Tertiary of the Great Basin and that of the marginal marine province in California: Science, vol. 40, p. 643-645.

Merriam, J.C., 1915a. Tertiary vertebrate faunas of the North Coalinga region of California – a contribution to the study of paleontologic correlation in the Great Basin and Pacific Coast Provinces: Transactions of the American Philosophical Society, vol. 22, no. 3, p. 191-234.

Merriam, J.C., 1915b. Faunas of the San Pablo Bay syncline and the Mount Diablo region: Meeting of the Paleontological Society Field Guide, 2-7 August 1915, 15 p.

Merriam, J.C., 1917. Relationships of Pliocene mammalian faunas from the Pacific Coast and Great Basin Provinces of North America: University of California Publications, Bulletin of the Department of Geology, vol. 10, no. 22, p. 421-443.

Miller, R.E., J.H. Green, and G.H. Davis, 1971. Geology of the compacting deposits in the Los Banos–Kettleman City subsidence area, California—mechanics of aquifer systems: U.S. Geological Survey Professional Paper 497-E, 45 p.

Morton, P.K., and B.W. Troxel, 1962. Mines and mineral resources of Kern County, California: California Division of Mines and Geology County Report 1, 370 p, scale 1:320,000.

Page, R.W., 1986. Geology of the fresh ground-water basin of the Central Valley, California, with texture maps and sections: U.S. Geological Survey Professional Paper 1401-C, 54 p., scale 1:500,000.

Piper, A.M., H.S. Gale, H.E. Thomas, and T.W. Robinson, 1939. Geology and ground-water hydrology of the Mokelumne area, California: U.S. Geological Survey Water-Supply Paper 780, 230 p.

Porter, L.E., 1943. Elk Hills Oil and Gas Field (U.S. Naval Petroleum Reserve No. 1), p. 512-516, in Jenkins, O.P. (compiler), Geologic formations and economic development of the oil and gas fields of California: California Division of Mines Bulletin 118, 516 p.

Repenning, C.A., 1980. Paleontologic resource evaluation, Naval Petroleum Reserve No. 1 (Elk Hills): U.S. Geological Survey Branch of Paleontology and Stratigraphy, Menlo Park, California.

Reynolds, R.E., 1987. Paleontologic resource assessment, Midway-Sunset Cogeneration Project, Kern County, California: unpublished report prepared for Southern California Edison Company by San Bernardino County Museum, San Bernardino, CA, 15 p.

Reynolds, R.E., 1990. Paleontological mitigation program, Midway-Sunset Cogeneration Project, Kern County, California: unpublished report prepared for Midway-Sunset Cogeneration Company, by San Bernardino County Museum, San Bernardino, CA, 45 p.

Shipman, P., 1977. Paleoecology, taphonomic history and population dynamics of the vertebrate assemblage from the middle Miocene of Fort Turnan, Kenya: unpublished PhD dissertation, New York University, New York, 193 p.

Shipman, P., 1981. Spatial distribution of fossils in sediments: p. 65-98 in Shipman, P., Life history of a fossil, an introduction to taphonomy and paleoecology, Harvard University Press, Cambridge, MA, 222 p.

Smith, A.R., 1964. Geologic map of California – Bakersfield sheet: California Division of Mines and Geology, scale 1:250,000.

Society of Vertebrate Paleontology (SVP), 1996. Conditions of receivership for paleontologic salvage collections: Society of Vertebrate Paleontology News Bulletin, vol. 166, p. 31-32.

Society of Vertebrate Paleontology (SVP), 2010. Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources: Society of Vertebrate Paleontology, http://www.vertpaleo.org/Impact_Mitigation_Guidelines.htm.

Spencer, L.A., 1990. Paleontological mitigation program, Midway-Sunset Cogeneration Project, Natural Gas Pipeline, Kern County, California: unpublished report prepared for Midway-Sunset Cogeneration Company by Paleo Environmental Associates, Inc., Altadena, CA, 12 p.

Stirton, R.A., and V.L. VanderHoof, 1933. Osteoborus, a new genus of dogs, and its relations to Borophagus Cope: University of California Publications, Bulletin of the Department of Geological Sciences, vol. 23, no. 4, p. 175-182.

Taylor, D.W., 1966. Summary of North American Blancan nonmarine mollusks: Malacologia vol. 4, no. 1, 172 p.

Wahrhaftig, C., S.W. Stine, and N.K. Huber, 1993. Quaternary geologic map of the San Francisco Bay 4^{o} x 6^{o} Quadrangle, United States: U.S. Geological Survey Miscellaneous Investigations Map I-1420, 1:1,000,000 scale.

Wells, J.C., 1952. Elk Hills Field, California, p. 241-245, *in* Guidebook Field Trip Routes, Geology, Oil Fields: American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Section Guidebook Joint Annual Meeting, Los Angeles, California, March 1952, 290 p.

West, R.M., 1991. State regulation of geological, paleontological, and archaeological collecting: Curator, vol. 34, p. 199-209.

White, R.E., 1987. Paleomagnetism of the Tulare Formation: unpublished master's thesis, California State University, Long Beach, CA, 272 p.

Wood, P.R., and G.H. Davis, 1959. Ground-water conditions in the Avenal-McKittrick area, Kings and Kern Counties, California: U.S. Geological Survey Water-Supply Paper 1457.

Woodring, W.P., P.V. Roundy, and H.E. Farnsworth, 1932. Geology and oil resources of the Elk Hills, California, including Naval Petroleum Reserve No. 1: U.S. Geological Survey Bulletin 835, 82 p.

Woodring, W.P., R. Stewart, and R.W. Richards, 1940. Geology of the Kettleman Hills oil field, California; U.S. Geological Survey Professional Paper 195.

Table 5.16-1
Summary of LORS—Paleontological Resources

LORS	Requirements	Conformance Section	Administering Agency	Agency Contact
Federal Jurisdiction				
Antiquities Act of 1906	Protects paleontological resources on federal lands.	5.16.5	(see Note 1)	(see Note 1)
NEPA, 1969	Protects paleontological resources on federal lands.	5.16.5	USEPA	TBD
PRPA, 2009	Protects paleontological resources on federal lands	5.16.5	BLM	TBD
State Jurisdiction				
CEQA	Protects paleontological resources on state lands.	5.16.5	CEC	Eileen Allen 916-654-4082
Public Resources Code Sections 5097.5/5097.9	Protects paleontological resources on state lands.	5.16.5	CEC	Eileen Allen 916-654-4082
Local Jurisdiction				
Kern County General Plan	Protects paleontological resources on county lands.	5.16.5	Kern County Planning Department	Cheryl Casdorph 661-862-8600

Notes:

1. The Antiquities Act of 1906 (16 United States Code [USC]) requires that objects of antiquity be taken into consideration for federal projects and the California Environmental Quality Act, Appendix G, also requires the consideration of paleontological resources. The Paleontological Resources Preservation Act of 2009 requires the Secretaries of the United States Department of the Interior and Agriculture to manage and protect paleontological resources on Federal land using scientific principles and expertise.

BLM = Bureau of Land Management
CEC = California Energy Commission
CEQA = California Environmental Quality Act (of 1970)
LORS = laws, ordinances, regulations, and standards
NEPA = National Environmental Policy Act
PRPA = Paleontological Resources Preservation Act
TBD = to be determined
USEPA = United States Environmental Protection Agency

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6.1 INTRODUCTION

This section discusses a reasonable range of alternatives for the Hydrogen Energy California Project (HECA or Project), and examines the ability of these alternatives to feasibly attain most of the Project objectives set forth in Section 6.1.2, to minimize or avoid significant environmental impacts of the Project, and to meet the purpose and need set forth in Section 6.1.3.

The following terminology will be used throughout this section:

- **Project or HECA.** The Integrated Gasification Combined-Cycle (IGCC) electrical generation, low-carbon nitrogen-based products Manufacturing Complex and associated equipment and processes, including its linear facilities.

- **Project Site or HECA Project Site.** The 453-acre parcel of land on which the HECA IGCC electrical generation facility, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes (excluding off-site portions of linear facilities), will be located

- **Occidental of Elk Hills, Inc. (OEHI) Project.** The use of the carbon dioxide (CO_2) for enhanced oil recovery (EOR) at Elk Hills Oil Field (EHOF) and resulting sequestration, including the CO_2 pipeline and associated EOR equipment.

- **OEHI Project Site.** The portion of land in the EHOF in which the CO_2 produced by HECA will be used for EOR and resulting sequestration.

- **Controlled Area.** The 653 acres of land adjacent to the Project Site over which HECA will control access and future land uses.

- **Proposed Action.** Department of Energy **(**DOE) financial assistance for the funded components of the Project. The Proposed Action applies to the HECA Project Site (including the integrated gasification combined-cycle electrical generation facilities, low-carbon nitrogen-based products Manufacturing Complex, and associated equipment and processes, except for the air separation unit), potable water linear, transmission linear, process water linear , natural gas linear and railroad spur.

- **Connected Actions.** Components of the Project that will not be funded by DOE, which include the air separation unit, OEHI CO_2 pipeline, OEHI CO_2 EOR and sequestration facilities, or certain other facilities.

- **Gasification Block.** Process units needed to produce hydrogen (H_2)- rich fuel—i.e., Gasification, Shift, Low-Temperature Gas Cooling (LTGC), Mercury Removal, Acid Gas Removal (AGR), Sulfur Recovery, Tail Gas Treating, EOR CO_2 Compression Units, and associated utilities.

- **Power Block.** Equipment associated with combined cycle power generation—i.e., combustion turbine (CT), steam turbine (ST), generator, heat recovery steam generator (HRSG), condenser, switchyard, and associated support systems.

- **Manufacturing Complex.** Process units needed to produce low-carbon, nitrogen-based products—i.e., Pressure Swing Adsorption (PSA), CO_2 Purification and Compression, Ammonia Synthesis, Urea, Urea Pastillation and Storage, Nitric Acid, Ammonium Nitrate, Urea Ammonium Nitrate (UAN) Units, and associated utilities.

6.1.1 Regulatory Background

The Energy Facilities Siting Regulations California Code of Regulations (CCR), guidelines titled *Information Requirements for an Application* require an applicant to consider:

> “. . . the range of reasonable alternatives to the project, including the No Action Alternative, that would feasibly achieve most of the basic objectives of the project, but would avoid or substantially lessen any of the significant impacts of the project, and an evaluation of the comparative merits of the alternatives” (20 CCR Appendix B).

The California Environmental Quality Act of 1970 (CEQA) also requires consideration of:

> “. . . a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant impacts of the project, and evaluate the comparative merits of the alternatives” (14 CCR § 15126.6[a]).

Thus, the focus of an alternatives analysis should be on those alternatives that:

> “. . . could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects” (14 CCR § 15126.6[c]).

The CEQA Guidelines further provide that

> “. . . among the factors that may be used to eliminate alternatives from detailed consideration in an Environmental Impact Report” (14 CCR § 15126.6[c]) are:
>
> - Failure to meet most of the project objectives;
> - Infeasibility;
> - Inability to avoid significant environmental impacts.

The National Environmental Policy Act (NEPA) similarly requires that federal agencies identify and analyze a reasonable range of alternatives in an Environmental Impact Statement (EIS) prior to approving or taking federal action that could have a significant impact on the environment. The EIS must rigorously explore and objectively evaluate all reasonable alternatives that meet the purpose of and need for the proposed action, including those alternatives that are not within the jurisdiction of the lead agency.

> “Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant” (Council on Environmental Quality (CEQ), 1983).

NEPA also requires a brief explanation of the reasons for eliminating an alternative from detailed study.

The Project objectives, as well as DOE's purpose and need statement, are outlined in Section 6.1.2 and Section 6.1.3.

6.1.2 Project Objectives

California is the most populous state in the United States. Its population is projected to continue to grow at a rate of just over 1 percent per year until 2030, putting California above the national population growth rate of about 0.8 percent per year. The combination of continued population growth and long-term economic prosperity will result in robust growth in energy demand. At the same time, the state has set aggressive environmental objectives, including reductions in levels of greenhouse gas (GHG) emissions. The Project represents an opportunity to satisfy several of California's environmental policy objectives regarding low-carbon power generation and GHG reduction, while supporting sustainable economic growth. The Project will respond to the future energy demands of California and will play an important role in eventually meeting the state's objective of reducing CO_2 emissions to 1990 levels by 2020.

A critical component of the alternatives analysis is the ability of the alternatives to feasibly attain most of the basic objectives of the Project. Project objectives are summarized as follows:

- Provide dependable, low-carbon electricity to help meet future power needs and to help "back-up" intermittent renewable power sources, such as wind and solar, to support a reliable power grid.
- Enhance the production and availability of in-state nitrogen-based products for use in agricultural, transportation, and industrial applications by producing approximately 1 million tons per year of low-carbon products, including urea, UAN, and anhydrous ammonia.
- Conserve domestic energy supplies and enhance energy security by using abundant solid feedstocks, coal and petroleum coke, to generate electricity and manufacture low-carbon nitrogen-based products.
- Mitigate impacts related to climate change by dramatically reducing average annual GHG emissions relative to those emitted from a conventional power plant and/or nitrogen-based product manufacturing facility by capturing, at a rate of at least 90 percent, and sequestering CO_2.
- Use captured CO_2 for EOR to produce additional oil reserves.
- Demonstrate advanced solid-fuel-based technologies that can generate clean, reliable, and affordable electricity in the United States and prove out carbon capture and sequestration as a viable method for reducing the carbon footprint of power generation and manufacturing.
- Facilitate and support the development of H_2 infrastructure in California by supplementing the quantities of H_2 available for future energy and transportation technologies.

- Help restore local groundwater quality and enhance agricultural production by using brackish groundwater water that currently threatens local agriculture.
- Minimize environmental impacts associated with the construction and operation of the Project through technology selection, Project design, and implementation of feasible mitigation measures, where necessary.
- Site the Project at a location over which HECA will have control, and which offers reasonable access to necessary infrastructure, including natural gas, process water supply, transmission and rail interconnection, and geologic formations appropriate for CO_2 EOR and sequestration.
- Ensure the economic viability of the Project by integrating electricity production with the manufacture of multiple products to meet market demand.
- Meet all requirements necessary to secure and retain DOE funding for the Project.

6.1.3 DOE's Purpose and Need

The purpose and need of the Proposed Action (i.e., providing limited financial assistance to the Project) is to advance the Clean Coal Power Initiative (CCPI) objectives as established by Congress: the commercialization of clean coal technologies that advance efficiency, environmental performance, and cost competitiveness well beyond the level of technologies that are currently in commercial service.

The Project will fulfill a need for additional baseload electricity generation by producing a nominal 300 megawatts (MW) output of low-carbon baseload electricity to the grid during operations, feeding major load sources, while providing environmental benefits regarding GHGs (among other benefits), and helping California to meet its obligations under California Assembly Bills 32 and 1925, California Senate Bill 1368, and California Executive Orders S-7-04 and S-3-05. These policies and executive orders address the need to reduce GHG emissions from power plants.

Additional details regarding DOE's purpose and need for the Project are provided in Appendix B1.

6.2 NO PROJECT/NO ACTION ALTERNATIVE

Under the No Project/No Action Alternative, HECA would not receive authorization from the California Energy Commission (CEC) to construct and operate a low-carbon IGCC polygeneration facility or receive funding from DOE to build the facility. As a result, the Project would not be developed. The potential environmental impacts identified in this Application for Certification (AFC) Amendment associated with the construction and operation of the Project would not occur. Electricity that would have been produced by the Project to help meet future electrical power needs would have to be generated by another source; electricity would be generated by other power-generation facilities that operate less efficiently and release larger quantities of air pollutants and GHG emissions than the Project. Likewise, nitrogen-based products that would have been generated by the Project would have to be produced by another source with a higher carbon footprint.

The No Project/No Action Alternative would not contribute to the goal of the CCPI Program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. Therefore, the No Project/No Action Alternative would not meet DOE's purpose and need, as defined in Section 6.1.3.

The No Project/No Action Alternative fails to achieve all Project objectives identified above related to production of energy, advancement of technology, and enhancement of energy security. Failure to achieve the Project objectives would also mean that the No Project/No Action Alternative would not further the important state laws and policies discussed below.

In 2005, the state energy agencies issued Energy Action Plan II (EAP II) followed by an update in 2008. EAP II emphasized "[the] need to develop and tap advanced technologies to achieve [the] goals of reliability, affordability and an environmentally sound energy future." The Project capital and operating costs, as well as the associated environmental benefits, were balanced such that the Project could provide baseload low-carbon power and new technology development. This technology development would not be advanced under the No Project/No Action Alternative.

California Assembly Bill 32 (AB 32) requires reduction of GHG emissions to 1990 levels by 2020. Furthermore, Executive Order S-3-05 sets a state target of reducing GHG emissions to 80 percent below 1990 levels by 2050. AB 32 requires the California Air Resources Board (CARB) to assign emissions targets to each sector in the California economy and to develop regulatory and market methods to ensure compliance, which takes effect in 2012. The satisfaction of AB 32 and Executive Order S-3-05 will require zero- or low-carbon power generation for facilities that are brought online in the next decade. In the absence of new low-carbon technologies policies, the state will miss its GHG reduction targets by a large margin. The Project's reliable low-carbon baseload generation will help California meet its GHG goals. The No Project/No Action Alternative does not advance these goals.

Senate Bill 1368 (SB 1368), passed in 2006, established an Emission Performance Standard (EPS) for GHG emissions from power plants used to serve baseload power in California. One of the requirements of SB 1368 is that utilities may sign long-term contracts (5 years or more) only with power plants that produce no more GHG emissions than a natural-gas combined-cycle (NGCC) power plant. Pursuant to SB 1368, the California Public Utilities Commission has set the EPS at 1,100 pounds of CO_2 per megawatt hour of electricity generated by the Project. This law effectively prohibits California utilities from owning or contracting long term with coal-fired power plants, in or out of state, unless they are operated with carbon capture and sequestration (CCS). The intended effect of SB 1368 is to encourage baseload low-carbon power production. The Project's GHG emissions will be well below this threshold requirement.

The HECA Manufacturing Complex will have significantly lower carbon emissions than traditional fossil-fueled production facilities. This is of heightened importance because carbon emissions are a component of GHGs that has been linked to global warming. Across the HECA facility, at least 90 percent of the CO_2 in the syngas will be captured as high-purity CO_2 and injected into deep-underground hydrocarbon reservoirs for sequestration. Based on this capture rate and expected production volumes, HECA nitrogen-based products will save significant GHG emissions, compared to similar production facilities using natural gas.

AB 1925, passed in 2006, required CEC to provide a report to the California legislature by November 2007 "with recommendations for how the state can develop parameters to accelerate the adoption of cost-effective geologic carbon sequestration strategies." This type of legislation clearly demonstrates California's commitment to supporting and encouraging in-state CCS demonstration technology. Again, the No Project/No Action Alternative would hinder the execution of this legislative mandate.

The use of a coal/petcoke fuel blend for the life of the facility provides the Project the greatest operational and commercial flexibility. The Project will add a nominal 300 MW of baseload low-carbon power to the grid, provide environmental benefits with regard to GHGs (among other benefits), and help California meet its obligations under AB 32, SB 1368, and AB 1925. In contrast, the No Project/No Action Alternative fails to meet the basic Project Objectives, and therefore fails to advance these goals. As a result, the No Project/No Action Alternative was rejected in favor of the proposed Project.

In accordance with CEQA Guidelines §15126.6(e)(2) and Council on Environmental Quality Regulations for implementing NEPA §1502.14(d), the No Project/No Action Alternative analysis set forth below discusses the existing conditions at the time environmental analysis was commenced, as well as what would be reasonably expected to occur in the foreseeable future if the Project were not approved. A more detailed discussion of existing conditions is provided in Section 5 of this AFC Amendment.

6.2.1 Air Quality

The Project Site is located near the unincorporated community of Tupman, Kern County, in the jurisdiction of the San Joaquin Valley Air Basin (SJVAB), which is the second-largest air basin in the state. 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. The Project Site receives an average of 6 inches of rain annually. During the winter, average low and high temperatures vary from the mid-30s to the mid-50s, respectively. About 80 percent of the precipitation in the area occurs from November through March.

SJVAB is designated as an extreme non-attainment area for ozone (O_3); SJVAB is designated as a federal and state non-attainment area for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). The basin was designated as a federal attainment area for particulate matter less than 10 microns in diameter (PM_{10}) in 2008; however, the basin is designated as state non-attainment for PM_{10}. SJVAB is designated as an attainment area for all other state and federal criteria pollutants. Air quality monitoring data representing existing air quality in the Project Area were obtained from the U.S. Environmental Protection Agency Air Data (2012) and the California Air Resources Board-California Air Quality Data website (2012). The monitoring data indicate that the air is in compliance with all National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) for NO_2, CO, and SO_2 for all averaging periods. However, the monitoring data indicate that the NAAQS and/or the CAAQS are periodically exceeded for O_3, PM_{10}, and $PM_{2.5}$.

The No Project/No Action Alternative would not involve construction or operation of the Project. Therefore, emissions from construction, commissioning, and operations would not be generated. Nonetheless, it is highly likely that the No Project/Action Alternative would result in greater fossil fuel consumption, GHG emissions, and air pollution than the Project over the long term. Without the Project, electricity would likely be generated from other, less-efficient plants with higher air pollutant and GHG emissions than the Project. The carbon capture and sequestration benefits of the Project would not be realized. Therefore, air quality impacts would be greater under the No Project/No Action Alternative relative to the Project. Additional details pertaining to the air quality impacts and air quality monitoring and control at the Project Site are discussed in Section 5.1, Air Quality.

6.2.2 Biological Resources

The Project Site is currently used for cultivation of cotton, alfalfa, and onions. The primary land uses in the Project vicinity are agriculture, oil exploration, and oil production. Several potential aquatic features are in the area; these features include canals and irrigation ditches.

Three listed plant species have the potential to occur in the study areas for the linear facilities. Eight non-listed special-status plant species have the potential to be found in the study areas for the linear facilities.

Three threatened or endangered wildlife species (blunt-nosed leopard lizard, Tipton kangaroo rat, and San Joaquin kit fox) are likely to occur along the linear facilities. Portions of the Project would be in the Western Kern County Core recovery area (See Section 5.2, Biology in this AFC Amendment). In addition, six non-listed special-status wildlife species (burrowing owl, loggerhead shrike, short-nosed kangaroo rat, Tulare grasshopper mouse, San Joaquin pocket mouse, and American badger) are also likely to occur along the linear facilities.

Existing uses in the area are likely to continue to impact biological resources through disturbance, habitat degradation, fragmentation, or potential mortality. These include agricultural activities and oil and gas development. Impacts from these existing uses are likely to continue under the No Project/No Action Alternative.

Due to the fact that the No Project/No Action Alternative would not involve construction or operation of the Project, no adverse biological resources impacts would occur, including adverse impacts to special-status plant and wildlife species, sensitive habitats, and aquatic features. The Project would have less-than-significant biological resources impacts with implementation of mitigation measures. Because biological resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to biological resources at the Project Site are provided in Section 5.2, Biological Resources.

6.2.3 Cultural Resources

The landscape in the Project vicinity has been altered by previous surface and subsurface disturbance from agriculture, oil and gas production, construction of irrigation and drainage canals, and unpaved roads.

Cultural resource investigations and reports for this site were conducted in accordance with state and federal requirements and guidance, as described in Section 5.3. Eleven archaeological resources have been identified in or within close proximity to the archaeological resource study area as defined for the Project. Although the Project would avoid impacts to the eleven known archaeological resources in the study area, it is possible that archaeological deposits could be inadvertently exposed during Project-related construction activities.

The historic period architectural survey identified historic-period built environment properties present in the Project Area, including two resources eligible for listing in the National Register of Historic Places or the California Register of Historic Places: Old Headquarters Weir, and the California Aqueduct. None of the Project components or construction activities, therefore, would cause a substantial adverse change to the weir or the Aqueduct such that they would be materially impaired and unable to continue to convey their significance; however, potential impacts to these resources could occur from changes to the surrounding setting.

Existing uses in the Project Area currently impact cultural resources through disturbance, including agricultural activities and oil and gas development. Impacts to cultural resources as a result of these existing uses is likely to continue under the No Project/No Action Alternative.

Under the No Project/No Action Alternative, land disturbance that could have the potential to result in loss or degradation of cultural resources would not occur. Although the Project would have less-than-significant impacts on cultural resources, the degree of cultural resources impacts would be lower under the No Project/No Action Alternative. However, because cultural resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to cultural resources at the Project Site are discussed in Section 5.3, Cultural Resources.

6.2.4 Land Use

The Project Site is in western unincorporated Kern County, approximately 7 miles west of the outermost edge of the city of Bakersfield, 2 miles northwest of the unincorporated community of Tupman, and approximately 4 miles south of the unincorporated community of Buttonwillow. The Project Site is currently used for farming purposes, including the cultivation of cotton, alfalfa, and onions. Land in the Controlled Area to the north, west, and south of the Project Site is also currently used for the cultivation of these crops. Land within 1 mile of the Project Site consists primarily of agricultural use and undeveloped areas. Primary land uses surrounding the Project linear features are agriculture and oil extraction.

The Project Site is categorized as Prime Farmland, as defined by the California Department of Conservation. The Prime Farmland and Semi-Agricultural and Rural Commercial Land classifications extend over the Controlled Area, which is to the north, south, and west of the Project Site. Land within 1 mile of the Project Site is primarily included in the Prime Farmland classification. Grazing Land is located on the southern side of the Outlet Canal. Land within 0.25 mile of the Project linears is primarily included in the Prime Farmland or Grazing Land classifications.

The 453-acre Project Site is currently under Williamson Act contract, although the contract was tentatively cancelled by the Kern County Board of Supervisors in 2010. The Williamson Act restrictions over the tentatively cancelled acreage continue to remain in place until the conditions set forth in the Certificate of Tentative Cancellation are satisfied, including payment of the assessed cancellation fee, and recording of the final Certificate of Cancellation. Williamson Act contracts also cover most of the land currently used for farmland within 1 mile of the Project Site, as well as properties adjacent to the Project linear features.

Under the No Project/No Action Alternative, the Project Site would likely continue to be used for agricultural purposes. Impacts associated with the conversion of Prime Farmland and cancellation of Williamson Act contracts for the 453-acre Project Site would not occur. Although the Project would result in less-than-significant land use impacts, the degree of such impacts would be lower under the No Project/No Action Alternative. However, because land use impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative will not meet any of the Project objectives. Additional details pertaining to land use at the Project Site are provided in Section 5.4, Land Use.

6.2.5 Noise

A small number of noise-sensitive residential receptors are located approximately 0.5 to 4.5 miles from the Project Site, and are comprised of widely scattered farmhouses. The nearest single-family residences are located approximately 1,400 feet to the east of the Project Site. There are no hospitals, libraries, schools, places of worship, or other facilities where quietness is an important attribute in the area.

Ambient noise-level surveys were conducted in 2009 and 2012, as described in Section 5.5. Noise sources observed during the surveys consisted of local and distant traffic noise, barking dogs, wildlife, aircraft, trains, agricultural equipment, and farm animals.

Under the No Project/No Action Alternative, no noise would be generated from the Project because the Project would not be constructed or operated. Hence, there would be no changes to the current ranges of natural environmental conditions and types and intensities of human activities (both transportation-related and stationary) that might otherwise cause a change to the range of ambient environmental sound levels and their character. Although the Project would have less-than-significant noise impacts, the degree of such impacts would be lower under the No Project/No Action Alternative. However, because noise impacts would be less than significant under the Project (during construction and operation), the No Project/No Action

Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to noise at the Project Site are provided in Section 5.5, Noise.

6.2.6 Public Health and Safety

The Public Health and Safety analysis considered residential and sensitive receptors within a 6-mile radius of the Project Site. The closest residential neighborhood is in the unincorporated community of Tupman, approximately 2 miles southeast of the Project boundary. There are also additional single-family residences in the immediate Project vicinity, including residences approximately 1,400 feet to the east and 3,300 feet to the southeast of the Project Site. Additionally, Elk Hills elementary school is 1.3 miles to the southeast of the Project, and the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site and Controlled Area.

Under the No Project/No Action Alternative, public health and safety would not be affected by criteria air pollutants or toxic air contaminants associated with Project construction or operation. However, the Project would have less-than-significant public health and safety impacts under construction and operations. The potential for such impacts would be greater under the No Project/No Action Alternative, due to greater fuel consumption, GHG emissions, and toxic air contaminants resulting from status quo activities compared to the Project over the long term. As described in Section 6.2, under the No Project/No Action Alternative, electricity and nitrogen-based products would be generated by facilities that operate less efficiently and release larger quantities of toxic air contaminants and GHG emissions than the Project. Therefore, public health impacts could be greater under the No Project/No Action Alternative. Additional details pertaining to public health and safety at the Project Site are discussed in Section 5.6, Public Health.

6.2.7 Worker Safety and Health

Under the No Project/No Action Alternative, the Project would not be constructed and operated. Therefore, workers would not be employed by HECA or its subcontractors, and no risk of injury would exist to workers. However, because worker safety impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to worker safety at the Project Site are provided in Section 5.7, Worker Safety and Health.

6.2.8 Socioeconomics

The study area for the purposes of socioeconomic analysis included Kern County, Los Angeles County, the City of Bakersfield, the City of Wasco, and the unincorporated communities of Tupman and Buttonwillow. Generally, the economic conditions in these areas reflect the recent recession, with increases in unemployment and a downturn in the housing market.

Under the No Project/No Action Alternative, the Project would not be built, and therefore would not provide the anticipated increase in jobs or the potential increase in revenues to the local economy. Specifically, an average of 1,159 workers per month over the approximate 49-month construction and commissioning period, including a maximum of approximately 2,500 workers during peak construction activities, would not be employed under this alternative. Approximately, 200 full-time operations jobs would not be created.

The No Project/No Action Alternative would not support employment and wages in other industries in Kern County or the communities surrounding the Project Site. Substantial indirect and induced employment would not be created, and considerable tax revenues would not be generated under this alternative. Construction of the Project is estimated to cost approximately $3.15 billion. The total direct labor for construction is projected to cost approximately $1.37 billion. An estimated 60 percent of non-labor construction cost is anticipated to be spent in Kern County on materials and supplies. The remaining materials (comprising approximately 40 percent of non-labor cost), would be purchased outside Kern County. Annual direct labor income of operations for the Project would be approximately $30 million. Approximately 30 percent of material and supply purchases during operations would occur in Kern County.

Vacant housing, as well as temporary housing, in the study area would not be used by construction or full-time operations workers under the No Project/No Action Alternative. Local schools, public services, facilities, and utilities would not be affected under the No Project/No Action Alternative; however, the Project would have less-than-significant impacts on these resources. Under both the Project and the No Project/No Action Alternative, no impacts associated with the environmental justice population would occur. The Project would result in positive socioeconomic impacts that would not occur under the No Project/No Action Alternative. Additional details pertaining to socioeconomics impacts are provided in Section 5.8, Socioeconomics.

6.2.9 Soils

The predominant soils at the Project Site and along the associated linears consist of clays, loamy sands, gravely sandy loams, silt loams, fine sandy loams, and sandy loams. Details on the geology of the Project Site and vicinity are included under Section 5.15, Geological Hazards and Resources. Information regarding Agriculture and Important Farmlands is presented under Section 5.4, Land Use.

The No Project/No Action Alternative would not involve construction or operation of the Project. Therefore, there would be no potential for alteration of the existing soil profile, soil compaction, discovery of potentially contaminated soil, run-off, erosion, and sediment transportation that could result from grading, surface and subsurface ground disturbance, and vegetation removal. Existing rates of soil erosion and surface runoff would continue. Although the Project would result in less-than-significant soils impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because soils impacts are less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to soils on the Project Site are discussed in Section 5.9, Soils.

6.2.10 Traffic and Transportation

The transportation network within the Project study area is composed of a mix of interstate highways, county highways, and local roadways. The circulation system plays a major role in the movement of farm products originating from the San Joaquin Valley, Kern County, and outlying agricultural communities that require access and rely on the state and county roadways. The Project study area is primarily served by Interstate 5 (I-5) to the east. The primary local north-south roadways near the vicinity of the Project include Tupman Road, Dairy Road, and Morris Road. Station Road and Adohr Road provide local east-west access adjacent to and north of the Project Site.

All study intersections are currently operating at acceptable Level of Service (LOS) C or better, with the exception of State Route (SR) 119/Tupman Road, which is operating at LOS F during the p.m. peak hour; similar LOS for study intersections are forecast under Year 2016 No Project/ No Action conditions. Consultation with Kern County Roads Department indicated that there are no anticipated roadway and circulation improvements in the Project study area.

Under the No Project/No Action Alternative, no workers would travel to the Project Site during construction or operation. Further, no heavy equipment or construction deliveries would be brought to the Project Site. Project-related planned improvements, as outlined in Section 5.10, would not be made. There would be no increase in vehicle trips under the No Project/No Action Alternative. Although the Project would have less-than-significant transportation and traffic impacts with the implementation of mitigation measures, such impacts would be lower under the No Project/No Action Alternative. However, because transportation and traffic impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to traffic and transportation at the Project Site are provided in Section 5.10, Traffic and Transportation.

6.2.11 Visual Resources

The Project Site lies in the southwestern portion of San Joaquin Valley, which stretches from the Sacramento–San Joaquin Delta in the north to the Tehachapi Mountains to the south. Various California coastal ranges line the valley to the west (including the Diablo and Santa Ynez), and the Sierra Nevada act as the eastern valley boundary. The climate is dry, with hot summers and mild winters, and there is a persistent haze generally characteristic of the air quality in the area that impairs the clarity of distant views. The general area is characterized as relatively flat, with extensive current and previous soil disturbance associated with farming activities and ongoing oil field operations. The Project Site is generally flat, allowing for open, panoramic, and expansive views of the valley to the north, northwest, and east. The closest notable topography is Hillcrest Point, over 5 miles away.

Land within 1 mile of the Project Site is primarily used for farming purposes. The western border of the Tule Elk State Natural Reserve is approximately 1,700 feet to the east of the Project Site. The nearest single-family dwellings are approximately 1,400 feet to the east; 3,300 feet to the southeast; and 4,000 feet to the north. The EHOF is 1 mile south of the Project Site. Several semi-urban/urban areas surround the Project region, from 2 to 15 miles away from the Project Site. Other than a few locations on the outskirts of Tupman Road, none of these areas have direct views to the Project Site.

Landscapes within the visual sphere of influence (VSOI) were classified as having low scenic integrity. The Project Site is in areas characterized by low distinctive or diverse natural amenities, or lacking substantial positive cultural modifications. There are a number of existing cultural modifications (e.g., cultivated farmlands, industrial facilities, existing power transmission lines, a former fertilizer manufacturing plant adjacent to the Project Site, and oilfield activities and associated structures/storage tanks, etc.) within the VSOI. Although the Project is expected to change the existing character of the site, significant impacts to the scenic attractiveness of the VSOI as a whole are not anticipated due to adjacent industrial scenery.

Under the No Project/No Action Alternative, the Project would not be constructed or operated, and the Project Site would be maintained in its present state. Visual resources impacts resulting from the Project would not occur under the No Project/No Action Alternative. However, because visual resources impacts would be less than significant under the Project (during construction and operation) with the implementation of mitigation, the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to visual resources are provided in Section 5.11, Visual Resources.

6.2.12 Hazardous Materials Handling

Under the No Project/No Action Alternative, hazardous materials associated with construction and operation of the proposed Project would not be brought onto the Project Site. Limited hazardous materials handling (e.g., fertilizers) associated with agricultural use of the Project Site would continue. Although the Project would have less-than-significant hazardous materials handling impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because hazardous materials handling impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to hazardous materials management at the Project Site are provided in Section 5.12, Hazardous Materials Handling.

6.2.13 Waste Management

Under the No Project/No Action Alternative, waste associated with construction or operation of the Project would not be generated. Assessment and management of existing waste (as described in Section 6.2.9) that may be present on the Project Site would not be conducted as they would be under the Project. However, because waste management impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional detail pertaining to waste management at the Project Site is provided in Section 5.13, Waste Management.

6.2.14 Water Resources

The Project Site is located in the Kern County subbasin of the San Joaquin Valley groundwater basin. On a regional scale, the development of irrigated agriculture in the western San Joaquin Valley has significantly altered the groundwater flow system. The dominant recharge source in the subbasin is applied irrigation water. Water supply in Kern County is provided by groundwater, the Kern River, and other surface water imports, which include deliveries by the California State Water Project via the Friant–Kern Canal and the federally operated Central Valley Project via the California Aqueduct.

Groundwater in the vicinity of the Project is generally considered to be of relatively low quality due to the presence of water-soluble deleterious minerals in the parent rocks. Shallow groundwater presents problems for agriculture in the vicinity of the Project, with high concentrations of Total Dissolved Solids, sodium chloride, and sulfate.

Under the No Project/No Action Alternative, there would be no potential for discharges from the Project that could degrade surface or groundwater quality, and no impacts related to subbasin water balance, potable water supply demand, and groundwater level drawdown would occur. However, beneficial impacts of the Project on local groundwater quality would not be realized under this alternative, and water resource impacts from agricultural use of the site would continue. Although the Project would have less-than-significant water resources impacts, the potential for such impacts would be lower under the No Project/No Action Alternative. However, because water resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to water resources for the Project Site are discussed in Section 5.14, Water Resources.

6.2.15 Geologic Hazards and Resources

The Project is located along the northeastern face of the Elk Hills, which are the surface manifestation of an anticlinal uplift along the western side of the San Joaquin Valley. The Elk Hills are composed of sands, conglomerates, mudstones, and shales derived from the Coast Ranges to the west. The Elk Hills are being dissected by numerous streams that redeposit the eroded materials on an apron of small coalescing fans along the northeastern flank of the hills, which abut the much larger Kern River fan to the north.

The Project, like most of California, is in a seismically active region. A review of geologic literature did not identify the presence of any known active or potentially active faults at the Project Site or crossing the Project linears. The closest known faults classified as active by the State of California Geologic Survey are the San Andreas Fault, approximately 21 miles to the west; the White Wolf Fault, approximately 23 miles to the southeast; and the Pleito Thrust, approximately 27 miles south of the Project Site. There are no known significant mineral resources present on the Project Site.

Under the No Project/No Action Alternative, development of a low-carbon polygeneration facility at the Project Site would not occur; therefore, impacts related to geologic hazards and resources would not occur. Although the Project would result in less-than-significant geologic hazards and resources impacts, the potential for such impacts would be lower under the No Project Alternative. However, because geologic hazards and resources impacts would be less than significant under the Project (during construction and operation), the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details pertaining to geologic hazards and resources at the Project Site are discussed in Section 5.15, Geological Hazards and Resources.

6.2.16 Paleontological Resources

Two stratigraphic units would be potentially impacted during Project construction activities: Quaternary alluvium, and Tulare Formation. Although no fossils were previously reported to directly underlie the Project Site, numerous fossil localities nearby in the Quaternary alluvium and the Tulare Formation have been reported in both the published scientific literature and museum records. In addition, numerous previously unrecorded fossil localities were identified during the field surveys of the Project Site and linear facility rights-of-way (ROWs). Many of these previously reported and unreported localities occur within 1 mile of the HECA linear facilities and the OEHI CO_2 pipeline.

Some current uses of the site and surrounding area adversely affect paleontological resources through disturbance, including agricultural activities and oil and gas development. Impacts as a result of these existing uses would likely continue under the No Project/No Action Alternative. In addition, the natural processes of water and wind erosion and abrasion from blowing sand may degrade exposed paleontological resources, as well as revealing additional specimens.

Under the No Project/No Action Alternative, no potential would exist for land disturbance associated with construction or operation of the Project to cause loss or degradation of paleontological resources. Although the Project would have less-than-significant paleontological resources impacts with the implementation of mitigation, the potential for adverse paleontological resources impacts would be lower under the No Project/No Action Alternative. However, because paleontological resources impacts would be less than significant under the Project, the No Project/No Action Alternative would not avoid a significant impact of the Project. In addition, the No Project/No Action Alternative would not meet any of the Project objectives. Additional details regarding paleontological resources for the Project Site are provided in Section 5.16, Paleontological Resources.

6.3 SITE AND LINEAR FACILITIES LOCATION ALTERNATIVES

In determining if an alternative site or linear facilities location would feasibly attain the Project objectives, HECA used the following site evaluation criteria:

- Environmental impacts;
- Safety (proximity to residents, schools, day-care centers, etc.);
- Proximity to sensitive receptors (population and sensitive species);
- Environmental justice considerations;
- Economic feasibility;

- Site acreage (300+ acres), topography, lowest elevation (to maximize power generation);
- Proximity to CO_2 customer for CO_2 EOR and sequestration;
- Minimize impacts on transportation corridors;
- Feasibility of land acquisition;
- Proximity to infrastructure to minimize impacts from Project Site access and linear facilities;
- Proximity to raw water supply.

6.3.1 Proposed and Alternative Sites

The Project Site is in an agricultural area in Kern County, California, near the EHOF. The Project Site is contiguous land bounded by agricultural land and Adohr Road to the north, Tupman Road to the east, agricultural land and an irrigation canal to the south, and the Dairy Road ROW to the west. The Project Site is in a sparsely populated area. There are only a few homes within a mile of the Project Site, and the unincorporated community of Tupman is approximately 2 miles from the site. Primary access for truck deliveries will be from I-5, to Stockdale Highway west, to Morris Road, south to Station Road, then west to the entrance on Tupman Road. The topography of the Project Site is flat. The geology at the Project Site has been determined suitable for facility construction.

The Project Site was selected based upon, among other considerations, the available land; proximity to a CO_2 storage reservoir; and the existing natural gas transportation, electric transmission, brackish groundwater supply, rail, and roadway infrastructure that could support the Project. The geology in the vicinity of the Project Site makes it one of the premier locations in the United States for CO_2 EOR and Sequestration.

HECA's initial AFC (08-AFC-8) was submitted to CEC on July 30, 2008, which proposed the Project on a different site. The Project was subsequently moved when it was discovered that previously undisclosed sensitive biological resources existed at the prior site. As a result, HECA was required to conduct an alternative site analysis that was not merely theoretical, but was in fact necessary to identify an alternative site for the Project, which has now become the Project Site. HECA filed a Revised AFC in May 2009. In the process of selecting this Project Site, several alternative sites in the vicinity of the unincorporated communities of Buttonwillow and Tupman were considered. However, the alternative sites were rejected for various reasons, including (1) topography, (2) distance from the proposed CO_2 custody transfer point, (3) lengths of linear facilities, (4) sensitive environmental receptors, and/or (5) land availability. These sites and their relevant information are presented in Table 6-1, Alternative Sites Reviewed and Status.

Figure 6-1, Alternative Sites, shows the locations of these alternative sites.

Based on this analysis, no alternative sites were identified that were environmentally superior to the Project Site, and would allow attainment of most of the Project objectives. Thus, the Project Site was selected.

6.3.2 Linear Facilities

- The Project Site employs several strategies to minimize or avoid impacts from linear facilities. The Project maximizes the use of existing ROWs for linear facilities, while minimizing the number of private land owners involved. In addition, to the degree feasible, the Project has co-located linear facilities in the same ROW to minimize impacts. Moreover, all linear facilities have been sited to limit the number of miles traversed, and were thoroughly reviewed to limit environmental impacts. Six linear facilities have been proposed to support the Project. The electric transmission line will interconnect the Project to a future Pacific Gas and Electric Company (PG&E) switching station approximately 2 miles east of the Project Site.

- For drinking and sanitary use, the Project will use potable water supplied by West Kern Water District approximately 1 mile east of the Project Site. The potable water pipeline will be co-located within the 100-foot electric transmission line permanent ROW for the entirety of its route.
- The industrial railroad spur will run from the San Joaquin Valley Railroad (SJVRR) to the Project Site in order to facilitate feedstock and equipment delivery and nitrogen-based product export.
- A natural gas line will interconnect with a PG&E natural gas pipeline located north of the Project Site. The natural gas line will be co-located in the permanent railroad spur ROW for the entire railroad spur route.
- The process water supply pipeline will be in an existing ROW owned by Buena Vista Water Storage District (BVWSD).
- Construction of a CO_2 pipeline to transfer the CO_2 captured during gasification from the Project Site to OEHI.

6.3.2.1 Electrical Transmission Line and Potable Water Line

The Project evaluated interconnections to both PG&E's Midway Substation north of the Project Site, as well as to a future PG&E switching station east of the site. Numerous routing options were evaluated in detail to the Midway Substation, including routes presented in the 2009 Revised AFC. However, the PG&E Midway Substation was eventually eliminated from consideration based on the following: (1) Midway had identified congestion in and around the substation; and (2) PG&E's switching station represents the shortest and most direct interconnection point available to the site, and Midway required a substantially longer line length.

For selecting the currently proposed route to the PG&E switching station, the following factors were considered:

- **Feasibility of land acquisition.** This route involves a minimum number of land owners. Negotiations with these land owners have been successful in gaining agreements for the transmission line ROWs.

- **Safety and proximity to potential sensitive receptors.** There are no residences or other occupied buildings (i.e., residences, schools, day-care centers, etc.) along the entire proposed route.

- **Overall economic feasibility.** Due to the close proximity of the interconnection point with the Project Site, the identified route provides the shortest and most direct transmission line available.

Other transmission features that were evaluated included the following:

- Transmission structure types;
- Conductor sizes and conductor families;
- Circuit bundle configurations;
- Ground wires;
- Insulators;
- Construction methods.

Potable water will be supplied by West Kern Water District (WKWD) for drinking and sanitary purposes. Numerous routing options for the potable water linear were evaluated in detail, including the route presented in the 2009 Revised AFC. However, the current potable water linear alignment is several miles shorter than the previously proposed route; it will be placed in the electrical transmission corridor ROW over the entire route, which will minimize environmental impacts. In 2010, HECA considered the use of a potable well that would be located either on or adjacent to the Project Site. However, the water from the potable well would have required treatment. HECA has selected the currently proposed potable water supply from WKWD because the source is relatively close to the Project Site and the water would not require treatment prior to use.

6.3.2.2 Industrial Railroad Spur and Natural Gas Line

The Project is proposing two alternatives for transporting coal to the Project Site. Alternative 1 represents the construction of an approximately 5-mile industrial railroad spur installed from the SJVRR to the Project Site; Alternative 2 is discussed in Section 6.4. Several railroad spur routing options were evaluated in the area; however, based on the following considerations, the currently proposed route was selected:

- **Main line.** The route ties into the SJVRR main railroad line.

- **Land availability.** HECA has been in discussions with landowners, and the proposed route represents the most feasible alignment, based on land availability and discussions with landowners.

- **Safety and proximity to potential sensitive receptors.** The proposed route is sited in less-populated areas, and there are minimal occupied buildings (i.e., residences, schools, day-care centers, etc.) along the entire proposed route.

The PG&E natural gas pipeline will be co-located with the railroad spur. The natural gas supply pipeline will tap into PG&E's main supply pipeline. Several natural gas pipeline routing options were considered. However, the current pipeline route was selected to ensure that it would be co-located with the railroad spur. Therefore, the above considerations for the railroad spur routes were also applied to the natural gas pipeline routes. In addition, the remaining portion of the natural gas pipeline that is not co-located with the railroad spur location was selected based on the location of the PG&E main supply pipeline.

6.3.2.3 Process Water Line

The process water source for the Project runs in a northwesterly direction from the Project Site for approximately 15 miles, and will consist of brackish groundwater supplied by the BVWSD, which would be treated on site to meet Project standards. The process water pipeline route runs from Seventh Standard Road to the Project Site, along the existing BVWSD road on the northwestern side of the West Side Canal.

Alternatives to the proposed process water linear route were analyzed, and supporting decision criteria for the proposed route are provided in Section 6.7, Alternative Water Supplies.

6.3.2.4 CO_2 Pipeline

An approximately 3-mile CO_2 pipeline will transfer the CO_2 captured during gasification from the Project Site south to the OEHI CO_2 Processing Facility. There are limited options for CO_2 sequestration available to the Project in order to meet the Project's stated objectives. As mentioned above, the Project Site was selected based upon, among other considerations, proximity to a high-quality CO_2 storage reservoir. In previous AFC submittals, oil fields in the Ventura Basin and the southern end of the San Joaquin Basin were evaluated for their sequestration and EOR potential. The EHOF was determined to be the preferred field, due to its closer proximity to the HECA Project Site, shorter CO_2 supply line length, results of previous CO_2 pilot studies, and decreased construction time and requirements (URS, 2009). The proposed CO_2 pipeline alignment has been sited to minimize impacts to resource areas, as is further discussed in Appendix A of this AFC Amendment.

6.4 COAL TRANSPORTATION

HECA is currently considering the following two alternatives for the transportation of coal to the Project Site:

- **Alternative 1, rail transportation.** An approximately 5-mile new industrial railroad spur that would connect the Project Site to the existing SJVRR–Buttonwillow railroad line. This railroad spur would also be used to transport some of the HECA products to customers.

- **Alternative 2, truck transportation.** Truck transport would be via existing roads from an existing coal transloading facility northeast of the Project Site. The truck route distance is approximately 27 miles.

Environmental sections presented in Section 5 of this AFC Amendment evaluate the environmental impacts of each of these alternatives.

6.5 ALTERNATIVE GENERATING TECHNOLOGIES AND CONFIGURATIONS

HECA was formed to develop a material business consisting of the production of low-carbon baseload electricity by capturing CO_2 and transporting it for use in CO_2 EOR and sequestration (storage). The Project also includes an integrated Manufacturing Complex that will produce low-carbon, nitrogen-based products. These particular Project objectives drove the generation technology selection. Accordingly, the (IGCC technology was selected because of its unique ability to produce low-carbon H_2-rich fuel for baseload power generation as well as for its superior carbon-capture features. The technology selection was driven by the following objectives: (1) proving commercial scale IGCC-with carbon-capture operability, and (2) proving associated economic viability. A key aspect is delivering a high-reliability operating plant within a minimum period after initial start-up. Other generating technologies, such as solar, wind, geothermal, hydroelectric, and nuclear, were not selected because they fundamentally fail to achieve the Project objectives**.**

6.5.1 Mitsubishi Heavy Industries Gasification Technology

IGCC with carbon capture is the only technology which meets the goal of the Project to generate low-carbon power using H_2-rich fuel produced from a solid feedstock. Other technologies such as pulverized coal technology and oxyfuel technology do not meet this goal. Furthermore, pulverized coal technology with carbon capture is an unproven technology at the Project's scale; it has lower efficiency, higher water usage, and higher emissions.

Mitsubishi Heavy Industries' (MHI) gasification technology forms the initial section of the IGCC Project. Other gasification technology options were considered, including those of GE, Shell and ConocoPhillips. MHI's oxygen blown gasification process was selected for the following reasons:

- The two-stage gasification process provides for greater than 99 percent carbon conversion, resulting in a gasification solids by-product having virtually no carbon content.

- Dry feed system translates into reduced water consumption, as well as reduced size and cost of the wastewater treatment facility (no black water)

- Water wall design versus refractory design provides thermal protection for greater reliability and plant availability (less down time) and reduces maintenance costs.

- Increased efficiency as a result of reduced oxygen and coal/petcoke demand for producing a given amount of syngas. Also, MHI's technology produces high pressure superheated steam in the syngas cooler, which enhances power production.

- Lower overall emissions and higher CO_2 production (for enhanced oil recovery and sequestration) than other competing gasification technologies.

Based on the above reasons, MHI is the selected technology supplier

6.5.2 Acid Gas Removal System

Two important design criteria for the acid gas removal (AGR) system were: (1) removal of sulfur in the H_2-rich fuel to a target of less than 5 ppm by volume (ppmv) total sulfur (a level compatible with state-of-the-art art selective catalytic reduction technology); and (2) production of a high-purity CO_2 stream that contains over 90 percent of the total carbon in the raw syngas. There are numerous AGR technologies available, but only a few have found widespread acceptance for gasification projects. The three most commonly selected technologies are methyldiethanolamine (MDEA), Selexol®, and Rectisol®.

For the reasons discussed below, Rectisol® was selected because of its ability to meet the Project's target levels for sulfur removal and purity of the CO_2 stream. All three of these solvents are capable of selective removal of hydrogen sulfide from a sour syngas stream. However, the sulfur slip (H_2S + COS) in the treated syngas is highest for methyldiethanolamine (MDEA) (an order of magnitude higher than the desired target level). For this reason, MDEA did not meet the requirements of the Project.

Selexol® is commonly selected for IGCC applications where the gasifier pressure is relatively high and where the depth of sulfur removal is sufficient to allow the use of conventional selective catalytic reduction catalysts in the heat recovery steam generators (HRSG). There are several Selexol® units in commercial operation treating syngas. However, Selexol® loses its capital cost advantage when either very deep sulfur removal or high-purity CO_2 capture is required. As previously stated, both are required. Furthermore, as compared with Rectisol®, only one Selexol® plant is understood to be operating at sulfur levels less than 5 ppmv in the H_2-rich fuel at a scale smaller than that required for the Project. There is sufficiently more of an experience base showing that Rectisol® is more likely to achieve the Project's design criteria for sulfur recovery.

Additionally, Rectisol® is the more common selection when the syngas is used for chemical manufacturing and when very deep sulfur removal is required. Rectisol® solvent is often used in the production of commercial grade methanol; it is low cost and is available from multiple suppliers. Rectisol® is commercially proven with 50 Rectisol® plants in operation, and with many power plants demonstrating sulfur removal at, or better than, the design criteria for the Project. Another important factor in the selection of Rectisol® is its ability to remove trace contaminants, such as carbonyl sulfide (COS), hydrogen cyanide (HCN), ammonia (NH_3), mercaptans, mercury (Hg), iron (Fe) and nickel (Ni) carbonyls; and mixtures of benzene, toluene, and xylene (BTX).

As a result of the extensive evaluation performed by HECA, it chose Rectisol® for the Acid Gas Removal (AGR) system. With its significant sulfur removal capability, proven operating experience demonstrating sulfur removal consistent with the Project's design criteria, and removal of trace contaminants, Rectisol® was deemed superior to Selexol® for the Project.

6.5.3 MHI 501 GAC® Combustion Turbine

MHI's 501GAC® combustion turbine was selected as the combustion turbine for the following reasons:

- MHI's proven experience with high (greater than 90 percent) H_2 fuel.
- Highest efficiency of all "G" class machines, particularly with the air-cooled model.
- Single-shaft design reduces capital costs (one versus two generators) and equipment footprint (plot space requirements).
- Rapid ramp rate for the MHI 501GAC machine, versus competing turbine technologies.

6.5.4 Conclusion

In conclusion, a thorough review of alternative generation technologies and configurations was conducted. Based on this review, none of the alternatives satisfied the basic Project Objectives, as described above, without resulting in increased adverse impacts to the environment or impaired project feasibility as compared to the proposed Project. As a result, the alternative generation technologies and configurations were rejected in favor of the proposed Project's generation technology.

6.6 MANUFACTURING COMPLEX ALTERNATIVES AND TECHNOLOGY SELECTION

The Project was studied both with and without a Manufacturing Complex component. A number of benefits are achieved by the addition of the Manufacturing Complex, including the following:

- Greater capability for the plant to vary power output in response to planned daily changes in power demand. The Project uses gasification with carbon capture and storage to produce H_2, a clean, carbon free, high energy carrier for electricity and nitrogen-based product production. In contrast to power markets where demand is variable, the H_2 and carbon capture production equipment operate best at steady conditions thereby offering limited electrical output flexibility. The key to overcoming this limitation is addressed through HECA's ability to produce and store nitrogen-based products. When maximum power output is indicated, the production of nitrogen-based products is reduced while the H_2 production rate remains unchanged. Similarly, when lower power output is indicated, H_2 is diverted to producenitrogen-based products. This flexibility is an important power generation characteristic to facilitate grid stability and higher penetrations of other clean low carbon generation technologies such as intermittent renewable energy.

- The Manufacturing Complex will provide nitrogen-based products manufactured locally, important to the California agriculture industry, with a low carbon footprint, and the avoidance of transportation supply chain GHG emissions.

- The combination of a Manufacturing Complex and power plant results in greater co-production energy efficiencies than achieved by a standalone power plant of the same design.

- The Manufacturing Complex enhances economic viability of the Project by adding another revenue stream.

6.7 ALTERNATIVE WATER SUPPLIES

Several potential alternative water supplies were studied for the Project, as well as potential technologies for reducing water demand.

The water supply options considered included:

- Ocean water

- Brackish water
  - Industrial wastewater
  - Semitropic Water Storage District
  - Buena Vista Water Storage District

- Inland Wastewaters
  - Municipal effluent
  - Agricultural wastewater

- Other inland waters
  - State Water Project
  - Fresh groundwater
  - Municipal water supply

In addition to evaluating the ability of the alternatives to feasibly attain the general Project objectives, HECA used the following water supply specific criteria as a means of evaluating potential water supply alternatives:

- Environmental impacts
- Beneficial impact to local groundwater quality and agriculture
- Economic feasibility
- Feasibility of land acquisition
- Proximity to raw water supply
- Minimization of the parasitic electrical demand

In addition, the analysis took into consideration California State Water Resources Control Board Resolution No. 75-58,[1] referred to as the California Water Policy, which addresses the use and disposal of inland waters used for power plant cooling.

6.7.1 Water Supply Alternatives Decision Analysis

The following hierarchy of tests was applied to each water supply alternative:

[1] Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling, Resolution 75-58, State Water Resources Control Board, June 19, 1975.

Test 1. Is the alternative water supply feasibly available at the Project Site? (If not, then disregard this alternative. If yes, proceed to Test 2.)

Test 2. Will the subject water supply alternative satisfy California Water Policy? (If not, then disregard this alternative. If yes, proceed to Test 3.)

Test 3. Is the subject water supply alternative technologically sufficient (quantity and quality) to guarantee high safety and reliability (98 percent availability?) (If no, then disregard this alternative. If yes, proceed to Test 4.)

For water supply alternatives passing Tests 1 through 3, apply Tests 4 through 6:

Test 4. Rate other impacts associated with each water supply alternative, including transportation, biological, energy, health and safety, etc. (high, medium, and low).

Test 5. Rate relative capital costs of each remaining water supply alternative (high, medium, and low).

Test 6. Rate relative operation and maintenance (O&M) costs of each of the remaining water supply alternatives (high, medium, and low).

Tests 1 through 3 address “fatal flaw” criteria. Alternatives that did not pass Test 1, 2, or 3, were not evaluated further. For alternatives passing Tests 1 through 3, the evaluations from application of Tests 4 through 6 were evaluated for each water supply alternative, with the alternative with the highest evaluation being selected.

6.7.2 Wastewater Being Discharged to the Ocean

The Project Site is located approximately 75 miles from a significant source of ocean disposed wastewater. Although this supply is large, and technology for its successful use proven, the capital cost for transporting and treating the wastewater from this option is high (>$500 million). This alternative water supply failed Test 1, because it is not feasibly available at the Project Site. This alternative was eliminated from further consideration.

6.7.3 Ocean Water

The Project Site is approximately 75 miles from the Pacific Ocean. Although this supply is limitless, and technology for its successful use proven, the capital cost for transporting, treating, and disposing of this option is high (>$500 million). This alternative water supply failed Test 1, because it is not feasibly available at the Project Site. This alternative was eliminated from further consideration.

6.7.4 Brackish Water

6.7.4.1 Industrial Wastewater

Industrial wastewater in the form of produced water is available from the oilfields within 10 miles of the Project Site. Produced water refers to water that is “co-produced” from the many oil wells in the Kern County region. Produced water is an industrial wastewater that is separated from crude oil in the oil production process. Kern County oil well output is often 8 parts water to 1 part oil, leading to a large excess of produced water that the local oil producers must dispose of. The produced water is currently disposed by re-injection and discharge to evaporation ponds. There are approximately 15 million gallons per day (mgd) of produced water available when drawn from multiple locations within a radius of 10 miles of the Project Site. Producers of these waters indicated they were willing to provide this water to the Project. However, they are reluctant to guarantee specific quantities of future water supply. The business purpose of these organizations is oil production—not water production—and they are unwilling to complicate the former for the sake of the latter. Commercial discussions determined that a reliable produced water supply is not readily available; therefore, this alternative failed Test 1. Under the test hierarchy, previously described, this conclusion ends consideration of this alternative. Nevertheless, for the purposes of this analysis, the ability of this alternative to meet subsequent tests was evaluated.

Because inland wastewaters are identified in California State Water Resources Control Board Resolution No. 75-58 as a preferred alternative source of water supply, the produced water is consistent with the California Water Policy. Therefore, this supply does pass Test 2.

The produced water exhibits Total Dissolved Solids concentrations ranging from 10,000 to 40,000 milligrams per liter; it has elevated concentrations of potentially problematic ionic species, including silicon (Si), strontium (Sr), and barium (Ba); and it possesses significant oil and grease issues. Given the quality and ionic constituents of these supplies, the optimal technology for processing this raw water to Project standards is a “thermal process.” The thermal process uses a mechanical vacuum pump and heat input to boil the water and recover a good quality stream sufficient for utility purposes. This utility water stream must then be treated further with reverse osmosis and demineralization to achieve the Project demineralized water standard. Produced water will require significant treatment prior to use. This treatment is not unprecedented, but only one such example is known to HECA. This provides a higher level of technology risk than the Project is comfortable with. However, such treatment does appear to be technologically feasible, so this supply passed Test 3.

It is estimated that the capital cost to construct a water plant to process this raw water supply could be $200 million. The costs to operate this water plant are anticipated to be high, and could result in a nearly 15 MW additional parasitic load over use of brackish groundwater (due to the steam turbine cycle to operate the water plant). These capital and operating costs are substantial and they negatively impact the Project’s economics.

The thermal treatment technology will produce a concentrated brine waste stream. Based upon quality data already obtained, it is possible that this reject stream will have constituents at sufficient levels to trigger classification of the brine waste stream as hazardous waste. This waste generation would conflict with the intent of the Project design to minimize the production of hazardous waste to the extent feasible.

Although oilfield-produced water appears to be technologically possible as a water supply to the Project, it is not the preferred option, due to availability, environmental, waste disposal, and cost considerations.

6.7.4.2 Semitropic Water Storage District

The Semitropic Water Storage District (Semitropic) is in northwest Kern County. It has a groundwater storage capacity of 1.65 million acre-feet, with 650,000 acre-feet of capacity remaining.

Agriculture in a portion of the Semitropic District is impacted by shallow, brackish groundwater conditions resulting from agricultural irrigation. This impacted area is approximately 10 miles to the west/northwest of Wasco and affects an area of roughly 10 square miles.

Similar to the BVWSD, use of this water supply alternative is consistent with the California Water Policy in that the ultimate water supply will be brackish groundwater; it passed Test 2. However, in conversations with Semitropic, they were unable to verify the water supply quantity and composition; they were therefore unable to provide a firm water supply commitment for this Project. Therefore, Tests 1 and 3 could not be performed, and this alternative was rejected.

6.7.4.3 Buena Vista Water Storage District

The Project Site is in the southern portion of the BVWSD. The brackish groundwater will be supplied from Buena Vista Water Storage District (BVWSD), as part of BVWSD's Brackish Groundwater Remediation Project (BGRP), which is designed to remediate brackish groundwater that is considered to be unsuitable for agricultural or drinking uses. Implementation of the BGRP, which includes Project-specific pumping, is seen as a benefit to BVWSD in that it remove salts from the aquifer, impedes eastward flow of poor-quality groundwater, and enhances westward flow of good-quality groundwater. Project consumption of these impaired sources will beneficially affect local agriculture.

The District has stated that it will be able to provide brackish groundwater to the Project for the estimated life of the Project (see BVWSD/HECA contract in Appendix N-1, Water Resources Information). Because there is sufficient brackish groundwater available to meet the needs of the Project, this alternative passed Test 1. The use of brackish groundwater is consistent with the California Water Policy, and it passed Test 2.

The District's brackish water supply system will include a "picket fence" of wells to intercept the brackish water plume entering the District from the west. Because it is technologically feasible to obtain and treat the brackish groundwater to Project standards, this alternative passed Test 3.

As discussed in Section 5.14, Water Resources, this alternative does not result in any significant adverse environmental impacts. The relative capital costs and O&M costs associated with this water supply alternative are not insignificant; however, this option is economically feasible. Based on this evaluation, brackish water provided by BVWSD has been identified as the preferred process water supply for the Project.

6.7.5 Inland Wastewaters

6.7.5.1 Municipal Effluent

The Project Site is located approximately 17 miles northeast of the city of Bakersfield Wastewater Treatment Plant #3. This plant treats a large portion of the municipal effluent generated from the city of Bakersfield.

Previously, the Project had discussions with the city regarding their interest and availability in supplying water to the Project. Currently, the city is selling its treated effluent to local farmers for irrigation purposes. They do not have excess capacity outside of existing contracts, which can supply the Project with its total water needs. They do have some excess production (approximately 1 mgd), which is expected to increase in the intervening time between Project permit submission and start-up. This growth rate is estimated at approximately 0.25 mgd per year, resulting in another 1 mgd available by start-up in 2014. This amount is insufficient for Project needs, and would have to be augmented by an additional water supply.

Given that this supply is insufficient for Project needs, it failed Test 1, and was not selected as the preferred process water supply for the Project.

6.7.5.2 Agricultural Wastewater

Agricultural wastewater (i.e., tile drainage) is excess water from irrigation practices. This wastewater is not available in sufficient quantities in the vicinity of the Project Site, nor is it sufficiently reliable for use at the Project due to water quality variability. Therefore, this alternative failed Tests 1 and 3, and was eliminated from further consideration.

6.7.6 Other Inland Waters

6.7.6.1 State Water Project

The State Water Project's California Aqueduct is approximately 1,900 feet south of the Project Site. This source failed Test 1, because the Project does not have an allocation for the use of water from the State Water Project. In addition, it is anticipated that this source would fail to pass Test 2, because the availability of other viable sources of water would make use of this freshwater source inconsistent with the California Water Policy (State Water Resources Control Board Resolution No. 75-58). Direct use of water from the State Water Project was therefore eliminated from further consideration.

6.7.6.2 Fresh Groundwater

Fresh groundwater is found in the vicinity of the Project Site. Because this alternative water supply is feasibly available to the Project, it passed Test 1. Given the availability of other viable sources of water, use of this freshwater supply would be inconsistent with the California Water Policy, and this alternative water supply failed Test 2. It was, therefore, eliminated from further consideration.

6.7.6.3 Municipal Water Supply

Given the availability of other viable sources of water, use of a municipal freshwater supply would be inconsistent with the California Water Policy. This alternative water supply failed Test 2 and was eliminated from further consideration.

6.8 ALTERNATIVE WASTEWATER DISPOSAL OPTIONS

Following is a summary of the wastewater disposal alternatives that were evaluated:

- **Zero Liquid Discharge (ZLD) system.** A mechanical system using evaporation and crystallization to effectively reduce liquid wastes to a dry waste for landfill disposal.

- **Evaporation pond.** Large, lined surface impoundment for disposal of wastewater via atmospheric drying, resulting in a sludge that must be disposed of in a landfill system.

- **Class I non-hazardous injection well.** Disposal of wastewater via well discharge to a geologic formation that is unsuitable for potable water production and isolated from drinking water aquifers.

- **Disposal to wastewater treatment plant.** Discharge to a treatment works for removal of pollutants.

- **Surface discharge.** Discharge of wastewater to the ground or receiving waters, including lakes, rivers, and streams.

- **Off-site treatment.** Routing of the wastewater to a facility in another location employing one or more of several technologies by a contracted service company.

6.8.1 Wastewater Disposal Alternatives Decision Analysis

The following hierarchy of tests was applied to each alternative:

Test 1. Is the wastewater disposal alternative feasibly available at the Project? (If not, then disregard this alternative. If yes, proceed to Test 2.)

Test 2. Will the subject alternative satisfy applicable laws, ordinances, regulations, and standards? (If not, then disregard this alternative. If yes, proceed to Test 3.)

Test 3. Is the subject alternative technologically sufficient to guarantee high safety and reliability (98 percent availability? If no, then disregard this alternative. If yes, proceed to Tests 4 through 6.)

Tests 1 through 3 address “fatal flaw” criteria. Alternatives that did not pass Test 1, 2, or 3, were not evaluated further. For alternatives passing Tests 1 through 3, Tests 4 through 6 were applied and scored as high, medium, or low:

Test 4. Rate other environmental impacts, including transportation, biological, energy, health and safety, etc.

Test 5. Rate relative capital costs of each remaining alternative.

Test 6. Rate relative O&M costs of each remaining alternative.

The ratings from application of Tests 4 through 6 were evaluated for each alternative, with the highest rated alternative selected.

6.8.2 ZLD System

A ZLD system is a mechanical system using a mechanical vapor compression evaporator and crystallization to effectively reduce liquid wastes to a dry solid waste for landfill disposal. ZLD enables water to be reused within the plant, and it eliminates wastewater. Although this option is technologically feasible, it is energy-, operational-, and capital-intensive.

6.8.3 Evaporation Pond

An evaporation pond would consist of a large, lined surface impoundment for disposal of wastewater via atmospheric drying, resulting in a sludge that must be disposed in an approved landfill. A very large evaporation pond would be required for disposal of the large volume of wastewater produced by the Project. Due to space, economic, and environmental considerations, this alternative was determined to not be feasible. Therefore, this alternative was eliminated from further consideration.

6.8.4 Injection Disposal Well

This alternative includes the disposal of wastewater via wells that discharge to a geologic formation that is unsuitable for potable water production and is isolated from aquifers. The following geologic conditions protective of underground source of drinking water are required to obtain a permit to construct a Class I Non-hazardous Injection Well:

- A thick sequence of permeable sediments capable of accepting the injected wastewater.
- A thick sequence of impermeable sediments that will confine the injected wastewater and prevent migration towards underground source(s) drinking water.
- The injection operation should not facilitate the fracturing of the rocks or the integrity of the injection well.

Deep-well injection (DWI) is used widely on the western side of Kern County. Local subsurface strata are well understood, and large amounts of geologic data are available to define the appropriate wastewater disposal system. DWI for the rates expected would require a network of approximately 15 disposal wells (with five additional wells for redundancy), with multiple high-head booster pumps to enable injection. This infrastructure would be expensive to build and operate. Constructing this infrastructure either on site or off site would involve significant commercial negotiations. Because lengthy commercial discussions may disrupt the Project timeline, and considering that the ZLD was available at similar cost with no negative schedule impact, this DWI option was not selected.

6.8.5 Disposal to Wastewater Treatment Plant

The city of Bakersfield wastewater treatment plant is approximately 17 miles south of the Project Site. This alternative failed to pass Test 1 due to the distance and insufficient capacity at the wastewater treatment plant.

6.8.6 Surface Discharge

This alternative would involve the discharge of wastewater to the ground or receiving waters, including lakes, rivers, and streams. This method failed to pass Test 2, because the quality of the wastewater will not meet state and federal discharge limitations for direct discharge to surface waters. This alternative was eliminated from further consideration.

6.8.7 Off-Site Treatment

This alternative would involve the transport of the wastewater produced by the Project to an off-site facility for treatment and/or disposal. This wastewater disposal alternative failed to pass Test 1, because it is not feasibly available at the Project Site due to the volume of wastewater produced, and the absence of a treatment or disposal facility in the vicinity.

The evaluations from application of Tests 4 through 6 were totaled for each alternative, and the alternative with the highest evaluation was selected. Wastewater disposal options are evaluated in Table 6-2, Evaluation of Wastewater Disposal Options.

Lifecycle costs for ZLD are roughly similar to a DWI system. However, ZLD is more straightforward from a commercial perspective in comparison to DWI. On the basis of similar costs, and ease of commercial arrangements, the Project includes a ZLD system for disposal of water treatment wastes and cooling tower blowdown.

6.9 NEPA Additional Alternatives Considered

NEPA requires that an EIS evaluate the range of reasonable alternatives to an agency's proposed action. The range of reasonable alternatives encompasses those alternatives that would satisfy the underlying purpose and need for agency action. The purpose and need for the Proposed Action is set forth in Section 6.1.3. Given the CCPI programmatic purpose and need, the reasonable alternative prior to selection of this Project would have been to select another project that applied to and met the eligibility requirements of the CCPI program. The range of reasonable alternatives in competitions for grants, loans, and other financial support is defined in large part by the range of responsive proposals DOE receives. Unlike projects undertaken by DOE itself, DOE cannot mandate what outside entities propose, where they propose to do them, or how they propose to do them, beyond establishing requirements in the funding opportunity announcement that further the CCPI Program objectives. DOE's decision is limited to selecting among the applications submitted by project sponsors that meet CCPI Program goals.

Recognizing that the range of reasonable alternatives in the context of financial assistance and contracting is in large part determined by the number and nature of the proposals submitted, Section 216 of DOE NEPA regulations requires the Department to prepare an "environmental critique" that assesses the environmental impacts and issues relating to each of the proposals that DOE considers for an award (see 10 CFR 1021.216). DOE considers these impacts and issues, along with other aspects of the proposals (such as technical merit and financial ability) and the CCPI Program objectives, in making awards. In October 2010, DOE prepared a critique of the proposals that were deemed suitable for selection in this round of awards for the CCPI program, titled Environmental Synopsis CCPI Round 3.

DOE received 11 applications in response to the initial Funding Opportunity Announcement (issued August 11, 2008) for Round 3 of the CCPI, all of which were determined to have met the mandatory eligibility requirements listed in the FOA. The applications covered a wide geographic range, including sites in 14 different states representing nearly every region of the country. In response to the reopened announcement (issued June 9, 2009), DOE received 38 applications, of which 25 were determined to have met the mandatory eligibility requirements listed in the announcement. The 25 applications offered projects involving sites in 19 different states representing nearly all geographic regions of the country. The applications were evaluated against technical, financial, and environmental factors. By broadly soliciting proposals to meet the programmatic purpose and need for DOE action and by evaluating the potential environmental impacts associated with each proposal before selecting projects, DOE considered a reasonable range of alternatives for meeting the purpose and need of the CCPI solicitation.

Once DOE selects a project for an award, the range of reasonable alternatives becomes the project as proposed by the applicant; any alternatives still under consideration by the applicant or that are reasonable within the confines of the project as proposed (e.g., the particular location of the generating plant within the HECA Project Site or ROWs for linear facilities), and a No Action alternative.

Under the No Project/No Action Alternative, DOE would not provide funding to HECA. In the absence of DOE funding, DOE assumes HECA could reasonably pursue two options. HECA could build the Project without DOE funding, and the impacts of this option would be essentially the same as those of the DOE Proposed Action. Or, HECA could choose not to pursue its Project, and there would be no impacts from the Project, as discussed in Section 6.2. The No Project/No Action Alternative would not contribute to the goal of the CCPI Program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. However, as required by NEPA, DOE analyzes the option of HECA not building the Project in the absence of DOE funding as the No Action Alternative, in order to have a meaningful comparison between the impacts of DOE providing financial assistance and DOE withholding that assistance.

In summary, DOE currently plans to analyze the Project as follows:

- As proposed by HECA (with and without any mitigating conditions that DOE may identify as reasonable and appropriate);

- Project-specific alternatives that HECA is still considering (e.g., construction of the railroad spur or the use of the Wasco facility for transportation of coal to the site); and the no-action alternative; and
- The No Action Alternative of HECA not building the Project in the absence of DOE funding.

Project-specific alternatives considered by HECA in developing the Project are described in Chapter 2, Project Description, and their comparative impacts are presented in Chapter 5, Environmental Consequences. HECA analyzed several alternative sites and determined that the only reasonable site alternative was the proposed site based on, among other things, the absence of sensitive resources; the availability of land; and the site's proximity to the brackish groundwater supply, to electric transmission and natural gas facilities, and to a CO_2 storage reservoir.[2]

6.9 REFERENCES

CARB (California Air Resources Board) *Aerometric Data Analysis & Management (ADAM), 2012. Top 4 Air Quality Data Summaries*, http://www.arb.ca.gov/adam/topfour/topfour1.phpl. Accessed April 13, 2012.

Council on Environmental Quality (CEQ), 1983. Guidance Regarding NEPA Regulations. 40 CFR Part 1500.

URS Corporation (URS), 2009. Revised Application for Certification for Hydrogen Energy California; Kern County, California. Vol. 1. May.

USEPA (U.S. Environmental Protection Agency), 2012. *AIRS Air Quality Monitoring Data Reports*, http://www.epa.gov/airdata/. Accessed April 13, 2012.

[2] HECA initially selected another site; it subsequently decided to move the HECA Project when it discovered the existence of sensitive biological resources at the initial site.

Table 6-1
Alternative Sites Reviewed and Status

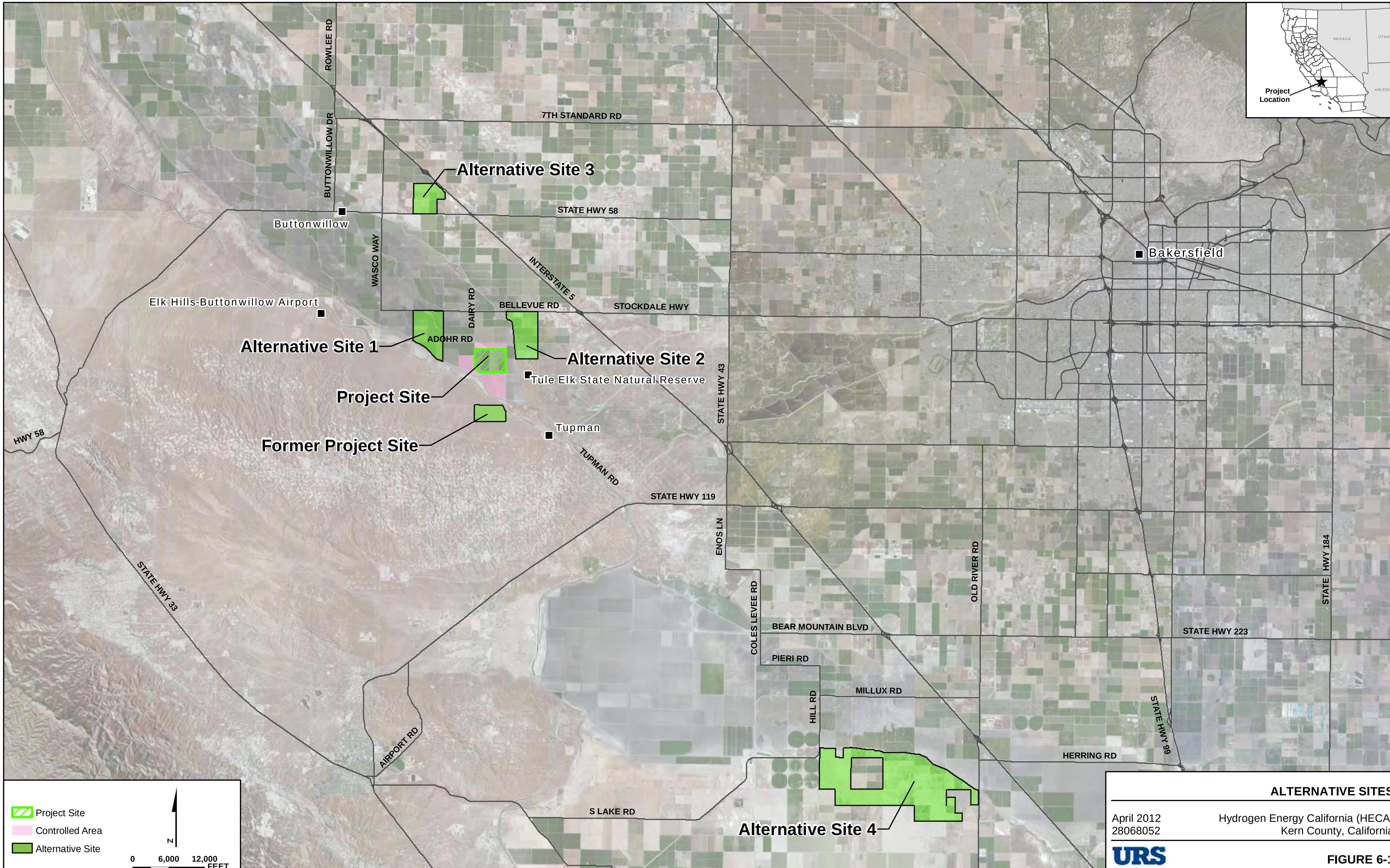
Property	Status
Project Site	Project Site—submitted in the 2009 Revised AFC and in this 2012 AFC Amendment
Former Project Site	Eliminated—due primarily to concentration of California threatened species identified
Alternate 1	Eliminated—owner not willing to sell
Alternate 2	Eliminated—sold to another buyer
Alternate 3	Eliminated—less desirable due to close proximity to I-5
Alternate 4	Eliminated—due primarily to length of linears and number of private land owners involved

Table 6-2
Evaluation of Wastewater Disposal Options

Wastewater Option	Test 1 Availability (pass?)	Test 2 Satisfy LORS? (pass?)	Test 3 Technologically Feasible? (pass?)	Test 4 Environmental Impacts	Test 5 Relative Capital Costs	Test 6 Relative O&M Costs
ZLD	Yes	Yes	Yes	Low	High	High
Evaporation pond	No	N/A	N/A	N/A	N/A	N/A
Deep injection well	Yes	Yes	Yes	Low	High	High
WWTP	No	N/A	N/A	N/A	N/A	N/A
Surface discharge	No	N/A	N/A	N/A	N/A	N/A
Off-site treatment facility	No	N/A	N/A	N/A	N/A	N/A

Source: HECA Project

Notes:
LORS = laws, ordinances, regulations, and standards
N/A = not applicable, because the alternative failed fatal flaw test
O&M = operation and maintenance
WWTP = wastewater treatment plant
ZLD = zero-liquid discharge



ALTERNATIVE SITES

April 2012
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE 6-1

Sources: Aerial Photo, USDA NAIP County Mosaic, 2005; Kern Water Bank Property, Kern County Parcels, 2008; Tule Elk Reserve, California State Parks, 2008; Roads, Kern County, 2008; Places, ESRI Streetmap Data, 2000-2005.

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Tables

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The Project will be designed for high reliability and efficiency. A detailed project description is provided in Section 2.0.

7.1 ORGANIZATION

Engineering standards and requirements are provided in Appendix D, Design Criteria. Details of the transmission system design are provided in Section 2.1.12.1, Electricity and Transmission Line. An overall description of the power plant design and operation can be found in Section 2.3, Power Generation. Design and engineering information is located in several places in this Application for Certification (AFC) Amendment as follows:

Power Generation	Section 2.3.2, Major Power Block Equipment Description; Additional information is also found in Appendix D, Design Criteria
Atmospheric Emission	Section 2.3.2.3, Emissions Controls Systems; Section 2.3.2.6, Emission Monitoring Systems; and Section 5.1, Air Quality
Waste Disposal System	Section 5.13, Waste Management
Noise Abatement	Section 5.5, Noise
Substations/Transformer	Section 2.3.3, Major Electrical Equipment and Systems; Section 4, Electrical Transmission; and Appendix C, Transmission Network Upgrade
Transmission System	Section 2.3.3, Major Electrical Equipment and Systems; Section 2.1.12.1, Electricity and Transmission Line; and Appendix C, Transmission Network Upgrade
Reliability	Section 2.9.2, Facility Reliability
Fire Control System	Section 2.5.11, Fire Protection

Information regarding design measures to provide for safe Project operation is contained in Section 2.8, Facility Safety Design.

A preliminary geotechnical investigation was performed by URS for the Project Site in 2009 (URS, 2009).

Additional engineering information is contained in Appendix D, Design Criteria—Engineering Construction Specifics:

Civil Engineering Design Criteria	Appendix D-1
Structural Engineering Design Criteria	Appendix D-2
Mechanical Engineering Design Criteria	Appendix D-3
Electrical Engineering Design Criteria	Appendix D-4
Controls System Design Criteria	Appendix D-5

7.2 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Laws, Ordinances, Regulations, and Standards (LORS) applicable to the Project are shown in Table 7-1, Applicable Laws, Ordinances, Regulations, and Standards. Please note that the design of structures and facilities will be based on the applicable building codes, specifications, industry standards, and regulations. Building permits will be reviewed during the building permit approval process by Kern County and their contractors.

7.3 INVOLVED AGENCIES AND AGENCY CONTACTS

Agency contacts regarding Project design are presented in Table 7-2, Involved Agencies and Agency Contacts.

7.4 REFERENCES

URS (URS Corporation), 2009. Preliminary Geotechnical Investigation, Proposed Hydrogen Energy California Project (HECA), Kern County, California, URS Job No. 289067571.

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
CIVIL ENGINEERING AND FOUNDATION DESIGN CRITERIA			
Federal			
Regulatory Water Quality and Soil Resources	DESC (Drainage, Erosion, and Sediment Control) Plan	National Resource Conservation Service (NRCS)	None
Title 29, Code of Federal Regulations (CFR) Part 1910, Occupational Safety and Health Standards	Safety and health	U.S. Department of Labor, Occupational Safety & Health Administration (OSHA)	None
Title 40, Code of Federal Regulation s (CFR) Part 112, Oil Pollution Prevention *et seq*.	Spill Prevention and Countermeasure Plan (SPCC)	U.S. Environmental Protection Agency (USEPA)	None
State			
California Business & Professions Code §6704 *et seq*., §§ 6730 and 6736	State professional registration	Department of Consumer Affairs, California Board For Professional Engineers and Land Surveyors	None
California Vehicle Code § 35780 *et seq*.	Permits for heavy truck loads	California Department of Transportation (Caltrans)	Permits for heavy truck loads
California Labor Code § 6500 *et seq*.	Permit for trenches, scaffolding, false work	California Division of Occupational Safety and Health Administration (Cal/OSHA) Department of Industrial Relations	Permits for trenches, scaffolding, false work
State of California, Department of Transportation (Caltrans) Standard Specifications	Meet specifications	Caltrans	None
Title 24 California Code of Regulations, California Building Standards Code	Meet design and construction requirements	Kern County	Building permit
Title 8, California Code of Regulations (CCR), Division of Occupational Safety and Health	Construction safety orders, general industrial safety orders, and work safety requirements	Cal/OSHA	Building permit for boiler, trenching, and shoring

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
State of California, Department of Water Resources	Encroachment permit	Department of Water Resources Division of Engineering, Real Estate	Encroachment permit
State of California, Water Resources Control Board	NPDES/DESC general permit	California Environmental Protection Agency	General permit
County			
Title Title 17, Buildings and Construction, Kern County Code, Chapter Chapter 17.20 Plumbing Code	Kern County requires a plumbing permit for the installation of any plumbing, gas, or drainage piping work or any fixture or water heating or treatment equipment in a building or premises as defined in subsection 17.20.060.	Kern County	Plumbing permit
Title 17, Buildings and Construction, Kern County Code, Chapter 17.28 Grading Code	Kern County requires a grading permit for any excavating or filling or combination thereof except for exempted work as defined in subsection 17.28.040.B. Grading permit covers drainage requirements	Kern County	Grading permit
Kern County Development Service Agency	Any off-site flooding and off-site sedimentation potential	Kern County	Drainage and compliance submittal checklist
Industry			
AREMA Rail Operations Design Criteria	Meet design criteria	American Railway Engineering and Maintenance-of-Way Association	None
ACPA Concrete Paving Design Criteria	Meet design criteria	American Concrete Paving Association	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
CASQA Storm Water Management BMPs	Meet design criteria	California Stormwater Quality Association	None
AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications	Meet design criteria	American Association of State Highway and Transportation Officials (AASHTO)	None
Standards and Specifications	Meet requirements	Asphalt Institute (AI)	None
Standards and Specifications	Meet requirements	American Concrete Institute (ACI)	None
Standards	Meet requirements	American National Standards Institute (ANSI)	None
Standards, Specifications, and Recommended Practices	Meet requirements	American Society of Testing and Materials (ASTM)	None
Standards and Specifications	Meet design and construction criteria	American Water Works Association (AWWA)	None
Codes and Standards	Meet design criteria	American Welding Society (AWS)	None
Standards	Meet requirements	Concrete Reinforcing Steel Institute (CRSI)	Building
Standards	Meet requirements	National Fire Protection Association (NFPA)	
Standards and Specifications	Meet design criteria	Steel Structures Painting Council (SSPC)	None
California Plumbing Code	Meet general regulations	International Association of Plumbing and Mechanical Officials	Building plumbing permit
ENGINEERING GEOLOGY CODES, STANDARDS, AND CERTIFICATIONS			
Federal None Apply			
State			
Warren–Alquist Act, Title 20, Appendix B	Require that the AFC address the geological and seismic aspects of the site	CEC and CCR	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
California Environmental Quality Act (CEQA)	Require that potential significant effects, which include geological hazards, be identified	Office of Planning and Research	None
County			
California State Planning Law, Government Code Section 65302	Requires that seismic safety element be included in the general plan	Kern County	Building
California Building Code (CBC), 2010	Certify the placement of earthen fills and the adequacy of the site for structural improvements	Kern County	Building
Industry			
California Business and Professions Code, § 7835	Requires registration for geologists who practice for others	California Building Standards Commission	None
California Building Code (2010 Edition), Chapter 14 & Chapter 18	Earthquake regulations/foundations/ excavation and grading	California Building Standards Commission	Building
STRUCTURAL AND SEISMIC DESIGN CRITERIA			
Federal			
Title 29 Code of Federal Regulations, Part 1910, OSHA	Occupational Safety and Health Standards	OSHA	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
State			
Business and Professions Code § 6704, *et seq*.; §§ 6730 and 6736	Requires state registration to practice as a Civil Engineer or Structural Engineer in California	California Building Standards Commission	None
Labor Code § 6500, *et seq*.	Permit for trenches, demolitions, false work, and scaffolding	Department of Labor & Industry Relations	Permit for trenches, demolitions, false work, and scaffolding
California Building Code (CBC), 2010	Meet requirements	Kern County	Building
Title 24 (CCR), minimum legal building requirements	Adopts current edition of California Building Code as minimum legal building standard	Kern County	Building
Standard Specifications	Meet specifications	California Department of Transportation	None
Title 8 CCR § 1500, *et seq*.; § 2300, *et seq*.; and § 3200, *et seq.* describe general construction safety orders, industrial safety orders, and work safety requirements and procedures	Requirements as applicable	Cal/OSHA	None
Industry			
Building Code Requirements for Reinforced Concrete (ACI 318)	Meet design criteria	ACI	Building
Building Code Requirements for Concrete Masonry Structures (ACI 530)	Meet design criteria	ACI	Building
Environmental Engineering Concrete Structures (ACI 350)	Meet design criteria	ACI	Building
Specification for Structural Steel Buildings (ANSI/AISC 360-05)	Meet specifications	American Institute of Steel Construction (AISC)	Building

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Code of Standard Practice for Steel Buildings and Bridges (ANSI/AISC 303-05)	Meet standards	AISC	Building
Manual of Steel Construction, 13th Edition	Meet standards	AISC	Building
Seismic Provisions for Structural Steel Building, Including Supplement No. 1 (ANSI/AISC 341-05)	Meet design criteria	AISC	Building
Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications (ANSI/AISC 358-05)	Meet design criteria	AISC	Building
Specification for Structural Joints using ASTM A325 or A490 Bolts, Research Council on Structural Connections (RCSC)	Meet specifications	AISC	Building
North American Specification for the Design of Cold-Formed Steel Structural Members, (NAS)	Meet specifications	American Iron and Steel Institute (AISI)	Building
Structural Welding Code-Steel	Meet standards	AWS	Building
Reinforced Masonry Engineering Handbook	Meet standards	Masonry Institute of America (MIA)	Building
Standard Specification for Carbon Structural Steel (ASTM A36)	Meet specifications	ASTM	Building
Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless (ASTM A53)	Meet specifications	ASTM	Building
Standard Specification for Steel Wire, Plain, for Concrete Reinforcement (ASTM A82)	Meet specifications	ASTM	Building
Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware (ASTM A153)	Meet specifications	ASTM	Building
Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement (ASTM A185)	Meet specifications	ASTM	Building

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Standard Specification for Carbon Steel Bolts and Studs (ASTM A307)	Meet specifications	ASTM	Building
Standard Specification for Structural Bolts, Steel Heat Treated, 120/105 ksi Minimum Tensile Strength (ASTM A325)	Meet specifications	ASTM	Building
Standard Specification for Structural Bolts, Alloy Steel Heat Treated, 150 ksi Minimum Tensile Strength (ASTM A490)	Meet specifications	ASTM	Building
Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes (ASTM A500)	Meet specifications	ASTM	Building
Standard Specification for Carbon and Alloy Steel Nuts (ASTM A563)	Meet specifications	ASTM	Building
Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel (ASTM A563)	Meet specifications	ASTM	Building
Standard Specification for Low-Allow Steel Deformed and Plain Bars for Concrete Reinforcement (ASTM A706/A706M)	Meet specifications	ASTM	Building
Standard Specification for Hot-Rolled Carbon, Low-Alloy, High Strength Low-Allow and Alloy Steel Floor Plates (ASTM A786/A786M)	Meet specifications	ASTM	Building
Standard Specification for Steel Structural Shapes for Use in Building Framing (ASTM A992)	Meet specifications	ASTM	Building
Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength (ASTM A1011/A1011M)	Meet specifications	ASTM	Building

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Standard Specification for Hardened Steel Washers (ASTM F436)	Meet specifications	ASTM	Building
Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength (ASTM F1554)	Meet specifications	ASTM	Building
Standard Specification for “Twist-Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength (ASTM F1852)	Meet specifications	ASTM	Building
Standard Specification for “Twist-Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength (ASTM F2280)	Meet specifications	ASTM	Building
American Association of State Highway and Transportation Officials (AASHTO)	Meet design criteria	AASHTO	Building
Standards for Welding Steel Tanks (AWWA D100 or API 650 11th Ed)	Meet standards	AWWA or API	Building
Standards for Prestressed Concrete Pressure Pipe, Steel Cylinder Type for Water and Other Liquids (AWWA C301)	Meet standards	AWWA	Building
Standards for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed (AWWA C302)	Meet standards	AWWA	Building
Heating, Ventilating, and Air Conditioning Guide (ASHRAE)	Meet design criteria	American Society of Heating, Refrigeration, and Air Conditioning Engineers	Building

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
ELECTRICAL ENGINEERING DESIGN CRITERIA			
Federal			
Advisory Circular AC 70/7460-1K (Obstruction Marking and Lighting)	Meet Standards	Federal Aviation Administration (FAA)	None
Industry			
Standards	Electrical specifications	American National Standards Institute (ANSI)	None
Standards	Electrical specifications	Institute of Electrical and Electronics Engineers (IEEE)	None
Standards	Electrical specifications	National Electrical Manufacturers Association (NEMA)	None
Standards	Electrical specifications	ASTM	None
Standards	Electrical specifications	Underwriters Laboratories (UL)	None
Standards	Electrical specifications	Factory Mutual (FM)	None
Standards	Electrical specifications	Occupational Safety and Health Act (OSHA)	None
Standards	Electrical specifications	National Fire Protection Association (NFPA)	None
Standards	Electrical specifications	North American Electrical Reliability Corporation (NERC)	None
Standards	Electrical specifications	American Petroleum Institute (API)	None
Standards	Electrical specifications	National Electrical Safety Code (NESC) (only for 230 kilovolt work)	None
Standards	Electrical specifications	National Electrical Code (NEC)	None
Standards	Electrical specifications	Insulated Cable Engineers Association (ICEA)	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Standards	Electrical specifications	Association of Edison Illuminating Companies (AEIC) (for medium voltage cable only)	None
Standards	Electrical specifications	Illuminating Engineering Society of North America (IESNA)	None
Standards	Electrical specifications	International Electrotechnical Commission (IEC) standards may be used on motors and other electrical equipment such as large synchronous motor starting Load Commutated Inverter (LCI) manufactured outside of the United States.	None
MECHANICAL ENGINEERING DESIGN CRITERIA			
State			
Title 8 California Code of Regulations (CCR) Division 1, Chapter 4, subchapters –7	Meet standards	Cal/OSHA	Permits for boiler and asbestos contractor
Title 29, Code of Federal Regulations (CFR) Part 1910, Occupational Safety and Health Standards	Safety and health	U.S. Department of Labor, Occupational Safety & Health Administration (OSHA)	None
Title 40, Code of Federal Regulation s (CFR) Part 60, Standards of Performance for New Stationary Sources	Protection of environment	U.S. Environmental Protection Agency (USEPA)	None
California Building Code (CBC)	Base plates, anchor bolts, saddles, platforms, pipe supports	Kern County	None
Flammable Liquids, Gases, and Vapors, Chapter 27 Fire Protection, Division 1, Chapter 4, subchapter 7, Group 27	Meet standards, prepare risk management plan	Kern County Department of Environmental Health	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Industry			
Design specifications	Meet specifications	American Boiler Manufacturer's Association (ABMA)	None
Design specifications	Meet specifications	Antifriction Bearing Manufacturers Association (AFBMA)	None
Design specifications	Meet specifications	American Gear Manufacturers Association (AGMA)	None
Design specifications	Meet specifications	Air Movers Control Association (AMCA)	None
Design specifications	Meet specifications	American National Standards Institute (ANSI)	None
Design specifications	Meet specifications	American Petroleum Institute (API)	None
Design specifications	Meet specifications	American Society of Civil Engineers (ASCE)	None
Design specifications	Meet specifications	American Society of Heating, Refrigeration and Air Conditioning (ASHRAE)	None
Design specifications	Meet specifications	American Society of Mechanical Engineers (ASME)	None
Design specifications	Meet specifications	American Society for Nondestructive Testing (ASNT)	None
Design specifications	Meet specifications	American Society for Testing Materials (ASTM)	None
Design specifications	Meet specifications	American Welding Society (AWS)	None
Design specifications	Meet specifications	American Water Works Association (AWWA)	None
Design specifications	Meet specifications	Compressed Gas Association (CGA)	None
Design specifications	Meet specifications	Expansion Joint Manufacturing Association (EJMA)	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Design specifications	Meet specifications	Heat Exchanger Institute (HEI)	None
Design specifications	Meet specifications	Hydraulic Institute Standards (HI)	None
Design specifications	Meet specifications	Institute of Electrical and Electronics Engineers (IEEE)	None
Design specifications	Meet specifications	Instrument Society of America (ISA)	None
Design specifications	Meet specifications	Manufactures Standardization Society of the Valve and Fitting Industry (MMS)	None
Design specifications	Meet specifications	Cooling Tower Institute (CTI)	None
Design specifications	Meet specifications	National Fire Protection Association (NFPA)	None
Design specifications	Meet specifications	National Bureau of Standards (NBS)	None
Design specifications	Meet specifications	National Electrical Code (NEC)	None
Design specifications	Meet specifications	National Electrical Manufactures Association (NEMA)	None
Design specifications	Meet specifications	Pipe Fabrication Institute (PFI)	None
Design specifications	Meet specifications	Steel Structures Painting Council (SSPC)	None
Design specifications	Meet specifications	Tubular Exchanger Manufactures Association (TEMA)	None
Design specifications	Meet specifications	Uniform Fire Code (UFC)	None
Design specifications	Meet specifications	Underwriters Laboratory (UL)	None
SYSTEM CONTROL ENGINEERING DESIGN CRITERIA			
Industry			
Design specifications	Meet specifications	ANSI/ISA	None
Design specifications	Meet specifications	ASME	None
Design specifications	Meet specifications	National Electric Code (NEC)	None

Table 7-1
Applicable Laws, Ordinances, Regulations, and Standards (Continued)

Jurisdiction LORS	Applicability	Administering Agency or Professional Association[1]	Required Permit
Design specifications	Meet specifications	National Electric Manufacturers Association (NEMA)	None
Design specifications	Meet specifications	National Electric Safety Code (NESC)	None
Design specifications	Meet specifications	National Fire Protection Association (NFPA)	None
Design specifications	Meet specifications	American Petroleum Institute (API)	None
Design specifications	Meet specifications	Process Industry Practice (PIP)	None

Note:
[1] Please note that the design of all structures and facilities will be based on building codes, specifications, industry standards, and regulations and will be reviewed during the building permit approval process by Kern County.

Table 7-2
Involved Agencies and Agency Contacts

Agency	Contact/Title	Telephone
Kern County Building Inspection Division 2700 “M” Street, Suite 100 Bakersfield, CA 93301	Charles Lackey, Director	(661) 862-8650
Kern County Planning Department 2700 “M” Street, Suite 100 Bakersfield, CA 93301	Lorelei H. Oviatt, AICP Division Chief	(661) 862-8866
Caltrans North Region Permits Office MS #41 1823 14th Street Sacramento, CA 942874	Kien Le	(916) 322-6001
San Joaquin Valley Air Pollution Control District Southern Region 34946 Flyover Court Bakersfield, CA 93308	Leonard Scandura, PE Supervising Air Quality Engineer	(661) 392-5601
U.S. Environmental Protection Agency Air Permits Office 75 Hawthorne Street San Francisco, CA 94105	Gerardo Rios, Chief, Permits Office Air Division	(415) 972-3974
California Energy Commission 1519 Ninth Street Sacramento, CA 95814	Eileen Allen, Facilities Siting Program Manager	(916) 654-4082
California Department of Fish and Game Central Region Headquarters Office 1234 E. Shaw Avenue Fresno, CA 93710	Julie Vance, Senior Environmental Scientist	(559) 243-4014 x 222
County of Kern, Environmental Health Services Department (EHSD) 2700 M Street, Suite 300 Bakersfield, CA 93301	Matthew Constantine, Director	(661) 862-8700
State of California, Central Valley Regional Water Quality Control Board 1685 E Street Fresno, CA 93706	Doug Patterson, Senior Water Resource Control Engineer	(559) 445-5146
California Occupational Safety & Health Administration District Office 6150 Van Nuys Boulevard, Suite 405 Van Nuys, CA 91401		(818) 901-5403
Department of Water Resources Division of Engineering, Real Estate Board 1416 19th Street P.O. Box 942836 Sacramento, CA 94236	San Joaquin Field Division 4201 Sabodan Street Bakersfield, CA 93313	(661) 858-5513

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

April 2012

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ACRONYM LIST

Acronym	Definition
^0C	Degrees Celsius
^0F	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

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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.

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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 CO_2 as CO_2 is a valuable commodity that will be purchased by OEHI from HECA. This will be done by separating the CO_2 from the recovered hydrocarbons in a closed loop system. The recovered CO_2 will be re-injected into the reservoir as part of the continuous EOR process. Injected and recycled quantities of CO_2 will be monitored closely. Since some of the CO_2 becomes trapped within the formation during each injection cycle, it is necessary to introduce additional amounts of purchased CO_2 to continue the EOR operation.

The reservoir geological environment will determine the extent to which CO_2 will be immobilized, trapped and retained in the reservoir, making it difficult to predict the recovery (and trapped) fractions for each pass of CO_2 through the reservoir. However, Occidental's extensive experience as a world-wide leader in operating CO_2 EOR indicates that during each cycle approximately 30 to 50 percent of the injected CO_2 mass will remain trapped in the reservoir and is unrecoverable. However, regardless of the fraction of CO_2 trapped during a cycle, the CO_2 remains within the closed looped system and absent minor losses due to fugitive emissions and operating losses, the injected CO_2 will become trapped in the reservoir when production ceases.

The key CO_2 trapping mechanisms that occur in the subsurface include physical trapping, residual gas trapping and geochemical trapping.

- Physical trapping (and trap filling) retains the CO_2 in the formation using structural and stratigraphic traps. Physical trapping of the buoyant CO_2 is provided by the same impermeable "caprock" that seals the oil and hydrocarbon gases underground.
- Residual trapping and dissolution of the liquid or gaseous CO_2 occurs as a result of capillary forces retaining some of the CO_2. Residual CO_2 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 CO_2 with natural fluids and minerals in the target formation, principally consisting of CO_2 dissolution in brine (i.e., solubility trapping), CO_2 precipitation as mineral phases (i.e., mineral trapping) and CO_2 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 CO_2 and have different capacities to trap CO_2. Over time, the process of physical and residual CO_2 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 CO_2 purchased from HECA.

Aboveground CO2 Handling Process Overview

CO_2 from the HECA Project will be transported via pipeline to the EOR Processing Facility, at which point the CO_2 will be distributed to CO_2 injection wells placed in a geometric pattern designed to optimize the recovery of oil from the reservoir.

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.

1.0 EXECUTIVE SUMMARY

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	

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**
		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.	

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**
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.

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**
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.

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**
		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.
UTIL-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.

1.0 EXECUTIVE SUMMARY

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

2.0 INTRODUCTION

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.

2.0 INTRODUCTION

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).

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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.

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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.

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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

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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).

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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.

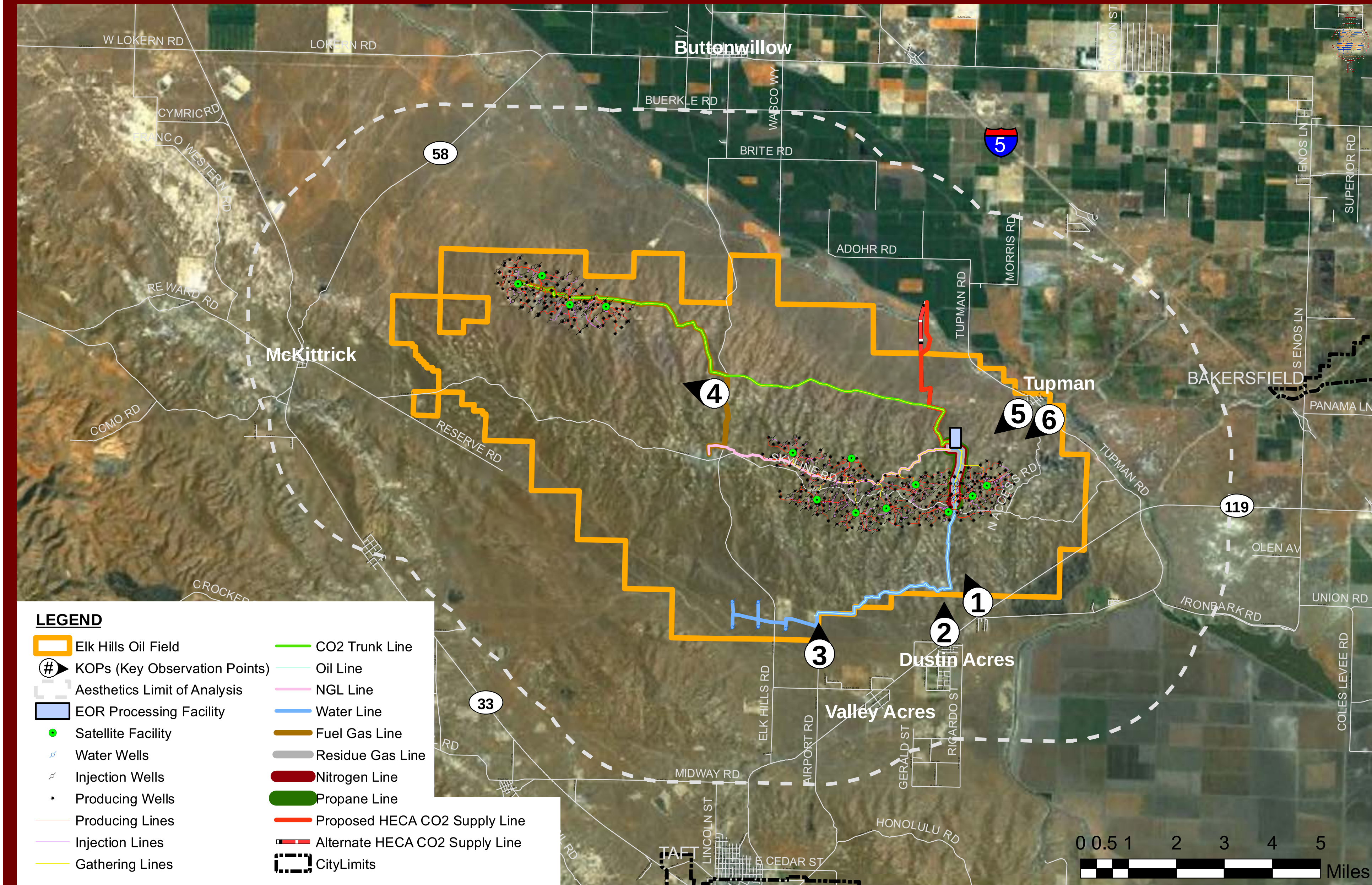

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Fig. 4.1-1

Project Viewshed and KOPs

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Project # 185802314

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.

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

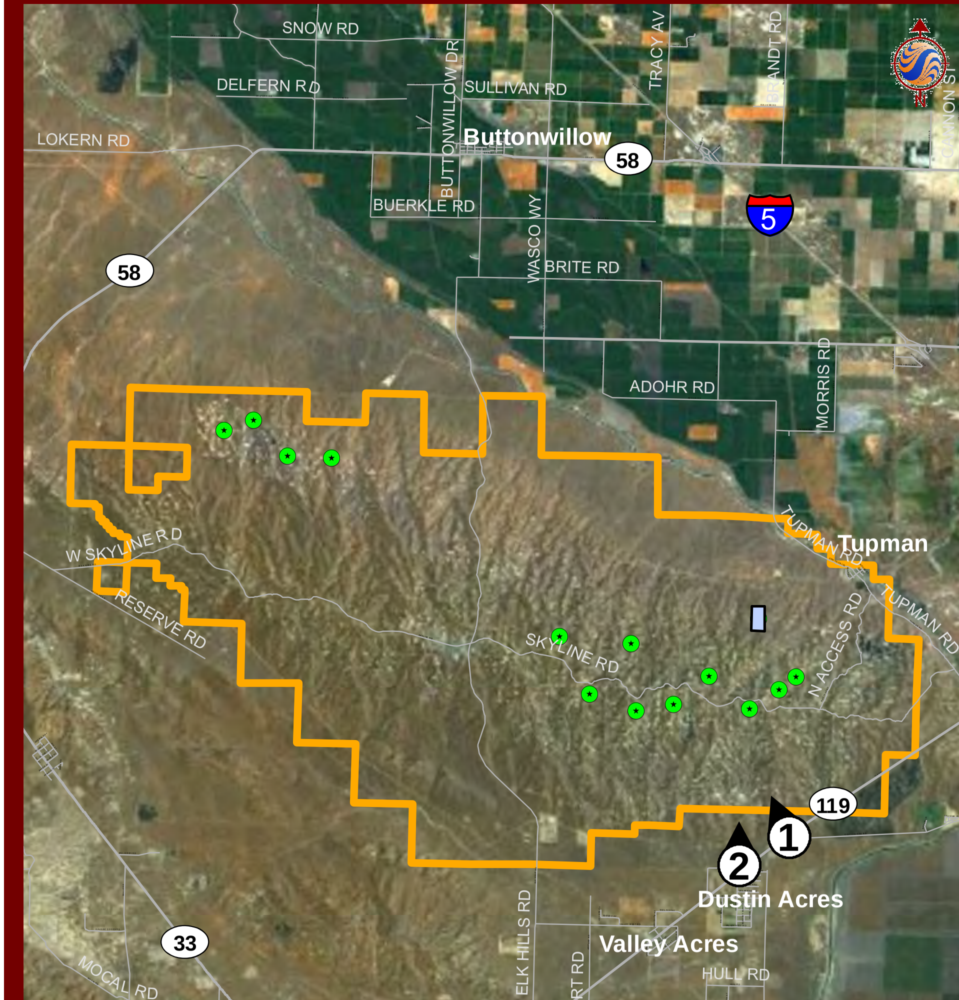
A field survey was conducted in September 2010 to photograph and document visual features on and around the proposed Project Site. The site and surrounding environment were observed from various KOPs and photographically documented to provide a baseline upon which to analyze visual impacts (see Figures 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.



LEGEND

- \# KOPs (Key Observation Points)
- EOR Processing Facility
- Satellite Facility
- Elk Hills Oil Field

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Fig. 4.1-2

Key Observation Points 1 and 2

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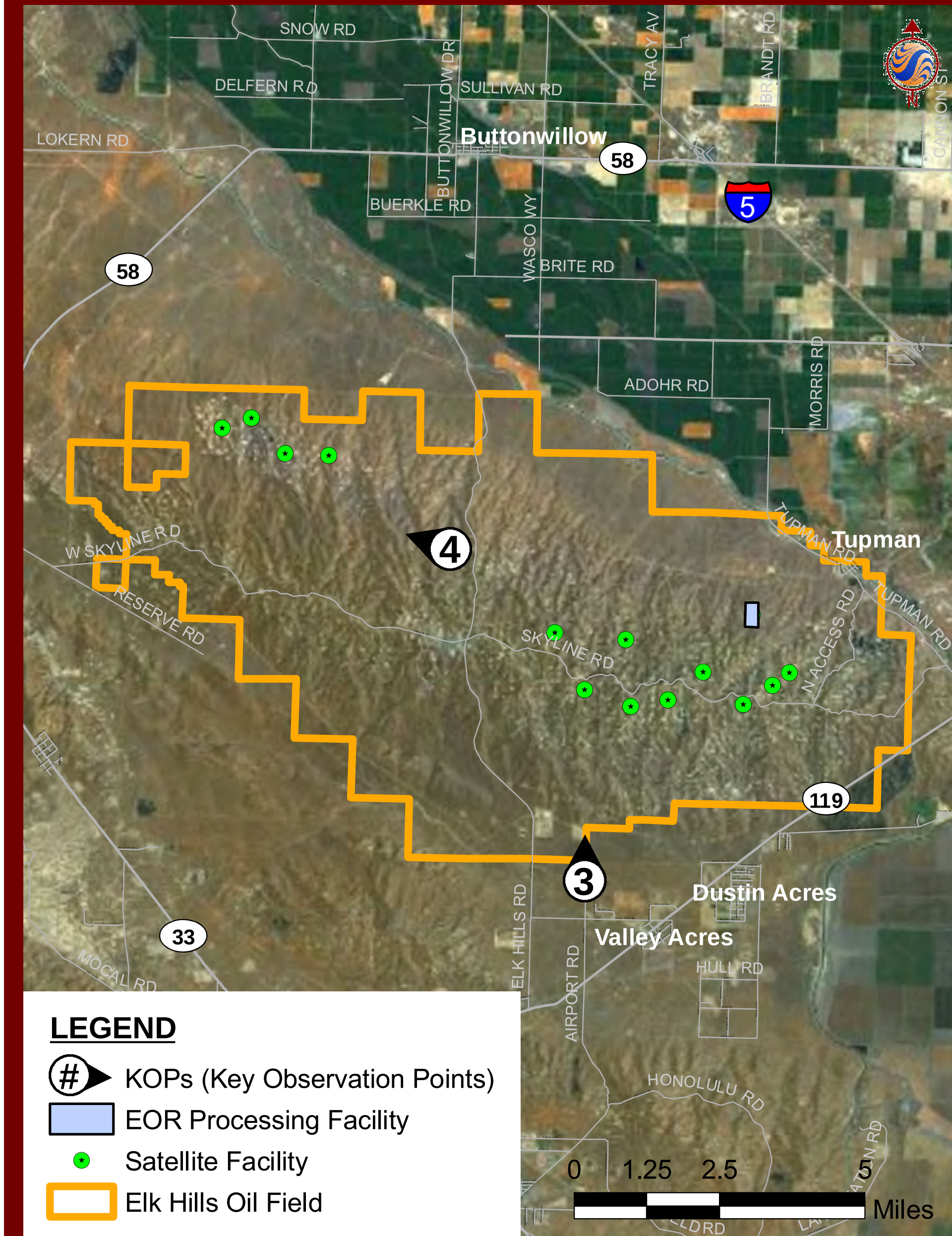
4.1 AESTHETICS

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.



Cartographic Design By: C. Flinders | Environmental Remediation

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Fig. 4.1-3

Key Observation Points 3 and 4

OEHI CO2 EOR Project - Supplemental Environmental Information

4.1 AESTHETICS

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.

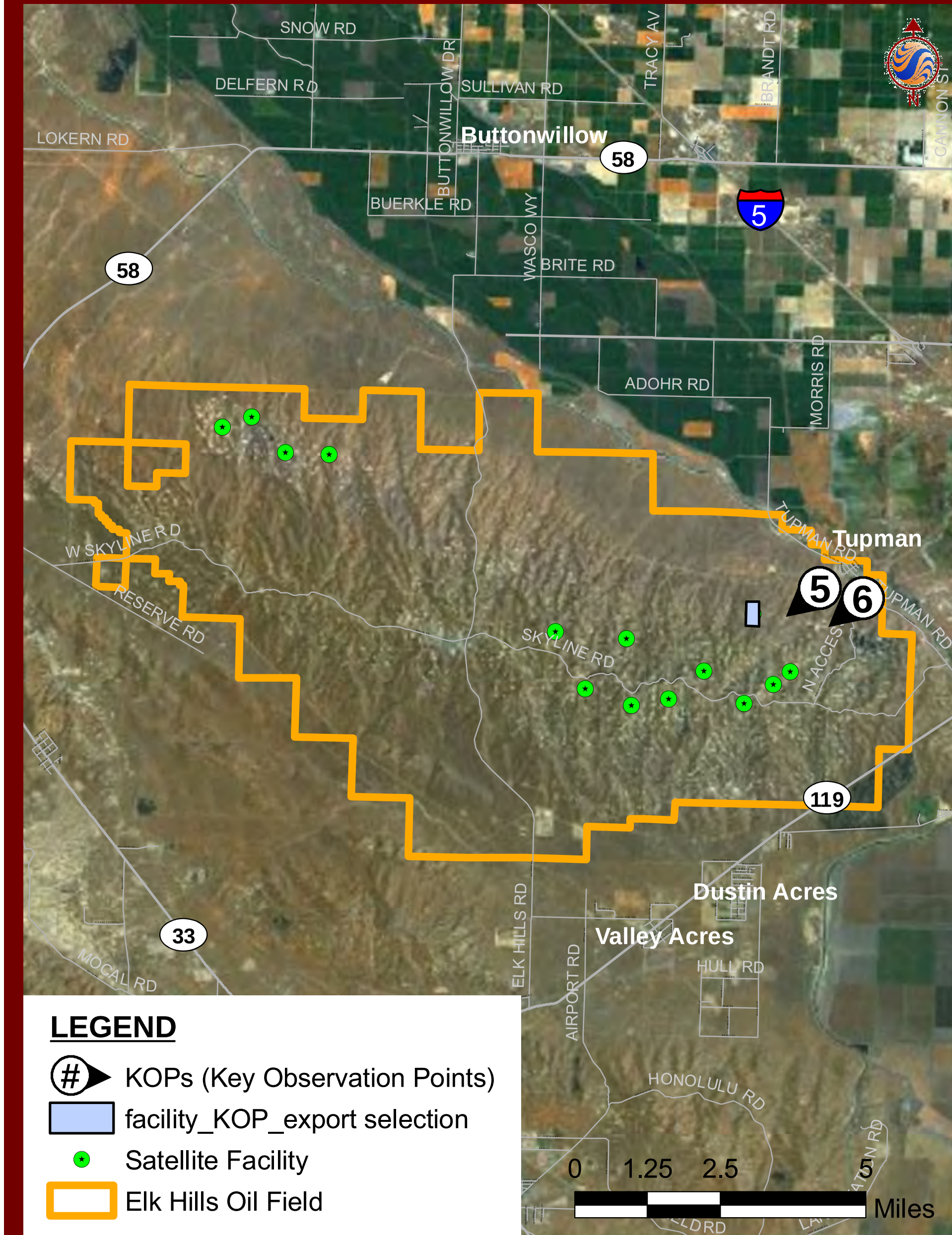

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Fig. 4.1-4

Key Observation Points 5 and 6

OEHI CO2 EOR Project - Supplemental Environmental Information

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.*

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.

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.

4.1 AESTHETICS

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

4.1 AESTHETICS

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.

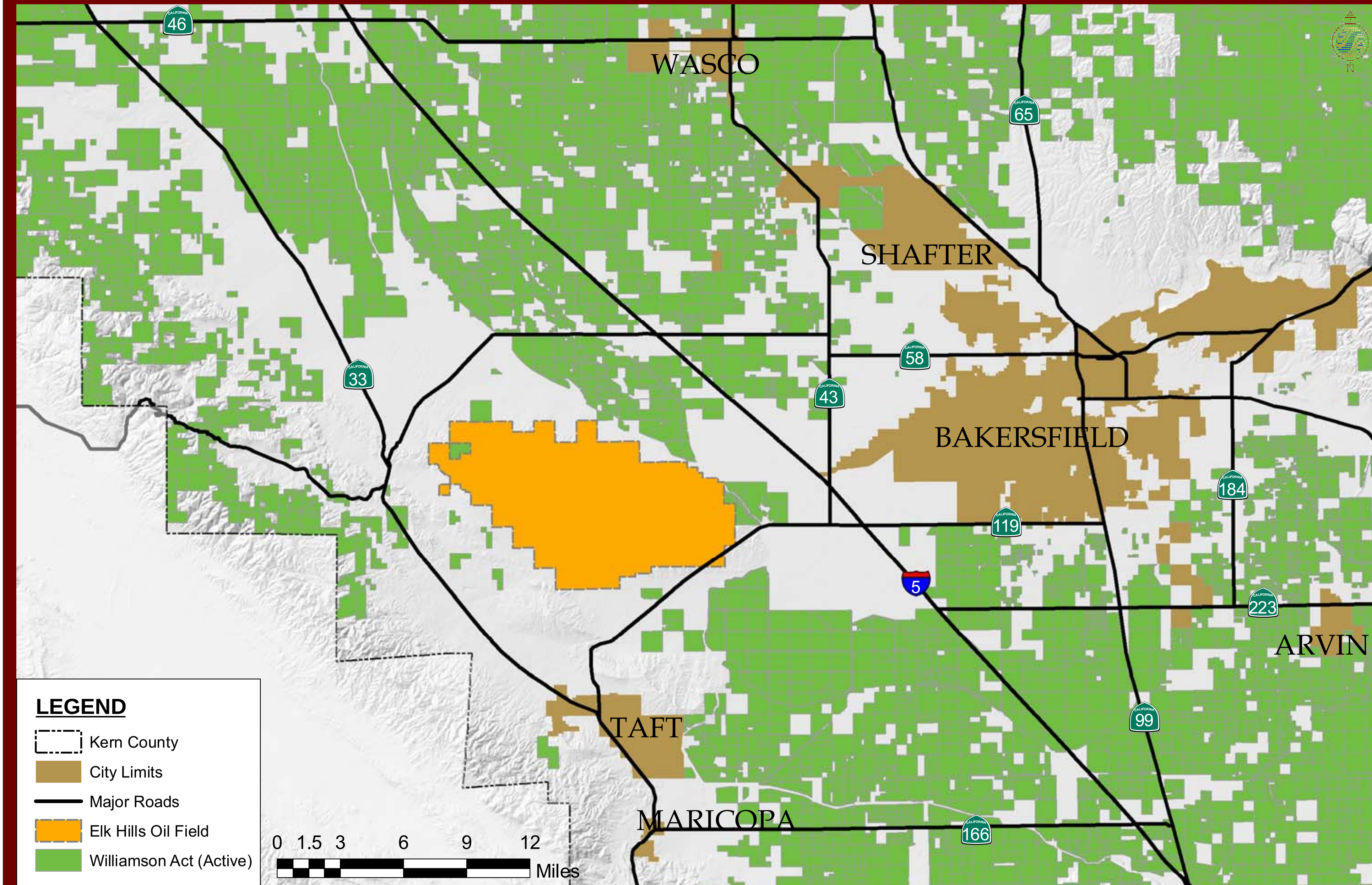
4.2 AGRICULTURAL RESOURCES

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

Fig. 4.2-1

Kern County Williamson Act Active Contracts

OEHI CO2 EOR Project - Supplemental Environmental Information

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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Project # 185802314

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.

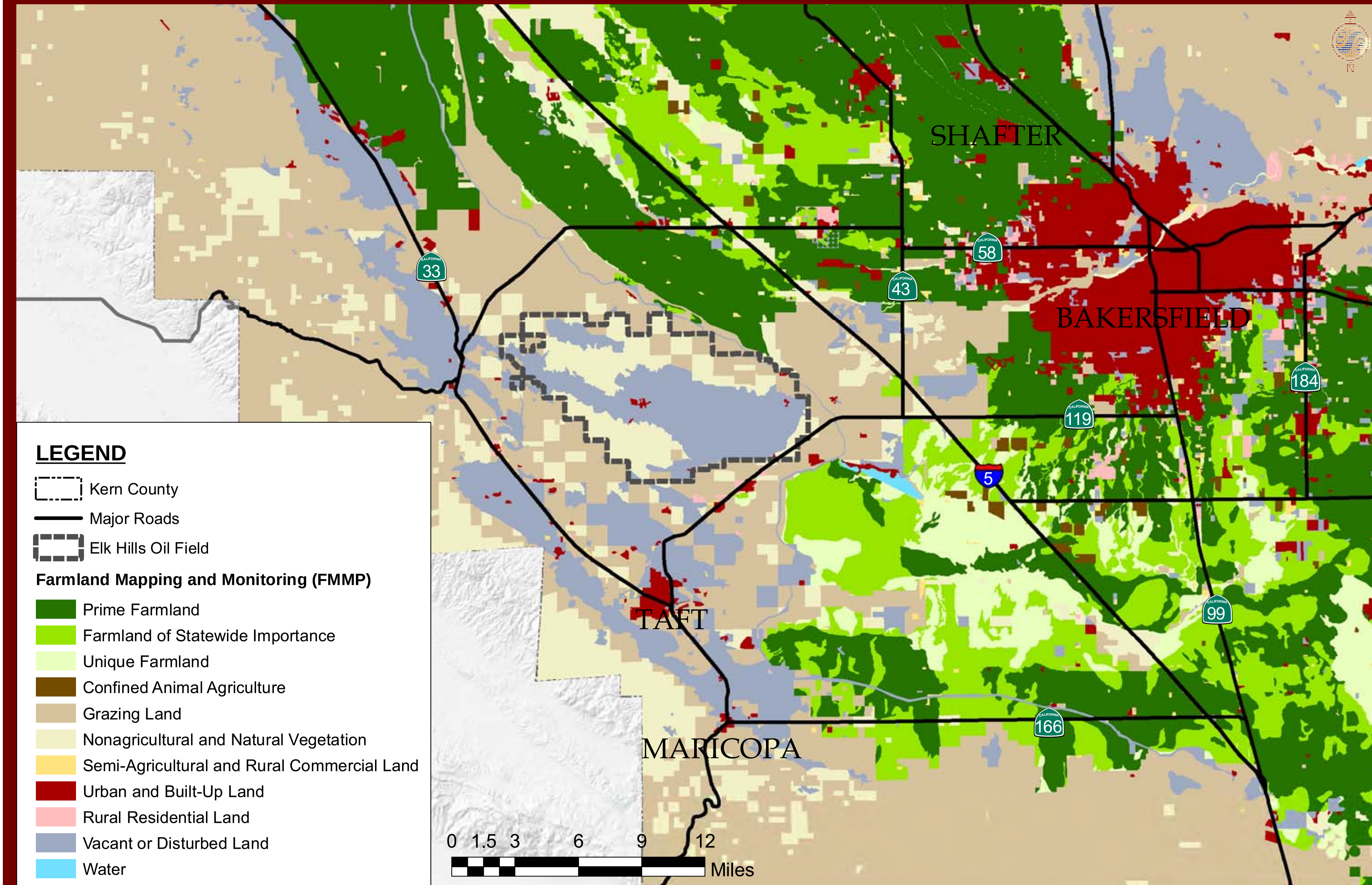

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Fig. 4.2-2

Kern County Important Farmland (FMMP)

OEHI CO2 EOR Project - Supplemental Environmental Information

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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.

4.2 AGRICULTURAL RESOURCES

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

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/m^3)**		–	–	–
Lead	**30 Day**	**1.5 μg/m^3**	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/m^3)**	Ultraviolet Fluorescence	No Federal Standards		
Vinyl Chloride[8]	24 Hour	0.01 ppm **(26 μg/m^3)**	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.

4.3 AIR QUALITY

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.

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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 (µg/m³)			Days Exceeding NAAQS (>150 µg/m³)			Maximum 24-Hour Concentration NAAQS (150 µg/m³)		
	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.

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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

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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 SO_2, 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:
  - o 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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- o 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 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.

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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**

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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.

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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;

4.3 AIR QUALITY

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.

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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.

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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.

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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

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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

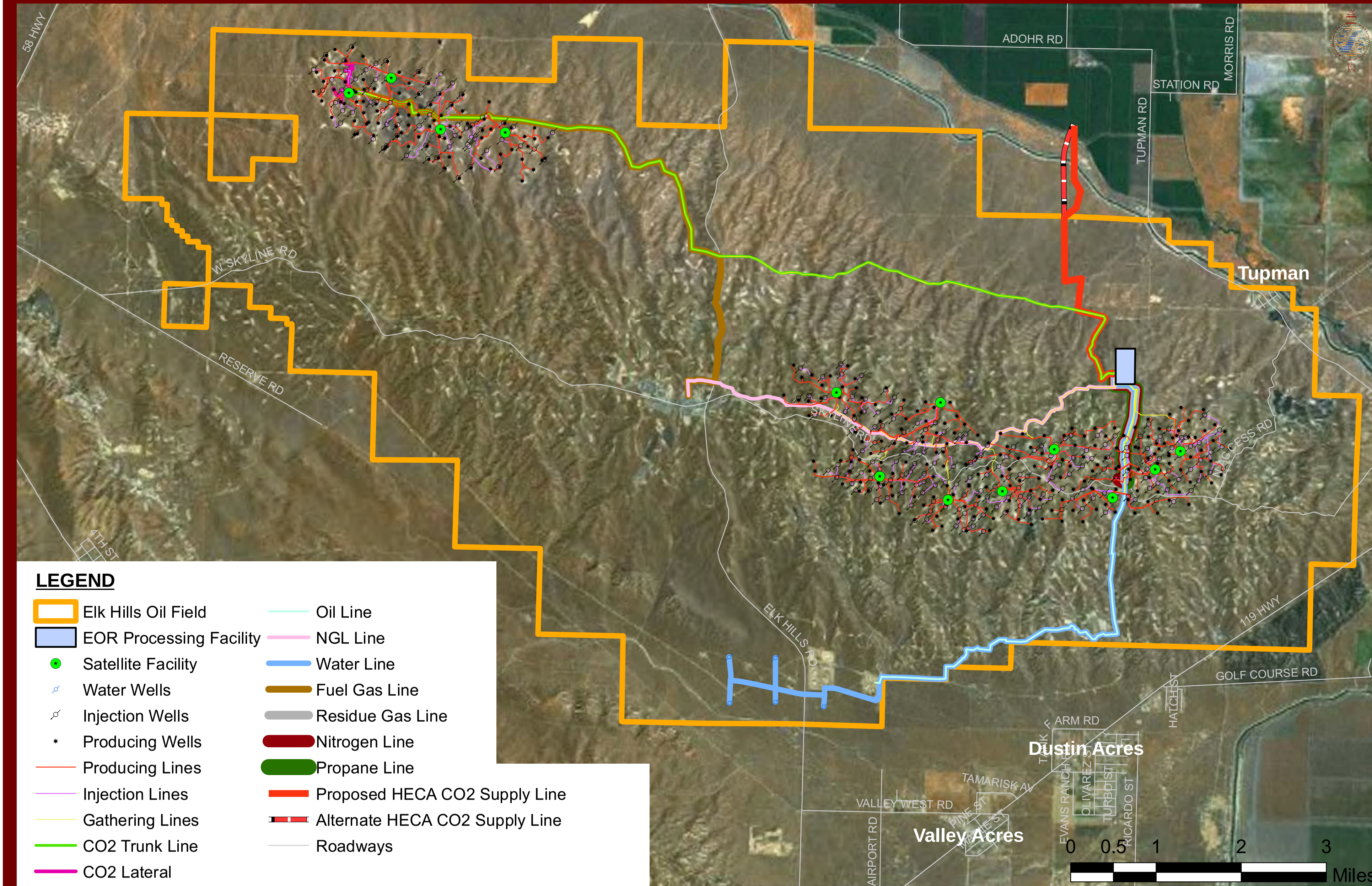
4.4 Biological Resources

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.



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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Project # 185802314

Fig. 4.4-1

Project Site Map

OEHI CO2 EOR Project - Supplemental Environmental Information

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

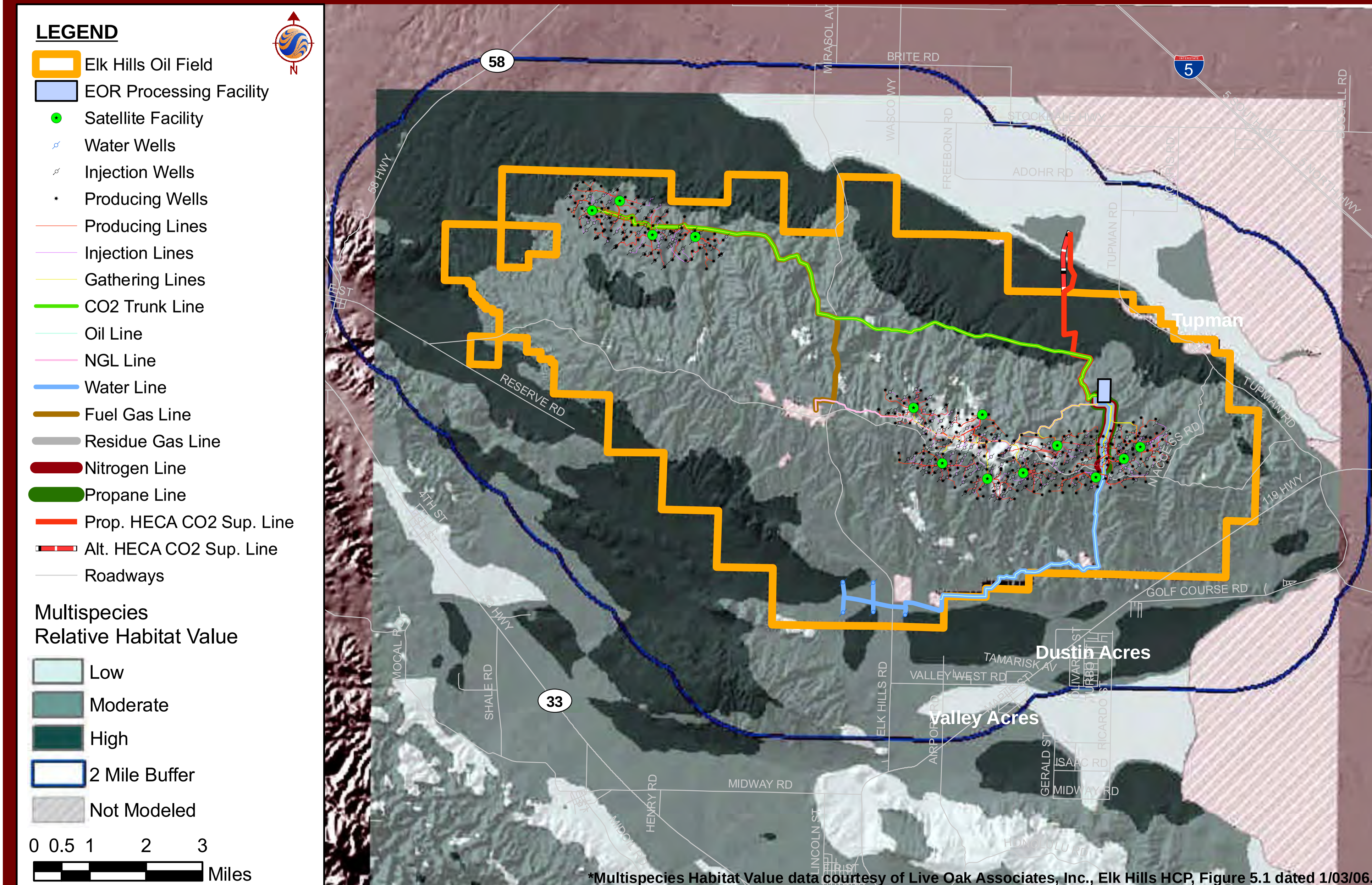
The Project Site is confined to the EHOF which is located on a narrow ridge orientated generally east to west, approximately 16 miles long and 6 miles wide covering an area of approximately 74 square miles. This approximately 48,000 acre tract of land is located along the southwest edge of the San Joaquin 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

4.4 BIOLOGICAL RESOURCES

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.



*Multispecies Habitat Value data courtesy of Live Oak Associates, Inc., Elk Hills HCP, Figure 5.1 dated 1/03/06.

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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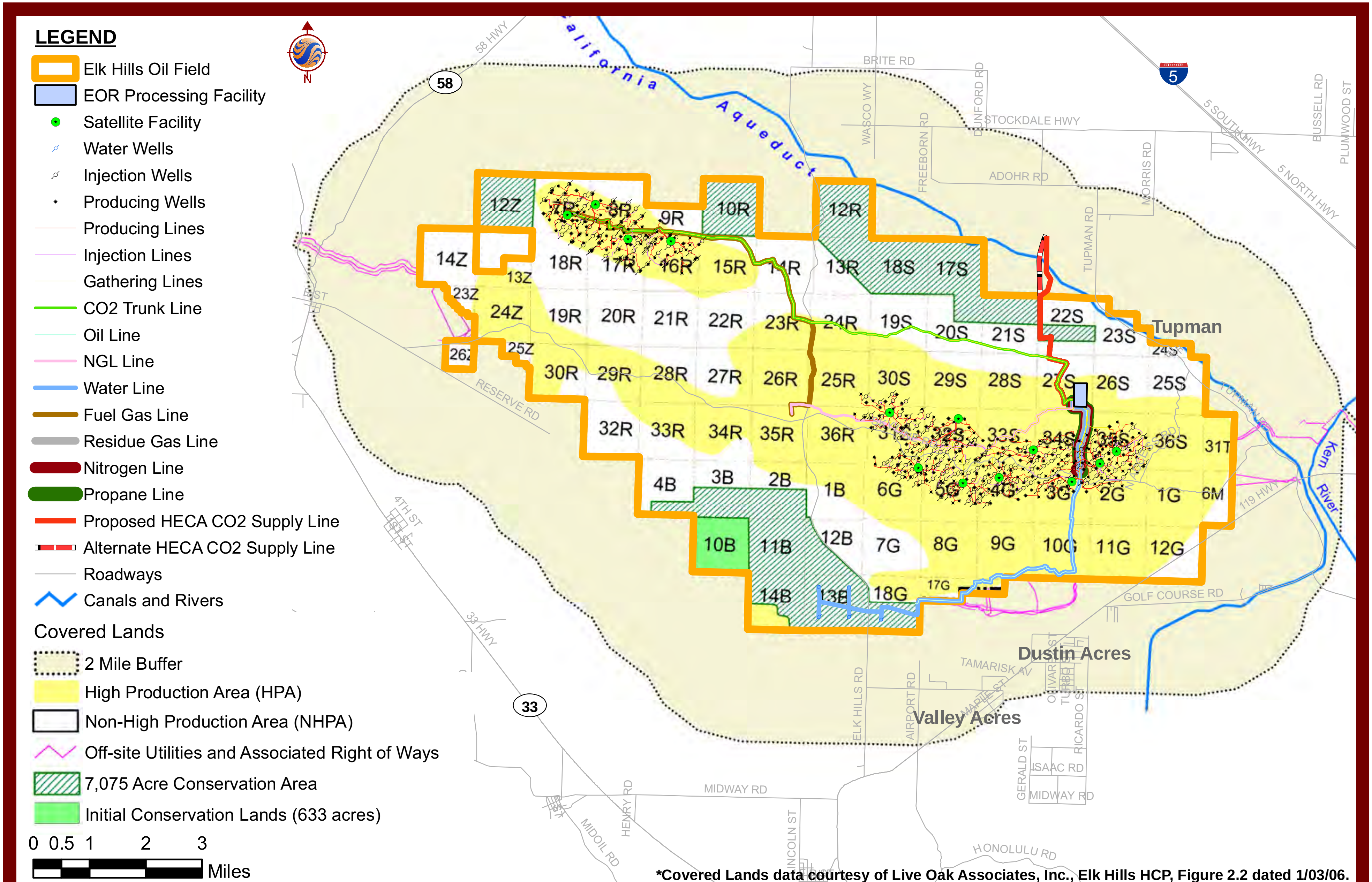
Project # 185802314

Fig. 4.4-2

Multispecies Habitat Value

OEHI CO2 EOR Project - Supplemental Environmental Information



Cartographic Design By: C. Flinders | Environmental Remediation

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Fig. 4.4-3

Oil Production Density

OEHI CO2 EOR Project - Supplemental Environmental Information

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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.

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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

4.4 BIOLOGICAL RESOURCES

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.

4.4 BIOLOGICAL RESOURCES

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**

4.4 BIOLOGICAL RESOURCES

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.

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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.

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

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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.

4.4 BIOLOGICAL RESOURCES

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.

4.4 BIOLOGICAL RESOURCES

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

4.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

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:

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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

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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".

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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.

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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

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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.

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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

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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:

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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.

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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.

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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

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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

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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).

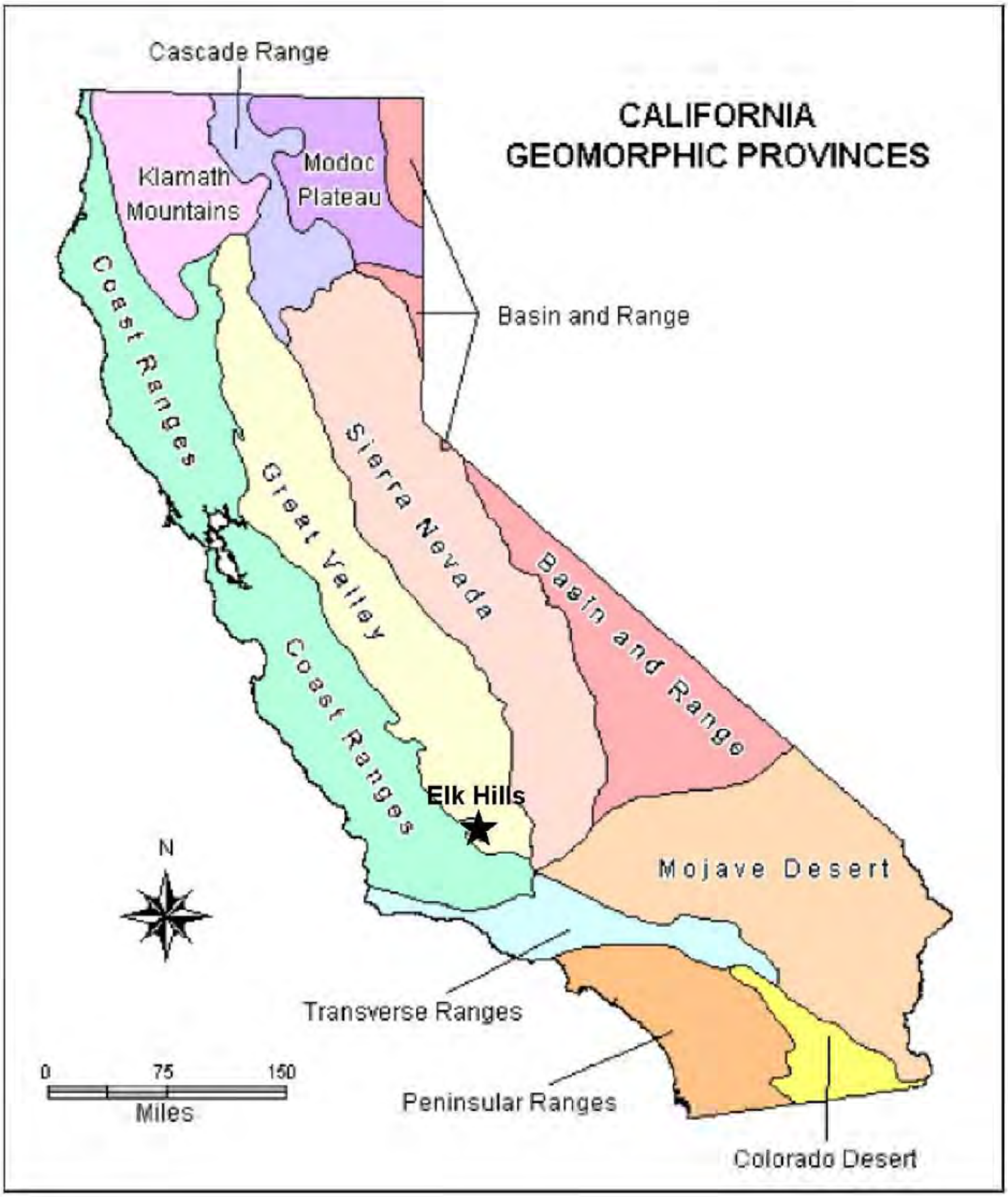

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Fig. 4.6-1

California Gemorphic Provinces

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).

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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.

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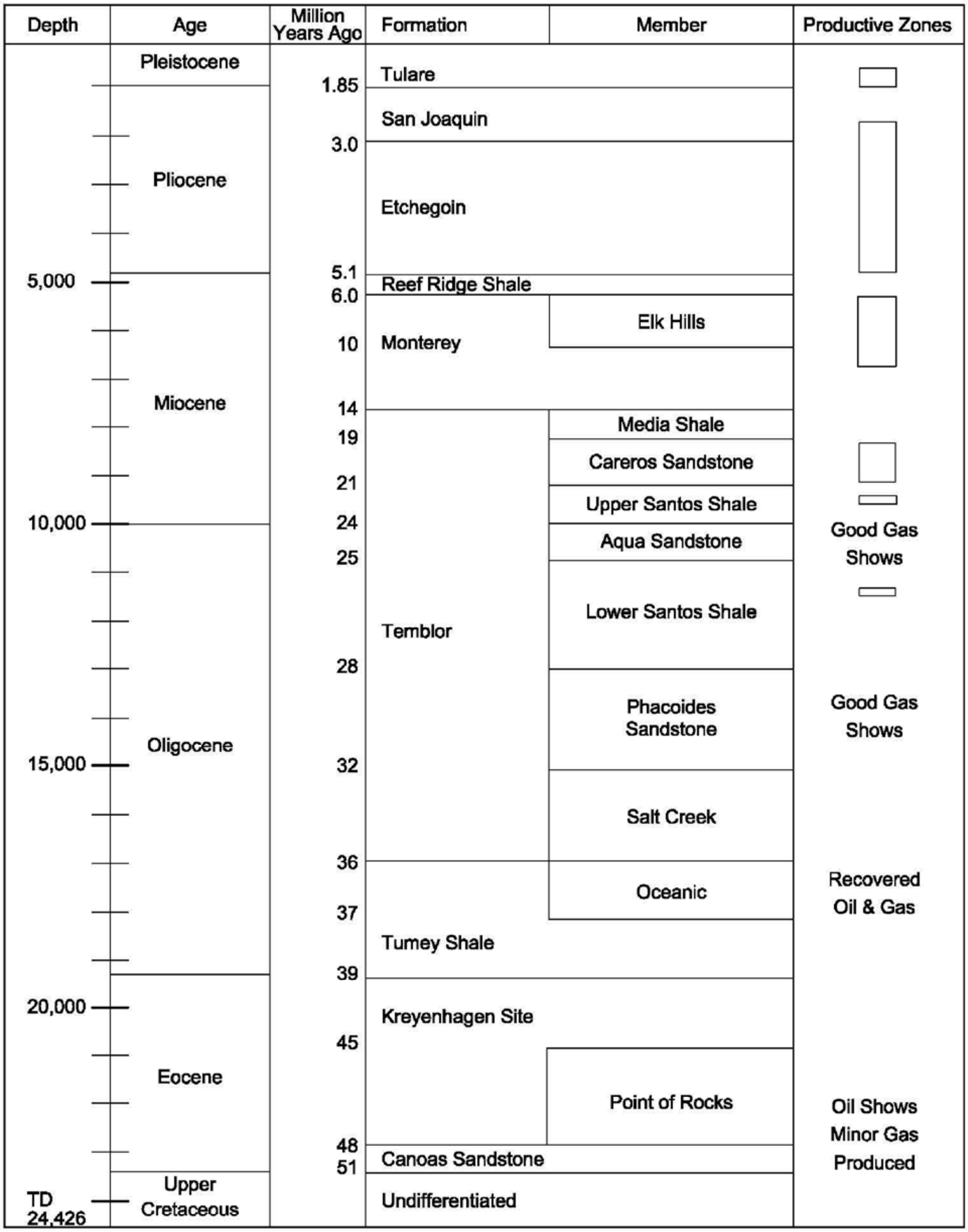
These faults may provide some limited communication between some of the productive sands, though most units are not in communication with one another, having different oil-water contacts. Further, individual anticline sands are compartmentalized, as exhibited by different pressures and temperatures (C&C 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

OEHI CO2 EOR Project - Supplemental Environmental Information

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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)."

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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."