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Responses to PSA/DEIS Information Requests, Set 2

Amended Application for Certification for HYDROGEN ENERGY CALIFORNIA (08-AFC-8A) Kern County, California

Prepared for:
Hydrogen Energy California LLC

hydrogen energy california

Submitted to:

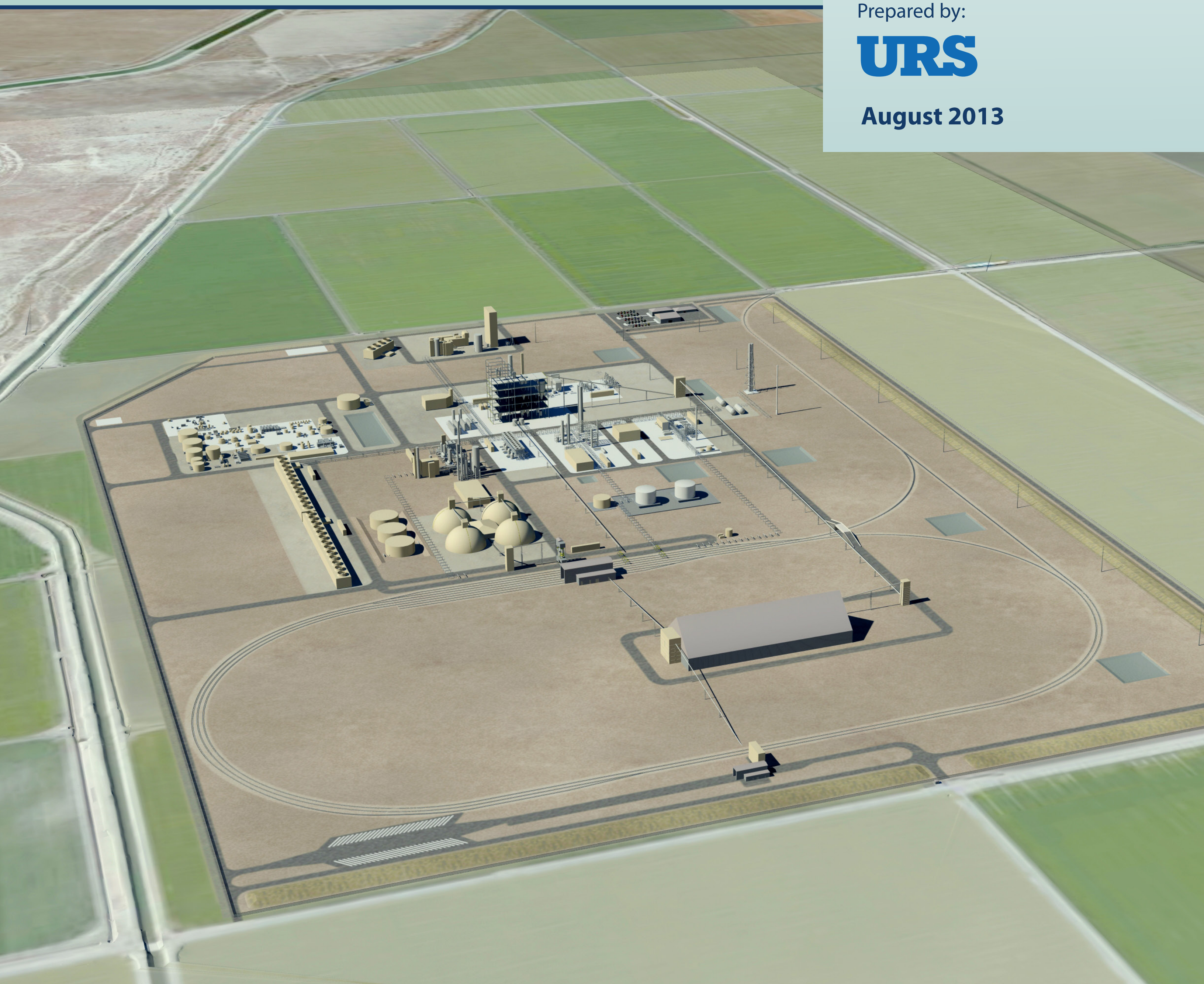
California Energy Commission

U.S Department of Energy

Prepared by:

URS

August 2013



RESPONSES TO PSA/DEIS INFORMATION REQUESTS – SET 2

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

AADT	annual average daily traffic
afy	acre-feet per year
AFC	Application for Certification
BGRP	Brackish Groundwater Remediation Project
bgs	below ground surface
BNLL	blunt-nosed leopard lizard
BSA	Buttonwillow Service Area
BVWSD	Buena Vista Water Storage District
BVWSD FEIR	BVWSD's Final Environmental Impact Report for the Buena Vista Water Management Program
CAISO	California Independent System Operator
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CO	carbon monoxide
CPUC	California Public Utilities Commission
CVRWQCB	Central Valley Regional Water Quality Control Board
DEIS	Draft Environmental Impact Statement
DTW	depth to water
EHOF	Elk Hills Oil Field
EOR	enhanced oil recovery
FDOC	Final Determination of Compliance
FEIS	Final Environmental Impact Statement
FSA	Final Staff Assessment
gpm	gallons per minute
GKR	giant kangaroo rat
HDAR	Hydrogeologic Data Acquisition Report
HDD	horizontal directional drilling
HECA	Hydrogen Energy California
hp	horsepower
I-5	Interstate 5
km	kilometers
kW	kilowatts
KWBA	Kern Water Bank Authority
LORS	laws, ordinances, regulations, and standards
mgd	million gallons per day
mg/L	milligrams per liter
mph	miles per hour
MRV Plan	Monitoring, Reporting, and Verification Plan
msl	mean sea level
MUTCD	Manual on Uniform Traffic Control Devices
MW	megawatts
NEPA	National Environmental Policy Act
NGCC	Natural Gas Combined-Cycle
OEHI	Occidental of Elk Hills, Incorporated
PSA	Preliminary Staff Assessment
psig	pounds per square inch gauge
SJAS	Nelson's (San Joaquin) antelope squirrel
SJKF	San Joaquin kit fox
SR	State Route
SWHA	Swainson's hawk

SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TKR	Tipton's kangaroo rat
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WWTF	wastewater treatment facility
WWTP	wastewater treatment plant
XPI	Extended Phase I

Introduction

The California Energy Commission (CEC) and U.S. Department of Energy issued the Preliminary Staff Assessment (PSA)/Draft Environmental Impact Statement (DEIS) for the Hydrogen Energy California (HECA) Project (08-AFC-8A) on June 28, 2013. CEC Staff identified additional information that they believe is needed from the Applicant to finalize their analyses and prepare the Final Staff Assessment (FSA)/Final Environmental Impact Statement (FEIS). These additional information requests are summarized in the Executive Summary, as well as in individual technical sections of the PSA/DEIS. Executive Summary – Table 2 identified 13 technical areas for which Staff requested additional information. The Applicant is also providing further clarification related to Water Supply and Alternatives.

HECA, the Applicant, provided a first set of responses to the PSA/DEIS information requests related to air quality; biological resources; carbon sequestration and greenhouse gas emissions; cultural resources; land use; soil and surface water; traffic and transportation; waste management; geology and paleontology; power plant efficiency; power plant reliability; transmission system engineering and alternatives. The first set of responses was docketed with the CEC on August 9, 2013. A tracking number has been assigned to each of the information requests for reference. This Set 2 submittal provides responses to most of the remaining information requests related to the following topics: biological resources; carbon sequestration and greenhouse gas emissions; cultural resources; land use; traffic and transportation; waste management; water supply; power plant reliability; and alternatives. Information related to noise and vibration and visual resources will be provided in September.

ENVIRONMENTAL ASSESSMENT

Technical Area: Biological Resources

INFORMATION REQUEST

BIO-1. Comprehensive mitigation strategy for project impacts to San Joaquin kit fox, giant kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, blunt-nosed leopard lizard, Swainson's hawk, burrowing owl and HECA's incremental contribution to cumulative effects to these species that are covered in the Recovery Plan of Upland Species of the San Joaquin Valley. Specifically, identify which species and acreage the applicant is proposing to mitigate through purchase of mitigation credits from the Kern Water Bank and which species and acreages would be mitigated through offsite land acquisition. For offsite land acquisition, please identify the species-specific habitat critieria [sic] for offsite mitigation lands and cost estimates for determining security (e.g., cost estimates for land acquisition, start-up actitivites [sic] and initial habitat improvements, funding during the three-year interim management period, and long-term management). Please also provide any preliminary discussions with land management entities for land acquisition and long-term habitat management for project impacts to listed species.

RESPONSE

HECA and Occidental of Elk Hills, Incorporated (OEHI) are consulting with the California Department of Fish and Wildlife (CDFW) and the U.S. Fish and Wildlife Service (USFWS) to refine the proposed mitigation for habitat loss associated with the HECA Project components, as well as the OEHI carbon dioxide (CO_2) enhanced oil recovery (EOR) Project. A comprehensive mitigation strategy for project impacts to special-status species will be submitted to the CEC based on the outcome of these consultations.

The comprehensive mitigation strategy for project impacts to San Joaquin kit fox, giant kangaroo rat, Tipton kangaroo rat, San Joaquin antelope squirrel, blunt-nosed leopard lizard, Swainson's hawk, and burrowing owl is summarized in this response. Table BIO-1-1 summarizes the potential special-status species impacts and proposed mitigation.

Table BIO-1-2 summarizes the habitat compensation that would be provided for temporary and permanent habitat losses associated with each of the special-status species potentially affected by the proposed project. The impact acreage, the associated species, and the proposed compensation, including acquisition of credits at the Kern Water Bank Authority mitigation bank, are presented as requested in the PSA. The potential impacts of the OEHI project Initial Injection Phase Project are included in Table BIO-1-2, which is consistent with the Biological Assessment submitted to the USFWS. A comprehensive description of the potential impacts and the proposed mitigation for both the HECA and OEHI projects will be provided pending the outcome of the consultation with USFWS and CDFW, as described in the response to Information Request BIO-5.

Table BIO-1-1
Special Status Species Impacts and Proposed Mitigation

Special-Status Species (Common Name/Scientific Name)	Impact Type	HECA/OEHI Proposed Mitigation
San Joaquin kit fox *Vulpes macrotis mutica*	Disturbance (temp) Movement habitat loss (temp/perm) Increased traffic mortality	1. Avoidance/minimization 2. Acquire credits from KWBA 3. Preserve current agricultural practices in controlled area to maintain movement corridor for kit fox 4. OEHI to provide additional details for CO_2 EOR facilities
Swainson's hawk *Buteo swainsoni*	Foraging habitat loss Nest site disturbance	1. Avoidance/minimization 2. Acquire credits from KWBA 3. Preserve current agricultural practices in controlled area 4. Establish additional nesting habitat in Controlled Area
Blunt-nosed leopard lizard *Gambelia sila*	Habitat loss (temp)	1. Avoidance/minimization 2. Acquire credits from KWBA 3. OEHI to provide additional details for CO_2 EOR facilities
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	Habitat loss (temp)	1. Avoidance/minimization 2. Acquire credits from KWBA
Giant Kangaroo Rat *Dipodomys ingens*	Habitat loss (perm/temp)	1. Avoidance/minimization 2. OEHI to provide additional details
Nelson's (San Joaquin) antelope squirrel *Ammospermophilus nelsoni*	Habitat loss (perm/temp)	1. Avoidance/minimization 2. OEHI to provide additional details for CO_2 EOR
Burrowing owl *Athene cunicularia*	Habitat disturbance (temp)	Avoidance/minimization

Notes:

CO_2 = carbon dioxide
EOR = enhanced oil recovery
HECA = Hydrogen Energy California
KWBA = Kern Water Bank Authority
OEHI = Occidental of Elk Hills, Incorporated

Table BIO-1-2
Mitigation Proposed for Potential Biological Resource Impacts of the HECA and OEHI Projects

<table>
<tr><th rowspan="2">Habitat/Land Use Types[1]</th><th rowspan="2">Affected Species and Habitat Use</th><th colspan="2">HECA Total</th><th colspan="2">OEHI Total[2]</th><th colspan="2">TOTAL</th><th colspan="2">Proposed Mitigation</th></tr>
<tr><th>Temp</th><th>Perm</th><th>Temp</th><th>Perm</th><th>Temp</th><th>Perm</th><th>HECA</th><th>OEHI</th></tr>
<tr><td>Alfalfa</td><td>SJKF (movement)
SWHA (foraging)</td><td>75.60</td><td>127.74</td><td>0</td><td>0</td><td>75.6</td><td>127.74</td><td rowspan="3">Temp: Implement avoidance and minimization measures
Perm: HECA will implement the following
1) Acquire 47 acre credits from KWBA mitigation bank
2) Plant four stands of five trees each (e.g., Fremont cottonwood or other native trees capable of growing to 30 feet tall or higher) within the Controlled Area to provide future nest sites for SWHA.
3) Continue cultivation of alfalfa and other row crops within Controlled Area to provide suitable foraging habitat for SWHA and movement of SJKF</td><td rowspan="3">None required – no impacts</td></tr>
<tr><td>Other Row Crop</td><td>SJKF (movement)
SWHA (foraging)</td><td>34.6</td><td>333.73</td><td>0</td><td>0</td><td>34.6</td><td>333.73</td></tr>
<tr><td>Orchards</td><td>SJKF (movement)</td><td>4.4</td><td>4.51</td><td>0</td><td>0</td><td>4.4</td><td>4.51</td></tr>
<tr><td>Natural/ Ruderal</td><td>SJKF (movement)
SWHA (foraging)
BNLL (all)
TKR (all - HECA only)
GKR (all - OEHI only)
SJAS (all - OEHI only)</td><td>3.7</td><td>0</td><td>28.89</td><td>63.9</td><td>32.59</td><td>63.9</td><td>Temp: HECA will acquire 8 acre credits from KWBA mitigation bank for SJKF, SWHA, BNLL, and TKR
Perm: No permanent impacts</td><td>NOTE: OEHI to provide mitigation details based on consultation with CDFW and USFWS (see response to Information Request BIO-5)</td></tr>
<tr><td>Developed/ Disturbed[1]</td><td>None</td><td>128.8</td><td>30.95</td><td>0</td><td>0</td><td>128.8</td><td>30.95</td><td>None required – no impacts</td><td>None required – no impacts</td></tr>
</table>

Notes:

[1] Areas not designated as cropland or Natural/Ruderal land have been classified as Developed/Disturbed.
[2] OEHI impacts based on U.S. Department of Energy Data Request – Initial Injection Phase Project Description (Stantec, 2012b). The OEHI Project as evaluated in the Application for Certification would temporarily impact 1,447 acres and permanently impact 261.6 acres, based on the Supplemental Environmental Information for CO2 Enhanced Oil Recovery Project (Stantec, 2012a).

BNLL = Blunt-nosed leopard lizard
CDFW = California Department of Fish and Wildlife
GKR = Giant kangaroo rat
HECA = Hydrogen Energy California
KWBA = Kern Water Bank Authority
OEHI = Occidental of Elk Hills, Incorporated
SJAS = Nelson's (San Joaquin) antelope squirrel
SJKF = San Joaquin kit fox
SWHA = Swainson's hawk
TKR = Tipton's kangaroo rat
USFWS = U.S. Fish and Wildlife Service

References

Stantec (Stantec Corporation), 2012a. Supplemental Environmental Information, Occidental of Elk Hills, Inc., CO_2 Enhanced Oil Recovery Project. Prepared for Occidental of Elk Hills, Inc. April.

Stantec (Stantec Corporation), 2012b. Modified CO_2 Supply Line Alignment Data Gap Analysis. Prepared for Occidental of Elk Hills, Inc. April.

INFORMATION REQUEST

BIO-5 Habitat mitigation strategy for habitat loss impacts from OEHI component of HECA at the Elk Hills Oik [sic] Field. Please identify whether species impacts including habitat loss for the OEHI component would be included under the Section 10 Habitat Conservation Plan currently under preparation or if habitat loss for the OEHI component of HECA would be mitigated under separate consultations with CDFW and USFWS;

RESPONSE

HECA and OEHI are consulting with CDFW and USFWS to refine the proposed mitigation for habitat loss associated with the HECA Project components, as well as the CO_2 EOR Project. The requested information will be submitted to the CEC based on the outcome of these consultations.

INFORMATION REQUEST

BIO-6. Western spadefoot toad habitat assessment along project linear routes including upland refugia and aquatic habitats preferably during the wet season (defined as October 15 to April 15 of any given year) and following sufficient winter or spring rains in order to identify potential depressional areas and upland refugia that may provide habitat for western spadefoot toad. All potential ponding areas should be identified and mapped with a GPS unit including the single pond where this species was identified previously. Information to be collected at each GPS'ed potential breeding area includes, but is not limited to: the specific numbering system of each potential breeding area, presence of tadpoles and species (if any), habitat community, microhabitat features, observed plant species, observed wildlife species including invertebrates, water temperature, approximate depth and surface area, and level of disturbance.

RESPONSE

All potential ponding areas in the Project area were identified, mapped with a GPS unit, and evaluated during surveys for the jurisdictional delineation, which was conducted during the 2012 wet season. The assessment of western spadefoot habitat in the Project area provided below is based on the 2012 surveys and a review of existing data, including the known occurrences of spadefoot in the Project vicinity, aerial photos of the Project area, and the natural history of the species.

Natural History

The western spadefoot is a California Species of Special Concern found from the Central Valley south to Baja California. It prefers open areas with sandy or gravelly soils. It is found in a variety of habitats, including mixed woodlands, grasslands, chaparral, sandy washes, lowlands, river floodplains, alluvial fans, playas, alkali flats, foothills, and mountains. Outside of natural habitats, western spadefoot toads have a capacity to breed in altered and manmade wetlands, including vernal pools that have been disturbed by activities such as earthmoving, discing, intensive livestock use, and off-road vehicle use; as well as in artificial ponds, livestock ponds, sedimentation and flood control ponds, irrigation and roadside ditches, roadside puddles, tire ruts, and borrow pits (USFWS, 2005).

The western spadefoot is primarily nocturnal and terrestrial, only entering water bodies to breed. During dry years, breeding may not occur. It spends the majority of its time burrowed in the ground. Its breeding season depends on weather conditions, but typically occurs between January and May. Eggs laid and attached to submerged vegetation are externally fertilized and mature in as little as 0.6 to 6 days. Depending on temperature and food availability, tadpoles morph in 3 to 11 weeks. At metamorphosis, juveniles emerge from the water and seek refuge in the immediate vicinity of natal ponds before dispersing, and then taking refuge in drying mud cracks, under boards, and under other surface objects. Beyond this initial dispersal event, however, little else is known about the actual distance spadefoot toads disperse upland from aquatic features in search of aestivation sites (USFWS, 2005). The decline of this species is attributable to loss of habitat to urbanization and agricultural land (Stebbins, 2003).

Occurrences in the Project Vicinity

The California Natural Diversity Database (CDFW, 2013) includes a single occurrence of western spadefoot toad within a 10-mile radius of the Project Site (Figure BIO-6-1). This 1996 occurrence is 10 miles due east of the Project Site, and consisted of juvenile spadefoot toads in an irrigation ditch that was surrounded by residential development and fallow irrigation fields. An additional occurrence was observed by URS in April 2009, approximately 1 mile south of the Project Site. This occurrence consisted of several hundred western spadefoot tadpoles in rainwater-filled depressions in an area of natural/ruderal vegetation. This feature is located between the West Side Canal and the Kern River Flood Control Channel. At the time of this observation, the pools were noted to be free of emergent vegetation, algal growth, or debris that could serve as a substrate on which the spadefoot could have deposited their eggs.

Although the species is in decline throughout its range, observations are likely to be underreported due to the species' predominantly fossorial behavior during the dry season and nocturnal activity during the wet season. The western spadefoot toad's ecological plasticity and adaptability to disturbed and degraded aquatic breeding habitat, including its ability to complete oviposition and metamorphosis in ephemeral pools in as little as 3 weeks, would allow this species to breed where suitable seasonal wetlands or standing water and adjacent natural upland habitat are present.

Habitat Assessment

Table BIO-6-1 summarizes the results of the western spadefoot habitat assessment.

Table BIO-6-1
Summary of Spadefoot Habitat Assessment

Project Component	Habitats Potentially Used by Spadefoot		
	Breeding (Vicinity)	Breeding (Project Area)	Upland Refugia
Project Site	—	—	—
Process Water Pipeline	X	—	X
Electrical Transmission Line and Switching Station	—	—	—
Potable Water Pipeline	—	—	—
Natural Gas Pipeline	X	X	X
Railroad Spur	—	—	—
CO_2 Pipeline	X	—	X

Notes:
— = habitat is not present
CO_2 = carbon dioxide
X = habitat is present

Aquatic habitats in the Kern River Flood Control Channel are potentially suitable for breeding western spadefoot. These features are not within the Project area, but are in the vicinity of the proposed 15-mile alignment of the process water pipeline and the CO_2 pipeline. The Kern River Flood Control Channel conveys overflow from the Kern River and the former Buena Vista Lake basin during the winter and spring months. Topographic depressions within the channel may be suitable breeding habitat for western spadefoot when the features are inundated by surface runoff or overflow from the channel. Uplands in the vicinity of these features may provide aestivation habitat if burrows or other suitable refugia are present.

The West Side Canal, which parallels the Kern River Flood Control Channel, is not expected to provide suitable breeding habitat for western spadefoot because the West Side Canal conveys irrigation water during the spring and summer months. The canal would typically be dry in late winter and early spring during the peak of western spadefoot toad breeding activity; in the late spring and summer months, the canal would again convey irrigation water that would disrupt or inhibit breeding activity.

Along the proposed CO_2 pipeline south of the Project Site, a limited section of potentially suitable aquatic and upland habitat may be present in areas of natural/ruderal vegetation between the Kern River Flood Control Channel and the California Aqueduct. This section of the CO_2 pipeline would be within 1,300 feet of the rainwater-filled depressions where western spadefoot tadpoles were observed by URS in 2009. This section of the CO_2 pipeline would be constructed using horizontal directional drilling techniques that will avoid any surface disturbance. However, the adjacent uplands within the Project area could support aestivating spadefoot if burrows or other refugia are present.

Western spadefoot are not expected to occur within the OEHI CO_2 EOR Processing Facility; along the 2-mile-long electrical transmission line to the east of the Project Site; or along the 5-mile-long industrial railroad spur to the north. Aquatic and upland habitats at these locations are not suitable to support the complete life cycle of the species. These Project components are located in primarily agricultural habitats that are incompatible with western spadefoot toad life stages, and the Project area is located a substantial distance from potential breeding habitats.

Seasonally ponded depressions along the proposed natural gas supply pipeline may provide suitable habitat for breeding and aestivating spadefoot, if these features remain ponded for at least 3 weeks in the winter/spring. Based on observations during the 2012 jurisdictional delineation (URS, 2013), these features were typically ponded less than 2 weeks, and are isolated by State Route (SR) 58 to the north and the San Joaquin Valley Railroad to the south. However, the presence of the nonlisted Lindahl's fairy shrimp (*Branchinecta lindahli*) indicates that aquatic conditions appropriate to support breeding western spadefoot may be present during some years, when precipitation results in ponding of a longer duration.

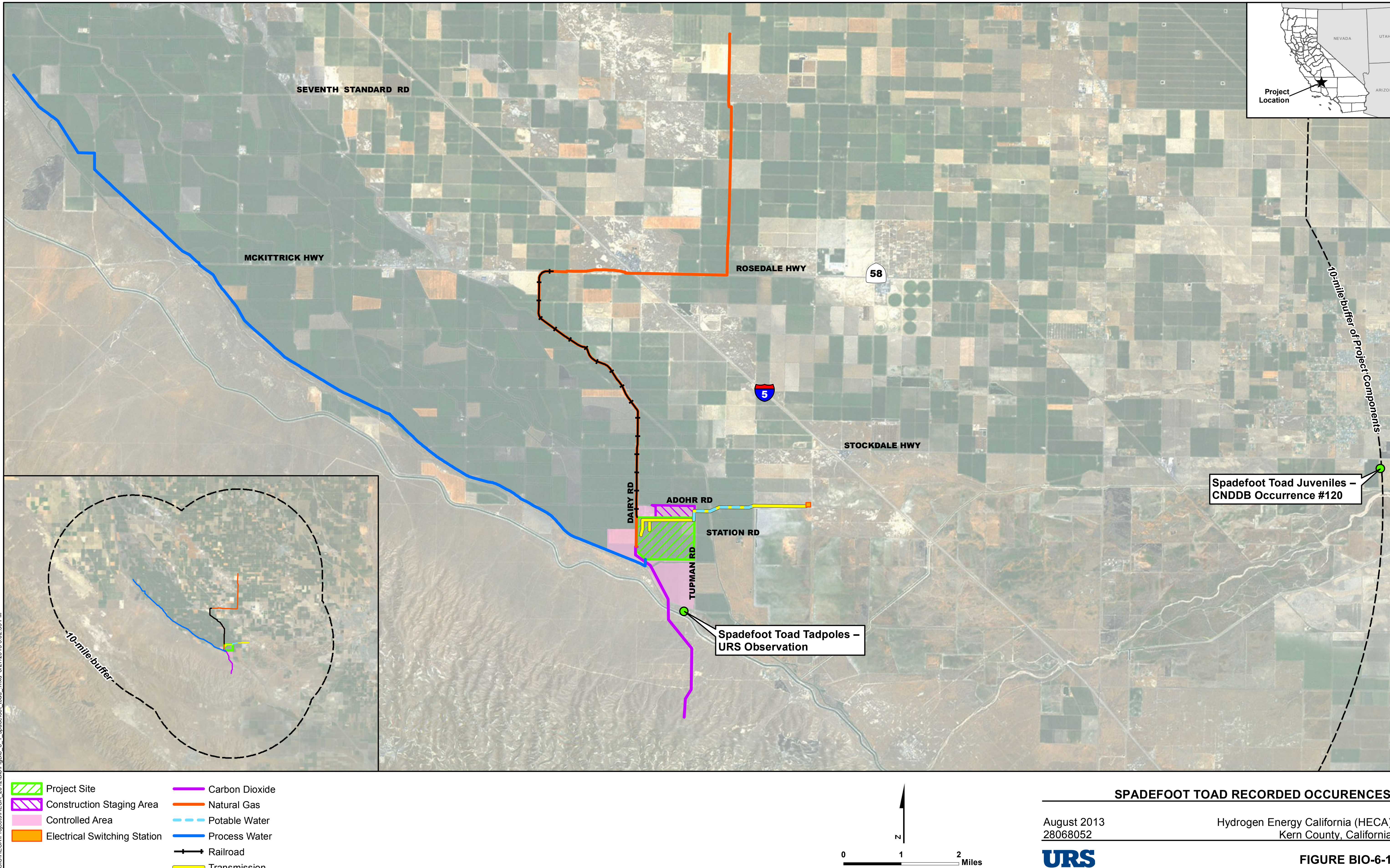
References

CDFW (California Department of Fish and Wildlife), 2013. California Natural Diversity Database. Electronic records retrieved for western Kern County within 10 miles of the HECA Project Area. California Department of Fish and Wildlife, Sacramento, CA.

Stebbins, Robert C., 2003. Peterson Field Guides: Western Reptiles and Amphibians, 3rd ed. Houghton Mifflin, New York. 533 p.

URS (URS Corporation), 2013. Jurisdictional Delineation of the HECA Project Area. Prepared for Hydrogen Energy California, LLC. May.

USFWS (U.S. Fish and Wildlife Service), 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi + 606 pages.



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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; CNDDB, 2013.

SPADEFOOT TOAD RECORDED OCCURENCES

August 2013
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE BIO-6-1

INFORMATION REQUEST

BIO-7. Vehicle-fox strike and incidental take analysis considering the project's contribution to existing traffic volumes and intersections of the proposed construction and operation routes with other linear right-of-ways that occur within and outside of San Joaquin kit fox core recovery areas. The applicant should calculate vehicle mortality rates to kit fox and other mammals over the life of the project.

RESPONSE

URS has prepared the following update to the vehicle-fox strike analysis.

Background

CEC Staff noted in the PSA/DEIS that the Waller probabilistic model, which looks only at traffic volumes and the time it takes an animal to cross the roadway, may be a more applicable method for determining wildlife incidental take due to roadkill. HECA's biological consultants have reviewed the Waller model and concluded that it is not the correct method to assess the potential impact to kit fox caused by Project-related vehicle activity. This conclusion is based on the inconsistencies between the Waller model and recent data collected on kit fox mortality in the Project area and vicinity. These inconsistencies are summarized below.

The Waller probabilistic road kill method (Waller et al., 2005) suggests that the lethality of linear transportation features (roadways, railways, etc.) to wildlife are governed primarily by two factors: traffic volume and animal velocity (the amount of time wildlife spends on the roadway in a crossing attempt). Vehicle speed is not a factor in the Waller model, and the authors indicated that they "believe that the influence of speed is small."

Waller et al. (2005) also concluded that increasing the number of road lanes does not increase the probability of animals being struck. If a two-lane road is expanded to four lanes, the probability of an animal being struck in each lane is halved, because traffic per lane is halved. However, because the number of lanes is doubled, the likelihood of the animal being struck is double. Therefore, the probability of an animal successfully crossing a two-lane road or a four-lane road is equal if traffic volumes are the same.

Bjurlin et al. (2005) conducted a 6-year intensive study of urban San Joaquin kit fox ecology within Bakersfield, southwest of Highway 58 and Highway 99. Between 1997 and 2004, 78 foxes were actively monitored with radiotelemetry collars (Bjurlin et al., 2005). Of the 78 monitored foxes, 27 percent were found to be definite vehicle strikes, 17 percent were due to predation, and 28 percent were unknown cause of death but were not likely to have died of vehicle collision due to lack of broken bones or contusions.

Bjurlin et al. (2005) was able to collect 48 vehicle-struck kit foxes in Bakersfield between January 1998 and August 2004. For each vehicle strike, the road classification was noted (local, collector, arterial, or highway), along with the traffic volume and posted speed limits. Arterial roads accounted for 72.9 percent of all strikes for the 48 retrieved kit fox bodies. A total of 327.4 kilometers (km) of local roads, 49.9 km of collector roads, and 50.9 km of arterial roads were within the study area (Table BIO-7-1). Mortality on the arterial roads was significantly more frequent ($p<0.001$) than can be explained by chance alone.

Table BIO-7-1
Summary Table from Urban Roads and the Endangered San Joaquin Kit Fox

Road Type	Lanes	Speed Limit	Mortality	Linear Quantity within Study Area
Local	2	25 mph	4.2%	327.4 km
Collector	2	30-45 mph	16.7%	49.9 km
Arterial	2 to 6	35-55 mph	72.9%	50.9 km
Highway	6	65 mph	2.1%	n/a
No Road	n/a	n/a	4.2	n/a

Source: Bjurlin et al., 2005
Notes:
km = kilometers
mph = miles per hour
n/a = not applicable

Three aspects of the information gathered by Bjurlin et al. (2005) from the 48 vehicle-struck kit foxes that directly conflict with the Waller model are related to the number of lanes of traffic, traffic volume, and vehicle speed.

The Bjurlin et al. (2005) study identified the following levels of mortality associated with arterial roads, which varied by the number of lanes:

- Two-lane arterial roads accounted for 4.2 percent, or two foxes;
- Four-lane arterial roads accounted for 35.4 percent, or 17 foxes; and
- Six-lane arterial roads accounted for 33.3 percent, or 16 foxes.

Based on the Waller model, the expected distribution of this subset of fox deaths should have been 2x, 4x, and 6x, assuming that traffic volumes are similar for each lane of traffic. For the 35 foxes that were struck on arterial roads, this would have resulted in two-lane arterial roads accounting for approximately 12.5 percent, or six foxes; four-lane arterial roads accounting for approximately 25 percent, or 12 foxes; and six-lane arterial roads accounting for approximately 37.5 percent, or 18 foxes.

When the traffic volumes were examined by Bjurlin et al. (2005) for 43 of the vehicle-struck kit foxes, the mean traffic volume was 21,861 vehicles per day. The Waller model would expect mortality to increase as traffic volume increased; however, the distribution of these 43 vehicle-struck kit foxes shows a roughly bell curve distribution (see Figure BIO-7-1).

Lastly, the Waller model does not consider vehicle speed, but the Bjurlin data indicate that "approximately 90 percent of roadkill (fox) were retrieved from roads with posted speed limits of greater than 45 miles per hour (mph)." More specifically, 56.3 percent of the 48 vehicle-struck kit foxes were on roads with speed limits of 55 mph, which would imply that vehicle speed may be an important factor in predicting fox-vehicle collisions.

Cypher et al. (2009) examined the effects of two-lane roads on rural San Joaquin kit fox from August 2001 through June 2004. The study area for this research was north of the town of McKittrick, and included portions of Highway 33 and Highway 58.

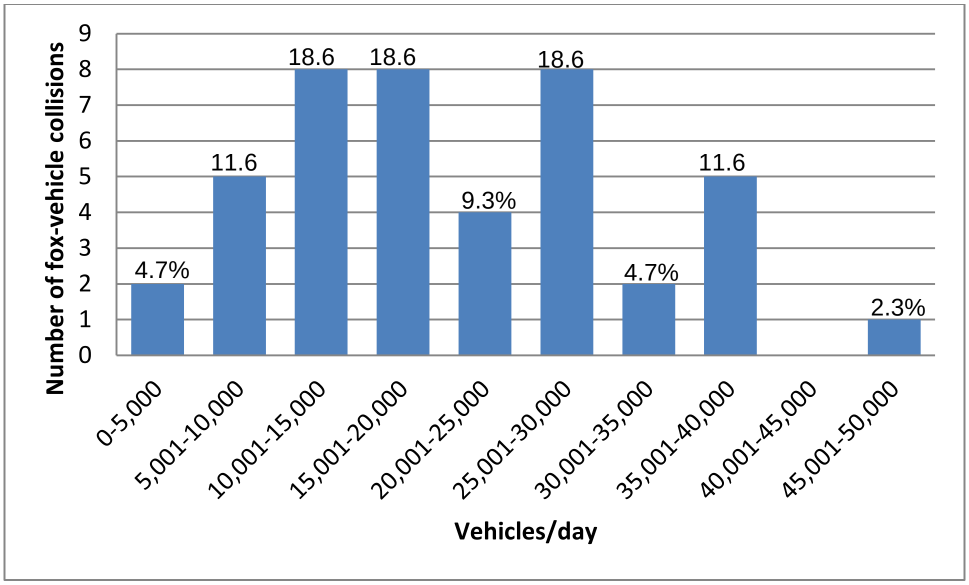

Figure BIO-7-1
Fox-Vehicle Collisions By Traffic Volume at Time of Death, Bakersfield, CA, 1998-2004

Source: Bjurlin et al., 2005.

Based on the information gathered from 60 radio-collared kit foxes during a 33-month study that included 19,909 radio-days, roads did not appear to impact kit fox survival (Cypher et al., 2009). Only one of the 60 radio-collared kit fox died from vehicle strikes; of the 22 recovered dead collared kit fox, 11 foxes were killed by large predators (likely coyotes). The remaining 10 foxes had been scavenged or were in a state of decomposition that made it impossible to determine the cause of death.

Based on these results, Cypher et al. (2009) indicated that the mortality rate of kit fox in natural areas from vehicles was similar to or lower than the rate reported in other studies. The information presented in Cypher et al. (2009) is summarized below in Table BIO-7-2.

Table BIO-7-2
Summary Table from Effects of Roads on Endangered San Joaquin Kit Fox

Location	Fox-Vehicle Mortality	Mortality Rate	Author
Lokern Natural Area	1 of 60	1.7%	Cypher et al., 2009
Lokern Natural Area	0 of 54	0.0%	Spiegel and Disney, 1996
Merced County	2 of 28	7.1%	Briden et al., 1992
Monterey and San Luis Obispo Counties	2 of 94	2.1%	Standley et al., 1992
San Luis Obispo County	1 of 41	2.4%	Ralls and White, 1995
Western Kern County	20 of 341 (adult) 11 of 184 (juvenile)	5.9% 6.0%	Cypher, 2000

Source: Cypher et al., 2009.

Cypher et al. (2009) also examined three risk categories associated with roadways within the rural study area. The traffic volumes on the roads within the study area were low to moderate, with 800 to 1,500 vehicles per day. The study looked at survival, reproductive success, pups per liter, distance moved between nights, distance from road of pupping and nonpupping dens, den switching, prey availability, and prey choice. Of these areas of investigation, only den switching was statistically different, but the "results of the den fidelity analysis also were unclear."

Updated Model

Although a model is a useful tool for estimating potential take, Waller et al. (2005) cautions that one "should not confuse the probability of roadkill with the rate of roadkill." If the animal in question is not in the area, the rate of roadkill will be zero, regardless of what the model indicates is the probability of being struck by a vehicle. This point is especially valid for species, like San Joaquin kit fox, that are sparsely distributed within their range.

In response to the CEC's Information Request, HECA's biological consultant has updated the kit fox mortality model based on two recent studies of kit fox in the Project area, and on current traffic estimates (URS, 2013). The updated model provides additional details requested by the CEC regarding the level of impact that the proposed Project would have during construction and operations over the entire life of the Project. The updated model is based on the following assumptions:

- 95 percent of mortality occurs at night, and 5 percent mortality occurs during the day;
- 85 percent of construction traffic would occur during the day, and 15 percent during night hours;
- For operations under Alternate 1 (Rail Option), 80 percent of traffic would occur during the day and 15 percent during night hours;
- For operations under Alternate 2 (Truck Option), 66 percent of traffic would occur during the day and 34 percent during night hours;
- Mortality rates are linear—more vehicles increases mortality in a linear fashion;
- Mortality rates are conservative—used highest rates from Bjorlin et al. (2005);
- Road type is conservative—used road type with highest mortality rates from Bjorlin et al. (2005);
- Kit fox population levels will remain the same throughout the project duration;
- Kit fox population range will remain the same throughout the project duration;
- Probability of mortality will remain the same throughout the project duration;
- Construction/Commissioning would have an average of 2,460 light vehicles and 420 truck average daily round trips;
- Operation traffic for Alternative 1 (Rail Option) would consist of 308 light vehicles and an average of 328 daily truck round trips; and
- Operation traffic for Alternative 2 (Truck Option) would consist of 308 light vehicles and an average of 1,072 daily truck round trips.

The new model assesses operational activity for 25 years, and includes a mortality index that considers whether traffic would occur during the day versus night; the new model indicates that the total number of fox-vehicle collisions for construction plus operation would be similar to that previously estimated, and therefore no additional mitigation is proposed. CEC Staff's proposed mitigation measures presented in the PSA/DEIS (BIO-7 and BIO-20) would mitigate the potential Project-related impacts.

Construction Model

During construction, the majority of vehicle construction traffic would originate from the Bakersfield area. The current traffic volumes were used as the baseline in the model (URS, 2013); however, the expected baseline traffic volumes at the time of construction would be higher, thus decreasing the potential Project-related impacts. The kit fox mortality estimate from Bjurlin et al. (2005), conducted in the urban Bakersfield area, was used to define the baseline fox mortality. Bjurlin et al. (2005) recorded 48 fox-vehicle collisions between January 1998 and August 2004 over 50.9 kilometers of arterial roads. This equals an average mortality of 0.012 fox per month per kilometer. This fox mortality rate is considered conservative, because data collected by Bjurlin et al. (2005) and Cypher et al. (2009) indicate that the mortality in rural fox populations is expected to be lower than the "mortality in urban" population, and highways had a lower level of mortality in both rural and urban areas than on arterial roads.

The potential construction Project-related increase to kit fox mortality for each section of roadway used for ingress/egress was calculated using the following formula:

> [(Project-related increase in Fox Mortality per month per km) × (km traveled) × (daytime Fox Mortality index) × (49 months of construction/commissioning)] + [(Project-related increase in Fox Mortality per month per km) × (km traveled) × (nighttime Fox Mortality index) × (49 months of construction)] = number of vehicle-fox collisions due to Project-related traffic

Table BIO-7-3 shows the Project-related impacts during the construction phase.

In total, construction of the proposed Project is estimated to result in 4.25 fox-vehicle collisions. This total is higher than the 2.39 fox-vehicle collisions estimated in the May 2012 Amended Application for Certification (AFC) submitted to the CEC. This impact is higher primarily because the impact duration was increased from 36 years to 49 months. The updated model includes a correction for the percentage of vehicle traffic that occurs in daytime versus nighttime. Most of the construction traffic occurs during daylight hours, but most of the mortality to kit foxes occurs during nighttime hours. Therefore, the previous model overstated the total impact because it did not include this correction.

Operations Model

There are two alternatives proposed for the operation of the Project, which is expected to span 25 years. The light vehicles associated with both alternatives are the same, with the majority of vehicles originating from the Bakersfield area. Tables BIO-7-4, BIO-7-5, and BIO-7-6 summarize the Project-related impacts during the operation phase, which are presented in two categories:

- The first category is for light vehicle traffic, which is the same for both alternatives (see Table BIO-7-4).
- The second category is for trucks, which vary depending on the Alternative selected (Alternative 1 versus Alternative 2; see Tables BIO-7-5 and BIO-7-6, respectively).

The potential Project-related increase to kit fox mortality due to operations is calculated for each section of roadway used for ingress/egress, using the following formula:

> [(Project-related increase in Fox Mortality per year per km) × (km traveled) × (daytime Fox Mortality index) × (25 years of operation)] + [(Project-related increase in Fox

Mortality per year per km) × (km traveled) × (nighttime Fox Mortality index) × (25 years of operation)] = number of vehicle-fox collisions due to Project-related traffic

Operations of the proposed project over 25 years are estimated to result in 5.66 kit fox-vehicle collisions for Alternative 1, and 9.86 vehicle-fox collisions for Alternative 2. This estimate is lower than the estimate originally included in the 2012 Amended AFC submitted to the CEC, which concluded that 20 years of operation would affect 8.85 kit foxes if Alternative 1 were selected, and 11.89 kit foxes if Alternative 2 were selected. The estimated mortality rates are less because the updated model includes a correction for the percentage of vehicle traffic that occurs in daytime versus nighttime. Most of the traffic increase would occur during daylight hours, but most of the mortality to kit foxes occurs during nighttime hours. The previous model overstated the total impact because it did not include this correction.

In total, construction and operations of the proposed Project is estimated to result in 9.92 fox-vehicle collisions for Alternative 1, and 14.11 fox-vehicle collisions for Alternative 2 over 25 years. These estimates are slightly higher than the estimated kit fox-vehicle mortality presented in the 2012 Amended AFC for the two alternatives, which were 8.85 foxes for Alternative 1 and 11.89 foxes for Alternative 2. As described above, the impact duration was increased from 36 months to 49 months for construction, and from 20 years to 25 years for operations, and used the most conservative mortality rate and most destructive road type identified in Bjurlin et al (2005). The updated model also includes a correction for the percentage of vehicle traffic that occurs in daytime versus nighttime. Most of the traffic increase would occur during daylight hours, but most of the mortality to kit foxes is likely to occur during nighttime hours. The previous model overstated the total impact because it did not include this correction.

Table BIO-7-3
Project-Related Impacts during the Construction Phase

Road Segments	AADT	Trucks	Cars	Added Traffic	% Change	Distance (One-Way) (km)	Project Mortality/ Month/km	Day-time Index[1]	Nighttime Index[2]	Duration (months)	Daytime Mortality × Round Trip	Nighttime Mortality × Round Trip	Total
Stockdale Highway	4,580	6	1,354	1,360	129.7	27.0	0.0036	0.0425	0.1425	49	0.40	1.34	1.74
SR 58	6,830	0	616	616	109.0	32.2	0.0011	0.0425	0.1425	49	0.15	0.49	0.63
SR 119 (Taft)	11,700	0	124	124	101.1	32.2	0.0001	0.0425	0.1425	49	0.02	0.06	0.07
Buttonwillow	1,850	320	0	320	117.3	8.0	0.0021	0.0425	0.1425	49	0.07	0.23	0.30
I-5 south	31,000	50	246	296	101.0	100.0[3]	0.0001	0.0425	0.1425	49	0.05	0.16	0.21
I-5 north	31,000	44	0	44	100.1	100.0[3]	0.0000	0.0425	0.1425	49	0.01	0.02	0.03
Tupman	126	0	124	124	196.9	6.0	0.0116	0.0425	0.1425	49	0.29	0.97	1.26
Added Vehicles		**420**[4]	**2,464**[5]										
Subtotal Fox Mortality													**4.25**

Notes:
1 Daytime index assumes 5 percent fox mortality and 80 percent construction traffic.
2 Nighttime index assumes 95 percent fox mortality and 20 percent construction traffic.
3 Distance on I-5 was estimated at an average of 100 km one-way before the traffic left kit fox habitat.
4 Average daily truck round trips – difference due to rounding.
5 Average daily car round trips – difference due to rounding.

AADT = annual average daily traffic
I-5 = Interstate 5
km = kilometer
SR = State Route

Table BIO-7-4
Project-Related Impacts by Light Vehicles during the 25-Year Operation Phase

Road Segments	AADT	Cars	Added Traffic	% Change	Distance (One-Way) (km)	Project Mortality/ Month/km	Day-time Index[1]	Nighttime Index[2]	Duration (years)	Daytime Mortality × Round Trip	Nighttime Mortality × Round Trip	Total
Stockdale – east	4,580	232	232	105.1	27.0	0.0073	0.04	0.19	25	0.39	1.87	2.26
SR 119 (Taft)	11,700	16	16	100.1	32.2	0.0002	0.04	0.19	25	0.01	0.06	0.07
I-5 north	31,000	16	16	100.1	100.0[3]	0.0001	0.04	0.19	25	0.01	0.07	0.09
I-5 south	31,000	16	16	100.1	100.0[3]	0.0001	0.04	0.19	25	0.01	0.07	0.09
Tupman	126	16	16	112.5	6.0	0.0180	0.04	0.19	25	0.22	1.03	1.24
Buttonwillow	1,850	16	16	100.9	8.0	0.0012	0.04	0.19	25	0.02	0.09	0.11
Added Vehicles		**312[4]**										
Subtotal Fox Mortality												**3.87**

Notes:

1 Daytime index assumes 5 percent fox mortality and 80 percent construction traffic.
2 Nighttime index assumes 95 percent fox mortality and 20 percent construction traffic.
3 Distance on I-5 was estimated at an average of 100 km one-way before the traffic left kit fox habitat.
4 Average daily car round trips – difference due to rounding.

AADT = annual average daily traffic
I-5 = Interstate 5
km = kilometer
SR = State Route

Table BIO-7-5
Project-Related Impacts of Truck Traffic from Alternative 1 during the 25-Year Operation Phase

Road Segments	AADT	Trucks	Added Traffic	% Change	Distance (One-Way) (km)	Project Mortality/ Month/km	Day-time Index[1]	Night-time Index[2]	Duration (years)	Daytime Mortality × Round Trip	Nighttime Mortality × Round Trip	Total
SR 119	11,700	10	10	100.1	32.2	0.0001	0.04	0.19	25	0.01	0.04	0.05
I-5 north	31,000	147	147	100.5	100.0[3]	0.0007	0.04	0.19	25	0.14	0.65	0.79
I-5 south	31000	161	161	100.5	100.0[3]	0.0007	0.04	0.19	25	0.15	0.71	0.86
Stockdale Highway	4,580	11	11	100.2	27.0	0.0003	0.04	0.19	25	0.02	0.09	0.11
Added Vehicles		**329**[4]										
Subtotal Fox Mortality												**1.80**

Notes:

1 Daytime index assumes 5 percent fox mortality and 66 percent construction traffic.
2 Nighttime index assumes 95 percent fox mortality and 34 percent construction traffic.
3 Distance on I-5 was estimated at an average of 100 km one-way before the traffic left kit fox habitat.
4 Average daily truck round trips – difference due to rounding.

AADT = annual average daily traffic
I-5 = Interstate 5
km = kilometer
SR = State Route

Table BIO-7-6
Project-Related Impacts of Truck Traffic from Alternative 2 during the 25-Year Operation Phase

Road Segments	AADT	Trucks	Added Traffic	% Change	Distance (One-Way) (km)	Project Mortality/ Month/km	Day-time Index[1]	Night-time Index[2]	Duration (years)	Daytime Mortality × Round Trip	Nighttime Mortality × Round Trip	Total
SR 43	11,500	368	368	103.2	43.0	0.0046	0.033	0.323	25	0.33	3.20	3.53
SR 119	11,700	30	30	100.3	32.2	0.0004	0.033	0.323	25	0.02	0.19	0.21
I-5 north	31,000	316	316	101.0	100.0	0.0015	0.033	0.323	25	0.24	2.37	2.61
I-5 south	31,000	330	330	101.1	100.0	0.0015	0.033	0.323	25	0.25	2.48	2.73
Stockdale Highway	45,80	29	29	100.6	27.0	0.0009	0.033	0.323	25	0.04	0.40	0.44
Added Vehicles		**1,073[4]**										
Subtotal Fox Mortality												**5.99**

Notes:

1 Daytime index assumes 5 percent fox mortality and 85 percent construction traffic.
2 Nighttime index assumes 95 percent fox mortality and 15 percent construction traffic.
3 Distance on I-5 was estimated at an average of 100 km one-way before the traffic left kit fox habitat.
4 Average daily truck round trips – difference due to rounding.

AADT = annual average daily traffic
I-5 = Interstate 5
km = kilometer
SR = State Route

References

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INFORMATION REQUEST

BIO-8. Water supply analysis and the effects of groundwater pumping to the sensitive vegetation communities and raptor nest trees which occur in the project area. The applicant must provide an analysis of the baseline groundwater levels and water source of raptor nest trees and alkali sink scrub habitat along HECA's linear routes, primarily the natural gas pipeline, processed water pipeline, and well field.

RESPONSE

The proposed Buena Vista Water Storage District (BVWSD), Brackish Groundwater Remediation Project (BGRP)/HECA well field is the only component of the proposed Project that may affect local water levels (i.e., due to pumping-induced drawdown). This analysis evaluates the potential effects of pumping-induced groundwater drawdown to the sensitive vegetation communities and raptor nest trees in the project area.

Figure BIO-8-1 identifies the locations of raptor nests (and other nest sites) documented in the Project area and vicinity, the planned location of the BGRP/HECA well field, and the various waterways within and adjacent to the BVWSD Buttonwillow Service Area (BSA). Nesting raptors, including Swainson's hawks, have been observed in the vicinity of the Project Area, in a tree near the center of the proposed BGRP/HECA well field. Swainson's hawk are listed as threatened under the California Endangered Species Act. Other nesting raptors and birds in the project area include common ravens and great-horned owls (see Figure 5.2-7 in the AFC).

As indicated on Figure BIO-8-1, the majority of the identified nesting sites are along the Kern River Flood Control Channel, immediately west of the western boundary of the BVWSD BSA. The West Side Canal is the western boundary of the BVWSD BSA and parallels the eastern margin of the Kern River Flood Control Channel. Localized recharge from seasonal flows in the Kern River Flood Control Channel are likely to be the main sources of water for the trees, but other sources may include infiltration from the West Side Canal, and irrigated fields.

As shown on Figure BIO-8-2, the 2011 average depth to groundwater (DTW) in the proposed BGRP/HECA well field area ranges from 40 to 70 feet below ground surface (bgs). Additional supporting data from the HECA Draft Hydrogeologic Data Acquisition Report (HDAR) (URS, 2010a) and the Draft HDAR Addendum (URS, 2010b) (December 2009 to March 2010 measured DTW from ten wells tested) indicate an average DTW of approximately 44 feet bgs (ranging from 36 to 53 feet bgs). Supplemental March 2012 DTW data from the BVWSD indicate that DTW ranges from approximately 30 feet bgs (in the north) to approximately 60 feet bgs (in the south) in the proposed BGRP/HECA well field area as water levels fluctuate in response to seasonal pumping/irrigation and recharge. Water levels also fluctuate with respect to water year.

Tree species used by nesting raptors near the proposed BGRP/HECA well field area include willows (*Salix* spp.) and Fremont cottonwoods (*Populus fremontii*). The maximum root depth of these species is typically 10 to 20 feet (USDA, 2013). Data shown on Figure BIO-8-2 indicate that the 2011 average DTW in the BGRP/HECA well field area aquifer system (40 feet bgs in the north to 70 feet bgs in the south) is well below the maximum root zone depth of willows and Fremont cottonwoods. Based on this information, it is unlikely that the trees used by nesting raptors in the project area are supported by the local aquifer system.

As discussed above, the anticipated drawdown induced by pumping would not affect the trees used by nesting raptors in the project area, because the roots associated with the trees in the drawdown area are well above the aquifer that will be pumped. Therefore, the expected drawdown due to Project-specific pumping is not expected to adversely affect the health of the nesting trees, including the tree used by nesting Swainson's hawks near the center of the well field, where the average DTW is approximately 70 feet bgs.

References

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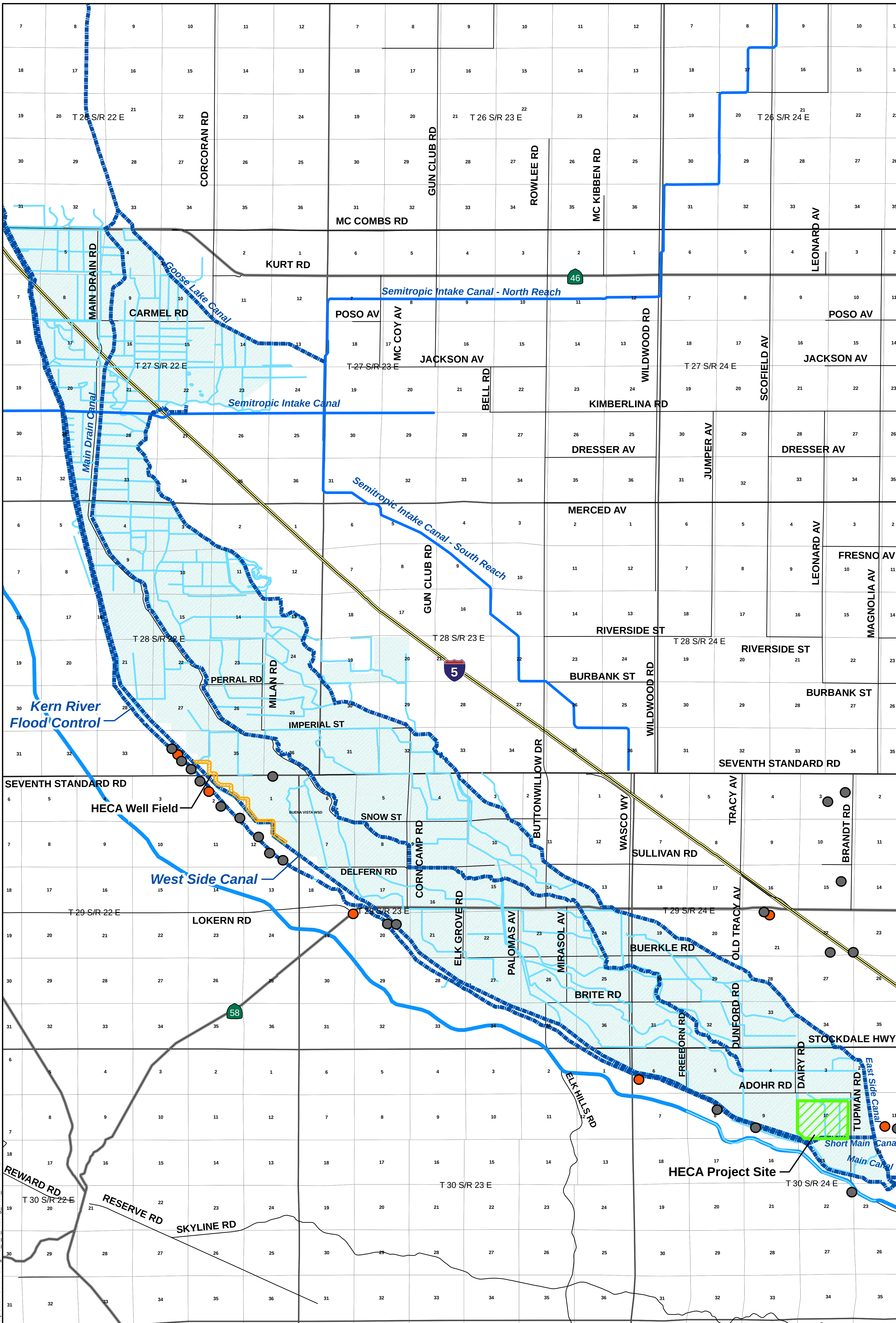

HECA Project Site

BVWSD Buttonwillow Service Area

BVWSD Well Field

BVWSD Water Ways

Nest Observations - Swainson's Hawk

Nest Observations - Other

NESTING SITES IN THE BUENA VISTA WATER STORAGE DISTRICT

August 2013
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE BIO-8-1

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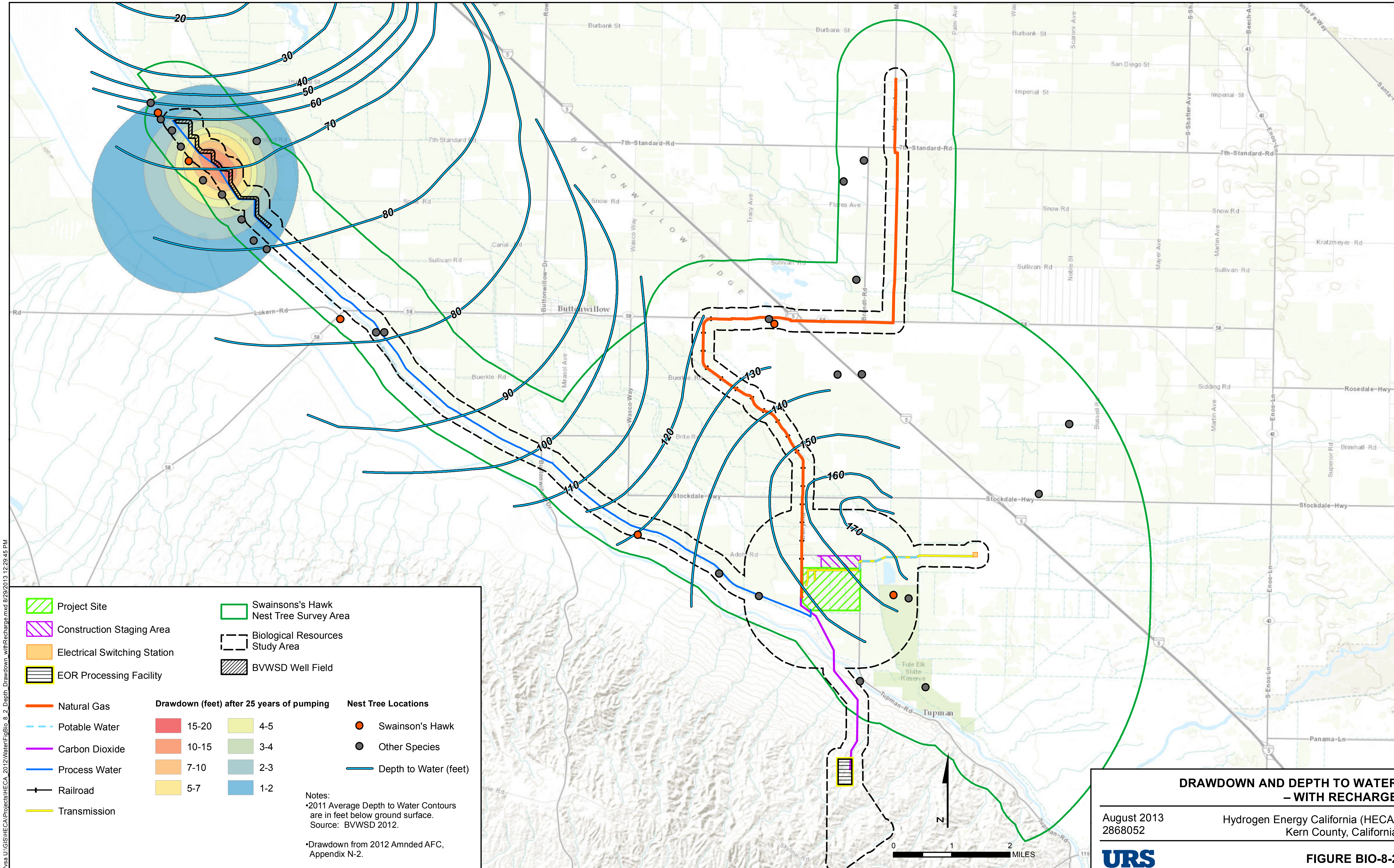

DRAWDOWN AND DEPTH TO WATER – WITH RECHARGE

August 2013
2868052

Hydrogen Energy California (HECA)
Kern County, California

FIGURE BIO-8-2

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Technical Area: Carbon Sequestration and Greenhouse Gas Emissions

INFORMATION REQUEST

CS-1. Staff requires the following information to complete the FSA/FEIS:

A binding contract between SCS Energy LLC and Occidental of Elk Hills, Inc., provided to the Energy Commission that:

a) Identifies the responsibilities of each party to demonstrate and document permanent sequestration of the supplied carbon dioxide.

b) Documents Hydrogen Energy California's rights to the entire carbon dioxide sequestration emissions reductions as necessary for SB 1368 EPS and other regulatory compliance.

c) Clearly states that the carbon dioxide sequestration emissions reductions shall not be used for any other purpose than providing for the compliance obligation needs for HECA.

d) This contract shall also require Occidental of Elk Hills, Inc., to provide a Carbon Dioxide Emissions Sequestration Plan to the Energy Commission for review and approval as detailed under the preliminary staff Condition of Certification GHG-3.

e) Clearly states the duration of the contract agreement.

RESPONSE

OEHI prepared a Monitoring, Reporting, and Verification Plan (MRV Plan) for quantifying the volumes of CO_2 that will become sequestered during OEHI's EOR operations. The MRV Plan was docketed with the CEC on June 13, 2012 (see Docket # 65750), and identifies the responsibilities of each party to demonstrate and document permanent sequestration of the supplied CO_2. The MRV Plan addresses the elements described in Staff's preliminary Condition of Certification GHG-3, and this proposed condition of certification should be revised to refer to the MRV Plan instead of an Emissions Sequestration Plan. The contract between SCS Energy LLC and OEHI will require OEHI to fully implement the MRV Plan.

HECA anticipates that the duration of an agreement for the sale and purchase of CO_2 would be 20 years, with a 5-year renewal option that would be effective upon the mutual agreement of the parties.

INFORMATION REQUEST

CS-5. Further information describing how OEHI would abate CO_2 if it leaks to the surface and escapes into the atmosphere.

RESPONSE

A detailed discussion of possible CO_2 leakage was provided in the MRV Plan as docketed with the CEC on June 13, 2012 (see Docket # 65750).

As noted in the MRV Plan, OEHI will be required to demonstrate to the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources that the well bores do not pose a threat of leakage to the surface from existing oil production operations. OEHI will be required to annually test injection wells for mechanical integrity, demonstrate proper construction of production wells, and provide a demonstration of well integrity for both injection and production wells at closure.

In addition, OEHI identified the following potential pathways for leakage to the surface from the Stevens reservoirs identified in the MRV Plan:

- Existing well bores;
- Faults and fractures;
- Natural and induced seismic activity;
- Previous operations;
- Pipeline/surface equipment;
- Overfill at lateral spill points;
- Dissolution of CO_2 into formation fluid and subsequent migration; and
- Drilling through the CO_2 area.

Based on a careful assessment of the potential risk of release of CO_2 from the subsurface, OEHI has determined that there are no reasonably expected pathways that are likely to result in a significant loss of CO_2 to the atmosphere. Furthermore, given the detailed knowledge of the field and the operating protocols, OEHI believes that it would be able to mitigate any leakage to the surface that could arise from currently unknown pathways. OEHI will use an iterative approach for both the monitoring and the resulting follow-up actions, to minimize CO_2 leakage.

INFORMATION REQUEST

CS-7J. The applicant stated that the power consumption for initial CO_2 compression that is completed at the HECA site was sufficient to provide CO_2 at a pressure necessary for geologic sequestration.

- ***Please confirm that means that the compression completed at the HECA site and the power consumed by the compressors on the HECA site is adequate to provide a level of compression that is sufficient to provide pressure necessary for geologic sequestration, or if the power consumption calculations include additional compression power consumption beyond that which is actually done at the HECA site that would be needed to obtain the desired pressure.***

- ***Please indicate if the assumed pressure necessary for geologic sequestration is the same pressure that is required by Oxy Elk Hills (OEHI) to inject the CO_2 into the Stevens formation.***

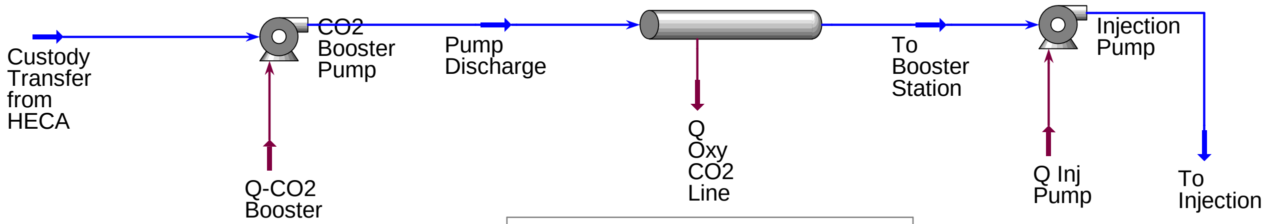
- ***Please indicate how much pressure is lost in terms of equivalent power consumption from the CO_2 custody transfer point to the point of receipt at the OEHI central EOR facility for initial injection into the oil reservoir.***

RESPONSE

The HECA CO_2 compressor pressurizes the CO_2 to approximately 2,500 pounds per square inch gauge (psig). At the HECA plant boundary, OEHI pressurizes the CO_2 stream to approximately 3,300 psig, consuming approximately 1,300 horsepower (hp) (or 975 kilowatts [kW]). The stream is transported by pipeline roughly 5 miles to the booster station; it loses approximately 270 psig pressure through the pipeline due to frictional losses. At the booster station, the CO_2 stream is pressurized to approximately 4,000 psig for injection into the Stevens reservoir for EOR and resulting sequestration, consuming approximately 1,360 hp (1,020 kW). Please see Figure CS-7J-1 for details.

CO2 Booster Pump		
Power	1312	hp

Injection Pump		
Power	1344	hp



Oxy CO2 P/L		
Inside Diameter(1)	11.94	in
Pipe Length(1)	2.640e+004	ft

Material Streams Displayed					
		Custody Transfer from HECA	Pump Discharge	To Booster Station	To Injection
Vapour Fraction		0.0000	0.0000	0.0000	0.0000
Temperature	F	120.0	141.1	133.7	155.8
Pressure	psia	2515	3314	3044	4014
Molar Flow	lbmole/hr	1.427e+004	1.427e+004	1.427e+004	1.427e+004
Mass Flow	lb/hr	6.214e+005	6.214e+005	6.214e+005	6.214e+005
Std Ideal Liq Vol Flow	barrel/day	5.157e+004	5.157e+004	5.157e+004	5.157e+004
Std Gas Flow	MMSCFD	129.8	129.8	129.8	129.8
Actual Volume Flow	barrel/day	6.275e+004	6.052e+004	6.105e+004	5.839e+004
Mass Density	lb/ft3	42.33	43.89	43.51	45.49
Master Comp Mole Frac (CO2)		0.9700	0.9700	0.9700	0.9700
Master Comp Mole Frac (Nitrogen)		0.0300	0.0300	0.0300	0.0300
Master Comp Mole Frac (H2O)		0.0000	0.0000	0.0000	0.0000

Source: Occidental of Elk Hills, Inc., August 2013

CO2 SUPPLY POWER REQUIREMENTS FOR INJECTION

August 2013
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE CS-7J-1

INFORMATION REQUEST

CS-7M. Please provide a detailed list of the monitoring and recordkeeping methods and procedures that are proposed to be used to demonstrate ongoing compliance with the SB 1368 emission performance standard (EPS) during facility operations. This should include:

- ***Monitoring methods and locations to establish CO_2 emissions from all onsite project sources, including fugitive emissions sources.***
- ***Monitoring methods and locations to establish net electricity generation values for all electricity consumed and generated.***
- ***Recordkeeping measures to ensure completeness and accuracy of data collected.***
- ***Coordination with OEHI to obtain necessary data on carbon sequestration to support the value of the sequestered CO_2 that can be used to account for the amount of CO_2 shipped to OEHI.***

RESPONSE

The monitoring and recordkeeping strategy that HECA will implement is outlined in Overview of Allocation of CO_2 Emissions, at the beginning of the responses to the Information Requests for Carbon Sequestration. The specific methods to monitor greenhouse gas emissions that will be implemented at HECA are presented in the San Joaquin Valley Air Pollution Control District Final Determination of Compliance (FDOC). Metering of net electricity generation will be determined by the California Independent System Operator (CAISO) and power purchaser(s).

HECA will use the custody transfer meter to continuously measure the volume and composition of the CO_2 sold to OEHI at the delivery point. OEHI will monitor and report the sequestered CO_2 volumes, as outlined in their MRV Plan, which has been provided to CEC.

Technical Area: Cultural Resources

INFORMATION REQUEST

CUL-2. Complete pedestrian survey results for all of HECA's linear alignments.

RESPONSE

All portions of the HECA linear alignments where access was secured have been subject to pedestrian survey. Results of the surveys have been submitted to the CEC. Figure A149-1, *Archaeological Survey Coverage*, was previously docketed on November 12, 2012, in association with the Applicant's response to Data Request A149. This figure shows the areas where pedestrian surveys were conducted, as well as the areas along the Project linears where the respective property landowners did not grant access for the pedestrian surveys. Despite repeated attempts by the Applicant, access to the applicable properties shown on this figure has not been obtained, and the Applicant does not anticipate that it will gain access to these properties prior to the FSA.

As has been the case with multiple projects permitted by the CEC, the Applicant does not have access to all properties within which Project linears occur; therefore, the Applicant cannot conduct pedestrian surveys of inaccessible areas prior to the FSA, and the Applicant proposes that a Condition of Certification be imposed that would require pedestrian surveys of all applicable areas prior to Project construction or ground disturbance.

INFORMATION REQUEST

CUL-3. Results of test excavations and evaluations of CRHR/NRHP eligibility for all archaeological sites that staff has identified as having the potential to be directly impacted by HECA or OEHI.

RESPONSE

Previous consultation between HECA, URS, and the CEC through the data request process has resulted in the determination that a total of 12 archaeological resource areas (resources) comprising archaeological sites and nearby isolates require additional archaeological analyses. Although the CEC has postulated that all 12 of these resources are in areas that will be directly impacted by Project implementation, the Applicant maintains that it is not definitively known if 10 of the 12 archaeological resources actually occur in the areas to be directly impacted by the HECA Project. Therefore, the Applicant previously proposed to CEC Staff to conduct an Extended Phase I (XPI) investigation to determine if the resources in question in fact extend into the Project's direct impact area. The XPI work plan, which outlines the methodology for implementing the XPI at 10 of the 12 archaeological resources, was submitted under confidential cover to the CEC on June 4, 2013. The XPI was approved by CEC Staff on August 15, 2013. The remaining two sites not incorporated into the XPI will be avoided by the Applicant, as discussed below.

The purpose of the XPI is to confirm the presence and/or absence of a cultural resource in the Project's direct impact area. If any intact resources are found to extend into the Project impact area during the XPI investigation, that resource would either be avoided or subject to test excavations. If test excavations were conducted and the resource was determined eligible for listing to the National Register of Historic Places, the resource would be subject to mitigation measures outlined in the Amended AFC, most likely data recovery excavation (CUL-4).

Table CUL-3-1 identifies the 12 resources and the proposed approach to each. A similar table is found within the recently approved XPI plan. In addition to the 12 resources listed in Table CUL-3-1, the CEC recently identified another resource, BS-IF-004, in the PSA/DEIS issued in June 2013. Because BS-IF-004 had not been identified as a resource of concern by the CEC previously, it was not addressed in the recently approved XPI plan. It is anticipated that the general methods outlined in the approved XPI plan could be implemented in the vicinity of this resource to determine if archaeological deposits associated with this resource extend into the Project's impact area (however, see the discussion below regarding access).

As shown in Table CUL-3-1, the Applicant only has site control over a single resource (HECA-2009-2), with the other resources falling within lands owned by others. Therefore, the Applicant has sought permission to conduct the XPI investigation from the owners of lands crossed by Project components. It should be noted that the route of the process water pipeline in the levee of the West Side Canal is not owned by the BVWSD but is an easement granted to BVWSD. Therefore, permission to conduct the XPI at these locations could not be granted by BVWSD, and the Applicant sought permission to conduct the XPI from the actual landowners.

As shown in Table CUL-3-1, the Applicant has been denied access to conduct the XPI investigation at all proposed locations except for one site (HECA-2009-9). Attachment CUL-3-1, filed confidentially, provides documentation of the Applicant's efforts to conduct the XPI investigation at the applicable properties. Although access to BS-IF-004 was not sought given its recent inclusion by CEC Staff to the list of resources of concern, this resource falls within lands whose owner has already denied access to their property to conduct the XPI. It is therefore not anticipated that the Applicant will receive permission to conduct the XPI investigation at BS-IF-004.

Table CUL-3-1
Known Archaeological Resources and Proposed Treatment

Primary # (P-15) or Temporary Designation	Associated Project Component	Isolated Finds Within Close Proximity	Trinomial (CA-KER)	Recommended Approach	Site Control by Applicant	Access Granted to Conduct XPI
89	Process water pipeline	KRM-IF-006	89/H	XPI	No	No
171	Process water pipeline, well field	None	171	XPI for assessing process water pipeline Avoidance by designating exclusion zone within well field	No	No
179	Process water pipeline	KRM-IF-002,-003, -004,-005	179	XPI	No	No
2485	Process water pipeline	BS-IF-003	2485	XPI	No	No
3108	Natural gas supply line	None	3108	XPI	No	No
6725	Process water pipeline	P-15-7176	5356/H	XPI	No	No
HECA-2008-1	Process water pipeline	None	N/A	Avoidance by placing process water pipeline below resource through HDD or similar procedure	No	Not required, site to be avoided
HECA-2009-2	Carbon dioxide pipeline, controlled area perimeter fence	None	N/A	Avoidance by CO_2 pipeline below resource through HDD or similar procedure; and placing fence atop levee, using shallow posts	Yes	Yes, but not required because site is to be avoided

Table CUL-3-1
Known Archaeological Resources and Proposed Treatment (Continued)

Primary # (P-15) or Temporary Designation	Associated Project Component	Isolated Finds Within Close Proximity	Trinomial (CA-KER)	Recommended Approach	Site Control by Applicant	Access Granted to Conduct XPI
HECA-2009-9	Process water pipeline, well field	None	N/A	XPI for assessing process water pipeline Avoidance by designating exclusion zone within well field	No	Yes
HECA-2009-10	Process water pipeline, well field	None	N/A	XPI for assessing process water pipeline Avoidance by designating exclusion zone within well field	No	No
HECA-2010-1	Switching station	None	N/A	XPI	No	No
HECA-2010-2	Natural gas supply line	None	N/A	XPI	No	No

Notes:

CO_2 = carbon dioxide
HDD = horizontal directional drilling
XPI = Extended Phase I

The Applicant has intended to mobilize a field crew and conduct the XPI at HECA-2009-2, pending the recently acquired approval of the XPI plan by CEC Staff. However, URS recently conducted a separate geoarchaeology investigation on the Project linears at the request of the CEC Staff; this report, entitled Geoarcheological Field Investigations and Sensitivity Assessment, was submitted to the CEC on August 26, 2013. According to the geoarchaeology report, Trench 10, excavated in the vicinity of HECA-2009-9 and CA-KER-171, demonstrates that the levee road within which the process water pipeline will be placed is not only “elevated over 5 feet above the ground surface in this location,” it is also “underlain by at least 60 centimeters (2 feet) of disturbed redeposited soils.” The report concludes that “there is no potential for the disturbance of intact archaeological deposits in this location” (Rehor, 2013:20). Given the geoarchaeological findings, the Applicant believes the need to conduct any field work at either HECA-2009-2 or CA-KER-171 is not justified.

In Trench 15, Rehor also identified more than 60 centimeters (2 feet) of disturbed redeposited soil in the vicinity of isolate finds KRM-IF-002 ,-003, -004, and -005; however, in this location the levee road is elevated only approximately 3 feet above the current ground surface (Rehor, 2013:4-23). Therefore, Rehor concludes that “there is little or no potential for the disturbance of intact archaeological deposits in this location” (Rehor, 2013:4-23). Rehor did recover cultural material in Trench 15, including two small chert flakes, a bivalve shell fragment, and a fish vertebra and states, based on his analyses, that all appear “to have been graded in from elsewhere” (Rehor, 2013:4-23). Rehor further suggests that the various isolates identified by URS in this vicinity along the process water pipeline, as well as a large obsidian biface he found on the ground surface nearby, are “clearly associated with redeposited organic clay slough soils and not in any original depositional context” (Rehor, 2013:4-23). Rehor hypothesizes that these isolates, as well as the cultural material recovered in Trench 15, are associated with CA-KER-179, which is situated approximately 200 feet beyond the CEC-mandated 50-foot buffer, and thus well outside the archaeological survey corridor. Because of these now known to be redeposited isolates, the Applicant believes that conducting any field work in this locale is not justified.

Because access to the remaining archaeological resources has not been secured, and will not be secured prior to the issuance of the FSA, the Applicant proposes that the completion of the XPI at the remaining resources—including resource BS-IF-004, as well as any follow up investigations, if necessary—be addressed through Condition of Certification.

Reference

Rehor, Jay, 2013. Draft Geoarchaeological Field Investigations and Sensitivity Assessment, Hydrogen Energy California Project, Kern County, California. Submitted by URS Corporation. August.

INFORMATION REQUEST

CUL-4. Results of geoarchaeological field sampling.

RESPONSE

The Geoarchaeological Field Investigations and Sensitivity Assessment Report for the HECA Project was submitted confidentially to CEC on August 26, 2013.

Technical Area: Traffic and Transportation

INFORMATION REQUEST

TRA-3. Under a proposed alternative, HECA would construct and operate a rail spur for delivery of fuel and products to and from the project site. Because the CPUC traditionally has jurisdiction over such facilities, staff will continue to coordinate closely with the CPUC to ensure appropriate design of the rail line for safe operation. In order to ensure that CPUC staff has sufficient information in order to assist in analyzing the proposal, the applicant must submit all the information otherwise required for a formal application pursuant to Title 20, California Code of Regulations, section 3.1 for all public at-grade rail crossings needed for the proposed rail spur. This information is outlined in the CPUC Rules of Practice and Procedure 3.7 to 3.11 under Section 1001 of the Public Utilities Code and should be submitted, to both the CPUC and Energy Commission staff.

RESPONSE

There will be two public at-grade crossings associated with the proposed rail spur, one at Stockdale Highway and one at Adohr Road. The Applicant conducted a field diagnostic with the California Public Utilities Commission (CPUC) on February 7, 2013, to obtain preliminary comments on the public crossings from the CPUC. Participants at the field diagnostic included representatives from CPUC, Union Pacific Railroad, San Joaquin Valley Railroad, Kern County Roads Department, and the Applicant. The meeting notes from the field diagnostic were docketed on February 26, 2013, as part of the Applicant's Response to CEC Data Request A155. These meeting notes outlined CPUC's comments on the proposed rail spur. Additional information regarding the public crossings was also provided in the Supplemental Response to CEC Data Request A155, docketed on March 20, 2013. The Supplemental Response provided detailed drawings and descriptions of the proposed warning signals at the public crossings.

A summary of the information that has been submitted to date, as well as additional information required for the formal CPUC Application for public crossings, is provided below. The information referenced and provided below is considered sufficient to meet the formal CPUC application requirements.

CPUC Application Requirements

- Applicant Information:

  HECA – Jim Croyle, 30 Monument Square, Suite 235, Concord, MA 01742, (978) 287-9529; jcroyle@scsenergyllc.com.

- Proposed Public Crossings:

  A new rail spur will be constructed that will include two new public at-grade crossings: one at Stockdale Highway and one at Adohr Road. Descriptions of the public crossings are provided in the Applicant's Response to CEC Data Request A155, docketed with CEC on February 26, 2013, and Supplemental Response to CEC Data Request A155, docketed on March 20, 2013.

- Describe proposed public crossings:

  – Descriptions are provided in the Applicant's Response to CEC Data Request A155, docketed with CEC on February 26, 2013; and Supplemental Response to CEC Data Request A155, docketed on March 20, 2013.

  – Vicinity maps, at a scale of 1 inch = 50 feet, for each of the two public at-grade road crossings, were provided as Exhibits C and D in Attachment A155-2, docketed with the CEC on March 20, 2013.

  – Plans that show the proposed public at-grade crossings in relation to the existing roads were provided as Exhibits A and B in Attachment A155-2, docketed with the CEC on March 20, 2013. Because the topography in the Project area is relatively flat, profiles were not developed. However, typical track sections that show relative elevations were presented in Exhibit E of Attachment A155-2.

- Describe the public benefits:

  Safety measures will be implemented to protect the public.

- Explain why a separation of grades is not practicable:

  Due to the relatively flat topography of the area, it would be physically impracticable to construct grade-separated crossings.

- Describe the existing and proposed crossing warning devices:

  The following rail safety devices are proposed at the two public at-grade crossings (see Attachment A155-2, docketed on March 20, 2013):

  – Crossing materials consisting of precast concrete panels;

  – Automatic warning devices, including two CPUC Standard No. 9s, three advance warning signs (two W10 1s and one W10 4); and

  – Required Manual on Uniform Traffic Control Devices (MUTCD) pavement markings.

- **Temporary traffic controls:**

  During construction, temporary traffic control, including temporary crossing closures and detours, will be provided in accordance with the California MUTCD, Section 8A.05 and Figure 6H-46.

INFORMATION REQUEST

TRA-5. Although potentially significant impacts associated with implementation of the proposed HECA project can be mitigated to a less-than-significant level, staff has concerns that the project has the potential to substantially increase traffic levels on farming roads not currently intended for heavy truck traffic and heavy load capacities. This substantial increase in traffic also has the potential to impact traffic associated with existing farming activities (e.g., tractors traveling on public roadway) thereby potentially resulting in safety issues and increased accidents to the public. Based on a recent Board of Supervisor's meeting held on February 26, 2013, the Board instructed the Public Works Department to review the roadways intended for heavy truck, and worker traffic and report back at their June 2013 Board meeting as to recommendations for improvements to the local roadway system. Staff will address the concerns and/or recommendations by Kern County in the FSA.

RESPONSE

The Applicant submitted a Revised Traffic Study Report to Kern County Roads Department and to the California Department of Transportation on July 26, 2013. This report was docketed with the CEC on August 1, 2013.

Based on their review of the revised Traffic Study Report, on August 19, 2013, the Kern County Roads Department docketed a letter requesting mitigation; and on August 21, 2013, the California Department of Transportation docketed a comment letter. The Applicant is reviewing both letters, and is working on providing responses that will be docketed with the CEC.

Technical Area: Waste Management

INFORMATION REQUEST

WM-1. Staff was not provided a breakdown of types and quantities of nonhazardous and hazardous waste that will be generated from the OEHI component of HECA to confirm that the project will not have an impact on Kern County landfills. This data would be needed for staff to complete an assessment of potential impacts.

RESPONSE

Section 4.16, Utilities and Service Systems, of the April 2012 OEHI Supplemental Information document, states that activities at the Elk Hills Oil Field (EHOF) currently generate several types of solid waste, most of which are nonhazardous waste streams. A total of approximately 4,000 tons/year (equivalent to one truck trip every three days) of nonhazardous solid waste, such as construction debris and domestic-type wastes and trash, are removed from the EHOF. The amount of solid waste generated as a result of the Project will not be significantly greater than that generated during existing construction and operations at the EHOF without CO_2 EOR. Therefore, no substantial increase in the generation of solid wastes above existing baseline conditions is anticipated as a result of Project implementation. As such, the Project is not expected to be served by a landfill with insufficient permitted capacity to accommodate the Project's solid waste disposal needs. Considering the above, the Project would have a less-than-significant impact on landfill capacities and facilities.

Section 2.13, Waste Management, of the Data Gap Analysis document states that the modified CO_2 supply line alignment would not generate additional waste or change handling practices beyond what was considered in HECA's 2009 CEC AFC filing.

Technical Area: Water Supply

In the PSA/DEIS, CEC Staff did not specifically identify additional information needed to complete the FSA/FEIS. However, Staff states that "much of the analysis presented below is the same or similar to that presented in the draft preliminary staff assessment at the workshop."

Following the February 20, 2013 Water Supply Workshop, the Applicant and the BVWSD submitted the following documentation.

- The Applicant's Slide Presentation from CEC Workshop, docketed on February 22, 2013.
- BVWSD's Response to CEC Staff's Preliminary Water Supply Analysis, docketed on March 22, 2013.
- BVWSD's Data submitted confidentially to CEC on March 26, 2013.
- BVWSD's Response to CEC Data Requests dated March 21, 2013 and Response to Preliminary Staff Assessment, docketed on August 21, 2013.

Staff concluded (on page 4.15-49) that they will conduct further analysis on the Project's water supply plan. Below, the Applicant respectfully provides additional information related to Staff's list of items requiring further review.

INFORMATION REQUEST

WS-1. Staff conducted a workshop on February 20, 2013….At the workshop, BVWSD indicated they have additional data that was not considered in staff's analysis. They offered to provide additional information and requested staff reanalyze the potential project impacts. BVWSD indicated some data is confidential and requested that staff work directly with BVWSD to obtain the data and ensure it is protected in accordance with state law. Staff agreed and transmitted data requests to BVWSD on March 21, 2013. Staff has not received the data or met with BVWSD since the workshop and is awaiting the data for further analysis in a revised staff assessment. Much of the analysis presented is the same or similar to that presented in the draft preliminary staff assessment at the workshop.

RESPONSE

BVWSD's responses to CEC's March 21, 2013, data requests were submitted to the CEC on August 21, 2013. The BVWSD submittal—which included supporting tables, figures, and appendices—served as their response to the 14 CEC data requests, and as their comments on the PSA/DEIS.

The Applicant has reviewed and concurs with the BVWSD responses, which included their evaluation and data supporting their understanding of the following technical topics:

- Local groundwater quality;
- The origin of elevated total dissolved solids (TDS) entering the BVWSD BSA from the west;
- Time-series water quality data from wells east and west of the approximate TDS "axial interface";

- The structural and hydrogeologic factors supporting the total or partial isolation (location or area specific) of the Buttonwillow Subbasin from the main Kern County Subbasin to the east;
- Information supporting the conclusion that the Buttonwillow Subbasin is not in overdraft and that BGRP Area B (HECA-specific) pumping would not contribute to overdraft of the main Kern County Subbasin;
- Updated BVWSD BSA water budget and water balance (inflows, outflows, and contributions to Kern County groundwater banking projects);
- Clarifications on BVWSD's support of the Applicant's use of hydraulic modeling parameters of specific yield, specific storage, and anisotropic ratios, and on BVWSD's disagreement with CEC Staff's use of alternative parameter values that seem unrealistic in light of BVWSD's data sets, knowledge of local geology and hydrogeology, and observed aquifer response associated with the operation and monitoring of 200+ agricultural wells within the BVWSD BSA;
- Updated crop inventory;
- Monitoring of the Reagan Pond impacted groundwater plume, and the possible influence of BGRP/HECA well field pumping on the eastern plume edge movement near California Aqueduct (to the west of the BVWSD BSA western boundary); and
- Economic, logistical, and practical data and evaluations demonstrating that BGRP Target Area A is not feasible as a source of HECA process water supply.

INFORMATION REQUEST

WS-2. Staff believes that other well configurations or locations could more effectively capture poor quality water or water with no other beneficial uses. If the project's pumping were able to better induce horizontal flow, particularly flow from the east, it is more likely that pumping could remove brackish water from the local aquifer. Staff believes this effect could be accomplished by a couple of distinct changes in the pumping strategy.

RESPONSE

HECA has worked closely with the BVWSD to ensure that the proposed brackish groundwater withdrawal program, including specifically the location of the wells, provides maximum environmental benefits and is consistent with applicable laws, ordinances, regulations, and standards (LORS).

The BVWSD BGRP was designed to improve local groundwater quality by intercepting and removing the high-TDS groundwater.[1] The BGRP Target Area B is focused on the worst local quality groundwater, with the intent of intercepting and removing it as a means of improving groundwater quality conditions.[2] Response to Information Request WS-3, below, explains why HECA's use of Target Area B, rather than Target Area A, is the environmentally and economically superior option.

HECA's use of brackish groundwater pumped from the BGRP Target B area will provide multiple benefits to BVWSD:

- There will be a net benefit to salt removal (i.e., TDS removal in terms of rate and mass) as a result of Project pumping; the pumping will remove high-TDS groundwater, thereby increasing the long-term water quality of available groundwater supplies.
- The Target Area B picket fence well field will be specifically designed to improve local groundwater chemistry by focusing on areas with the highest TDS levels, which are generally above 3,000 milligrams per liter (mg/L).
- Project pumping is expected to help increase crop diversity and crop yield within BVWSD by allowing farmers to access lower-TDS groundwater that can be used by a wider diversity of crops

Data support the conclusion that the BGRP/HECA brackish groundwater withdrawal program would tap into waters with very high TDS levels. BVWSD initially estimated that the HECA well field would likely produce brackish water with TDS levels between 2,000 and 4,000 mg/L.[3] On August 21, 2013, BVWSD submitted additional data to the CEC demonstrating that the groundwater within the area of HECA's withdrawal zone is even higher in TDS levels, and sufficiently brackish to comply with all applicable LORS.[4]

Specifically, the BVWSD August 21 data demonstrate that TDS levels in the vicinity of the HECA withdrawal program are generally greater than 3,000 mg/L. Well data collected over time

[1] See Docket No. 70025, BVWSD's Response to CEC Staff's Preliminary Water Supply Analysis, Memorandum from Dan Bartel, P.E., March 18, 2013 ("Bartel Memorandum"), at 1.
[2] Bartel Memorandum at 6.
[3] Bartel Memorandum at 6.
[4] See Docket No. 200285, BVWSD's Response to CEC Data Requests and PSA, August 21, 2013, at pp. 1-3.

support the conclusion that the wells in the western portion of the BVWSD area will have high enough TDS to comply with applicable LORS. For example, wells in the T28e/R22e area had an average TDS level of 3,439 mg/L over the span of 1990 to 2010, and wells in T29s/R22s had an average TDS level of up to 3,397 mg/L over that same timeframe. Time series plots for each of these areas show a trend of increasing TDS levels over these periods. These data are supported by prior research on the hydrology of the Kern River alluvial fan area (Dale, 1966).

In contrast to the high-TDS levels in the HECA withdrawal zone, the groundwater with lower TDS levels is outside of the HECA withdrawal area, to the east and south, as shown in Attachment 1 of the BVWSD August 21 submittal. Data from the eastern areas that show lower TDS concentrations may have influenced the TDS range used by Staff in the PSA. HECA's withdrawal program will be designed to avoid the areas with lower TDS levels, and to focus on areas with higher TDS levels—which BVWSD's data show is generally greater than 3,000 mg/L.

The Applicant recognizes that Staff did not have this well-specific information at the time the PSA/DEIS was prepared. However, these newly available data best reflect existing conditions, as required for the environmental review under the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). In the PSA/DEIS, Staff determined that well field production TDS levels may be in the range of 945 to 3,730 mg/L. This range is partially based on outdated information that does not reflect current conditions in Target Area B. The low TDS estimates are largely the result of including outdated groundwater data collected from as early as 1961.[5] Although these data can provide historical context, the Applicant and BVWSD do not agree that they are appropriate for evaluating current groundwater conditions.[6] If the outdated data were removed from the analysis, the PSA/DEIS would reflect higher TDS levels consistent with the estimates provided by BVWSD and the Applicant. As described above, the updated BVWSD submittal on August 21, 2013, provides improved data that show a TDS range that is generally greater than 3,000 mg/L.

In the PSA/DEIS, Staff considers whether the BGRP/HECA groundwater withdrawal program is consistent with applicable LORS and the CEC's policy of using the "least of the worst" available water. The HECA water supply program was designed with these principles in mind. The BGRP Target Area B is focused on the worst local quality groundwater, with the intent of intercepting and removing it as a means of improving groundwater quality conditions.[7] As explained above and shown in the BVWSD recent submittal, HECA would withdraw water with a TDS of greater than 3,000 mg/L. Therefore, HECA is squarely consistent with State Water Resources Control Board (SWRCB) Resolution 75-58, which indicates that brackish groundwater with TDS above 1,000 mg/L is appropriate for power plant cooling where "wastewater being discharged to the ocean" or "ocean" supplies are not available, as is the case here. HECA is also consistent with SWRCB Resolution 88-63 because HECA will withdraw from areas with TDS levels expected to be near or above 3,000 mg/L, and because the brackish groundwater supplies are not expected to be used for domestic or municipal use.

In the PSA/DEIS, Staff considers whether the HECA/BGRP brackish groundwater supplies should be protected for potential agricultural purposes to irrigate high-salt tolerant plants such as pistachios. Even if pistachios could be irrigated in the near term with high-TDS groundwater, it would not be environmentally beneficial or consistent with the BVWSD goals. The BVWSD

[5] Bartel Memorandum at 3.
[6] Bartel Memorandum at 3, 6.
[7] Bartel Memorandum at 6.

has explained that irrigating on a routine basis with high-TDS groundwater "will quickly degrade soils, agricultural production, and groundwater quality that is already extremely fragile."[8]

Although the proposal to use Target Area B is clearly superior to other alternatives, and is sufficiently defined to evaluate its effectiveness, it may be possible to further refine the well configurations or locations to improve the effectiveness of the groundwater withdrawal program. The Target Area B BGRP well field design will be finalized based on additional data gathered during the completion of a test well program that will be the first part of the well installation. The conceptual design for the BGRP Target Area B well field is for a linear well field along the BVWSD BSA western boundary in the area just south of 7th Standard Road. The design includes five wells (three pumping and two redundant) that are spaced at 0.25- to 0.5-mile intervals, with screened intervals between first water (encountered at approximately 40 feet bgs) and 400 feet bgs, capable of pumping up to 4,650 gallons per minute (gpm) (i.e., 7,500 acre-feet per year [afy], with each well capable of pumping up to 1,550 gpm). The final well field design will depend on the results of a test well program that calls for four exploratory borings (one to 1,000 feet bgs and three to 600 feet bgs), geologic and geophysical logging, evaluation of TDS stratification within the local aquifer system, and geotechnical testing of geologic samples.

The test well program is planned to be implemented during Project construction. The objective of the BGRP Target Area B well field is to build a well field that is optimal at removing elevated TDS groundwater from the local aquifer system, while being able to efficiently provide on-demand groundwater at rates up to 4,650 gpm (i.e., 7,500 afy) for the HECA process water supply component. The final well field design may include refinements to optimize removal of TDS from the local aquifer system, as well as to induce movement of better quality groundwater into the elevated TDS areas from the eastern part of the BVWSD BSA. These refinements could include focused well screened intervals adjacent to those aquifer zones having the highest TDS concentrations; and changes in well depths, numbers, intended spacing (and spacing configurations), and pumping strategies, so that the BGRP Target B objectives are effectively met.

Reference

Dale, R.H., James J. French, and G.V. Gordon, 1966. Ground-Water Geology and Hydrology of the Kern River Alluvial-Fan Area, California. U.S. Geological Service Water Res. Division Open-File Report: 66-21.

[8] Bartel Memorandum at 6.

INFORMATION REQUEST

WS-3. As described in this analysis and in the BVWSD FEIR, the northern portion of the district appears to contain low quality water at shallower depths. This water is detrimental to agriculture and should be removed from the crop root zone. In their FEIR, BVWSD identifies the intent to develop brackish groundwater remediation in the northern BSA and produce up to 4,500 AF/y, in addition to the supply allocated for HECA. Staff believes this opportunity provides a much greater potential for meeting the proposed objectives of remediation and power plant cooling supply. Supply wells located in BVWSD's northern BSA are more likely to remediate agricultural lands and produce a consistent poor quality supply.

RESPONSE

As stated in BVSWD's Responses to CEC Staff's Preliminary Water Supply Analysis, docketed with CEC on March 22, 2013:

> "BVWSD has offered a portion of Target Area B to HECA. Target Area A offers much better water quality and is distributed over a larger area which could be more suited and accessible to an in-district blending water supply program than Target Area B. In addition BVWSD is considering the Northern Area Pipeline Project … which would eliminate the BGRP Target Area A project all together by drastically reducing canal seepage and when combined with irrigation system changes has been modeled to solve the shallow perching issue with a wider range of benefits, reduced energy costs, and is more consistent with state water use efficiency goals."

The PSA/DEIS raises the question of whether Target Area A could provide alternative benefits to HECA's proposed use of Target Area B. The PSA/DEIS discusses information from the BVWSD's Final Environmental Impact Report for the Buena Vista Water Management Program, dated December 2009 (BVWSD FEIR) as support for the potential consideration of Target Area A.

Since the time of the publication of the Buena Vista FEIR, BVWSD has considered additional information and its analysis of the HECA water withdrawal program to determine that HECA's use of Target Area B would be environmentally and economically superior to using Target Area A, and would better advance the purposes of the BGRP. Most recently in the August 21, 2013, Responses to Data Requests, BVWSD provided additional information that clarifies that overall TDS values in the northern portion of the district (i.e., BGRP Target Area A) are lower and more variable than those in BGRP Target Area B. BVWSD currently estimates that TDS values are generally greater than 3,000 mg/L in BGRP Target Area B, based on BVWSD's more comprehensive evaluation of the available data (see BVWSD's August 21, 2013 responses to Data Requests 1, 2 and 3). In comparison, BVWSD estimates that TDS levels in Target Area A would be lower, in the range of 1,500 mg/L.[9] As a result, use of Target Area B would help remove more brackish (i.e., higher TDS) groundwater, further advancing the BGRP.

BVWSD also determined that Target Area A has a less reliable source of impaired quality groundwater for the HECA process water supply with respect to sustainability and on-demand supply rates and volumes. BVWSD determined that Target Area A would have resulted in reduced groundwater benefits when compared to Target Area B, because the well field and gathering system for Target Area A would be much more extensive, resulting in greater impacts

[9] See Bartel Memorandum.

and making it more difficult to farm the land.[10] The pipeline needed for HECA to use Target Area A would be about a third longer than for Target Area B, resulting in greater environmental impacts and costs.[11] Moreover, BVWSD determined that developing Target Area A for HECA would be substantially more expensive than Target Area B. As a result of this new information and analysis, BVWSD has elected to not develop BGRP Target A, notwithstanding the fact that it was described in the BVWSD FEIR. Therefore, BGRP Target Area A has been eliminated as a process water supply source for HECA.

With respect to remediating agricultural lands, the PSA/DEIS discussed the possibility that the Target Area B groundwater, although containing elevated TDS concentrations, could be used to irrigate salt tolerant crops such as pistachios. Even assuming this is the case for certain high salt-tolerant crops, the intent of the BVWSD Target Area B BGRP is to improve water quality so that crop diversity and yield may be improved, beyond that which may be possible with the application of lesser quality groundwater for the cultivation of salt tolerant crops. One aspect of improved water quality (i.e., being able to irrigate with water of lower TDS concentrations) is that a reduction in salt loading to the soil would improve soil quality (and in turn soil sustainability). In the February 20, 2013, Water Workshop and subsequent submittals, BVWSD has offered documentation to the CEC regarding the fact that continued irrigation with elevated TDS groundwater acts to cumulatively degrade soil quality due to salt retention. The BVWSD has explained that irrigating high-salt-tolerant crops on a routine basis with high-TDS groundwater " will quickly degrade soils, agricultural production, and groundwater quality that is already extremely fragile."[12]

[10] Docket No. 200285, BVWSD's Response to CEC Data Requests and PSA, August 21, 2013, at 15.
[11] *Id*.
[12] Bartel Memorandum at 6.

INFORMATION REQUEST

WS-4. The applicant has not sufficiently evaluated alternative water sources that may better satisfy water policy concerns. The Revised Application for Certification contains a brief description of the alternative water supplies considered for the project. The description of the alternative, agricultural wastewater, is very brief and general. BVWSD's Water Balance (FIER, 2009) indicates that surface outflow from the agriculture-dominated district may be significant. Staff is also aware that BVWSD is exploring methods for treatment and options for reuse of agricultural drainage, see "Low-pressure RO membrane desalination of agricultural drainage water," published in Desalination in 2003. Staff also notes approximately 12,000 to 15,000 acres of the Buttonwillow Service Area located north of the proposed well field is affected by a shallow water table. Use of this alternative water supply by HECA could provide dual benefits of root zone salt balance and improved soil aeration in the affected area.

RESPONSE

Agricultural wastewater is excess water from irrigation practices. This source is not available in sufficient quantities in the vicinity of the Project Site, nor will it be sufficiently reliable for use at the Project. Agricultural wastewater is an unreliable source of water, because the amount of water that is available depends on how the fields are operated, which in turn depends on the crop, climate, etc. Also, as a result of increased water conservation measures by farmers, including more efficient irrigation practices and conversion to more water-efficient crops, irrigation return flows become even more scarce and unreliable.

Surface outflow of agricultural wastewater from BVWSD was previously discharged from the district via the main drain. The referenced report was prepared in 2003, and summarized a demonstration project conducted from 2000 to 2002 to evaluate treatment of this wastewater. However, due to improved agricultural irrigation management practices (such as drip irrigation), this excess wastewater outflow no longer exists. Essentially, 100 percent of BVWSD's agricultural wastewater has been reclaimed and has not been discharged out of the district since mid-June 2013. Therefore, this potential source of water is no longer available.

The 12,000 to 15,000 acres of the BSA north of the proposed well field that is affected by a shallow water table is the same area as BGRP Target Area A; as explained in the responses to Information Requests WS-2 and WS-3, this is not a viable source. Target Area A has insufficient water to meet the required flow for the HECA Project. The engineering and associated infrastructure and operation costs of gathering and transporting groundwater from the northern portion of the BVWSD BSA (BGRP Target Area A) would be prohibitively complex and expensive, as outlined in BVWSD's August 21, 2013, Responses to CEC's Data Requests.

INFORMATION REQUEST

WS-5. Staff is interested in learning more about the proposed well field and potential water quality that may be produced from it. Additional wells may provide useful information about how water quality varies with depth at the proposed well field site and also may help provide clarity in future discussions on water policy and potential impacts.

RESPONSE

BVWSD provided analysis and documentation regarding local water quality at and subsequent to the February 20, 2013, Water Workshop. The August 21, 2013, Response to Data Requests provided documentation that TDS values in the BGRP Target Area B range from 3,000 to 5,000 mg/L. A test well program would be the first element of the BGRP Target Area B well field construction activities, and would be directed at identifying elevated TDS zones in the aquifer system so that the well field can be designed (well numbers, locations/configurations, depths, screened intervals, and pumping schedules) to optimize salt removal.

INFORMATION REQUEST

WS-6. Water alternatives dismissed by the applicant such as municipal wastewater from Bakersfield, oil field wastewater, or BVWSD Target Area A water, were eliminated because they can't supply the proposed project's entire water supply. However it is unreasonable to dismiss all of these options when any one of them could provide up to 50 percent of the project's water needs.

RESPONSE

As shown on Table 5.14-5 of the Amended AFC, the HECA Project needs approximately 7.4 million gallons per day (mgd) (peak daily), 6.6 mgd (average daily), or 7,400 afy of brackish water from BVWSD's well field. The amount of water needed depends on the quality of the source water.

The Applicant has evaluated alternative water supply sources and determined that none of the options would provide sufficient quantity or quality to serve the Project in the long term. As Staff requested, the Applicant considered the possibility of using a mix of water supplies where an alternative may supply only a portion of the Project's water need. In general, however, a mix of water supplies with different characteristics poses serious technical constraints for the Project, because a water treatment system would need to be designed to handle the wide variation in water quality from the various sources. Such a treatment system would be very expensive to construct, operate, and maintain. The multiple sources would also need to assure HECA that their water supply would be available on an on-demand basis, 24 hours per day and 365 days per year. Furthermore, constructing several separate pipeline systems from multiple sources would be impractical, would have environmental impacts, and would not be cost-efficient.

A summary of the potential water sources is provided below.

1. Municipal Wastewater from Bakersfield

The Applicant reviewed information for wastewater treatment plants (WWTPs) within 25 miles of the Project site (see Figure W-6-1). Five facilities are very small and handle less than 2 mgd of sanitary wastewater. Only two facilities, Bakersfield WWTP #3 and Bakersfield WWTP #2, handle sufficiently large volumes of sanitary wastewater flows. There is no tertiary-treated water (i.e., recycled water) currently available from the local municipal WWTPs.

The Project Site is approximately 17 miles northwest of the City of Bakersfield WWTP #3 (see Figure WS-6-1). This plant treats the municipal effluent generated from the western portion of the City of Bakersfield (i.e., generally west of Highway 99). The plant was upgraded in 2010, and has a current treatment design capacity of 32 mgd, although the average amount of wastewater currently handled is approximately 16 mgd. The plant's upgrades included 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 WWTP. All of the 2 mgd of recycled water is currently used for landscaping, and there is no excess available for the HECA Project (CVRWQCB, 2009a).

The WWTP treats and discharges approximately 16 mgd of secondary-treated wastewater. The treated effluent is transported via pipeline to Los Angeles' Green Acres Farm, west of Interstate 5.

Currently there is no infrastructure in place to convey recycled water, if it were available, or secondary-treated wastewater from the Bakersfield WWTP #3 to the HECA Project Site.

Assuming that a pipeline could be constructed along existing road rights-of-way, the pipeline route would be on the order of 25 to 30 miles long, depending on the actual route. The associated environmental impacts for construction of this pipeline have not been evaluated, but would be expected to be similar to those associated with the other Project linears.

The City of Bakersfield WWTP #2 does not produce any tertiary-treated water (CVRWQCB, 2009b). This plant is approximately 22 miles east of the HECA Project Site. WWTP #2 serves the eastern portion of the incorporated Bakersfield metropolitan area, generally east of Highway 99 in Kern County. The secondary-treated effluent is used to irrigate restricted agricultural crops (nonhuman consumption). Assuming that a pipeline could be constructed along existing road rights-of-way, the pipeline route would be on the order of 30 to 35 miles, depending on the actual route. The associated environmental impacts for construction of this pipeline have not been evaluated, but would be expected to be similar to those associated with the other Project linears. The Bakersfield WWTP #2 does not produce any tertiary-treated water (CVRWQCB, 2009b).

Other WWTPs in Kern County are much smaller than Bakersfield's WWTP #3 and #2, and are not able to provide the necessary quantity of water to the HECA Project. Also, none of these plants produce tertiary-treated water. Figure WS-6-1 shows the location of the WWTPs in the vicinity of the HECA Project. A summary of the plants and their associated design capacities is provided in Table WS-6-1.

Table WS-6-1
Wastewater Treatment Plants in Vicinity of HECA Site

Wastewater Treatment Plant or Facility Name	Waste Discharge Requirements Order Number[1]	Distance from HECA Site[2]	Average Flow (mgd)	Design Flow (mgd)	Effluent Quality
Bakersfield WWTP #2	R5-2009-0122	22	14.5	25	Secondary
Bakersfield WWTP #3	R5-2009-0161	17	15.8	32	Secondary (32 mgd) Tertiary (2 mgd)
Buttonwillow WWTF	R5-2009-0123	6	0.15	0.2	Secondary
I-5 at Highway 58 WWTF	R5-2007-0152	4	0.11	0.19	Secondary
Stoco WWTF	R5-2007-0153	3	0.02 to 0.03	0.05	Secondary
Shafter WWTF	R5-2005-0124	11	0.83	1.85	Secondary
Wasco WWTF	R5-2002-0198	18	1.8	3	Secondary

Notes:
[1] Orders available at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/index.shtml#kern.
[2] Approximate distance between Project Site and the WWTP is "as-the-crow-flies." See Figure WS-6-1.

HECA = Hydrogen Energy California
I-5 = Interstate 5
mgd = million gallons per day
WWTF = wastewater treatment facility
WWTP = wastewater treatment plant

In conclusion, the use of municipal wastewater is not a viable alternative due to the lack of available tertiary-treated wastewater in the vicinity of the Project. Moreover, even if secondary-treated wastewater were available in sufficient quantity, it would require expensive upgrades to either the WWTPs or HECA's treatment system, and require pipeline(s) at least twice as long as the proposed 15-mile process water pipeline.

2. Oil Field Wastewater

To enhance EOR performance, a technique of alternating cycles of water injection with cycles of CO_2 injection may be used. In this technique, referred to as "Water Alternating Gas" or "WAG," water is periodically introduced after the CO_2-oil miscible solution to "sweep" the solution to production wells and further enhance oil recovery.

Therefore, the majority of the EHOF-produced water is reused (e.g., treated and injected to enhance oil recovery). As stated in OEHI's response to AIR's data request #13 (docketed on January 4, 2013), OEHI's operations at the EHOF do not produce enough excess water to meet the HECA Project's water requirement in the long term. Although they might be willing to provide whatever quantity might be available to the Project, they are reluctant to guarantee specific quantities of future water supply. Their business purpose is oil production—not water production—and they are unwilling to complicate the former for the sake of the latter.

OEHI indicated in the response to AIR's data request #13 (docketed on January 4, 2013) that water produced from EHOF typically contains 27,000 to 30,000 mg/L of TDS. The HECA Project would need to include additional treatment technology to use this extremely high TDS water, if it were even available. In addition to the elevated TDS concentration, this water 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.

In Section 6.7.4.1 of the Amended AFC, the Applicant summarized the economic implications of using oilfield-produced water. The estimated capital cost to construct a water plant to process this raw water supply is approximately $200 million. The costs to operate this water plant are anticipated to be high, and could result in a nearly 15-megawatt (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 on 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 economically feasible.

A pipeline to convey EHOF's excess produced water, if it were available, from EHOF to the HECA Project Site could be co-located with the 3-mile-long CO_2 pipeline. The EHOF is at a higher elevation (approximately elevation 300 to 1,550 feet mean sea level [msl]) than the HECA Site (approximately elevation 282 feet msl); therefore, flow to the Project would be via gravity. The associated environmental impacts for construction of this pipeline would be expected to be similar to those associated with construction of the CO_2 pipeline.

3. BVWSD's Target Area A

Please see Applicant's response to Information Request WS-3 and BVWSD's "Response to CEC Data Requests dated March 21, 2013, and Responses to Preliminary Staff Assessment dated June 28, 2013," docketed with CEC on August 21, 2013.

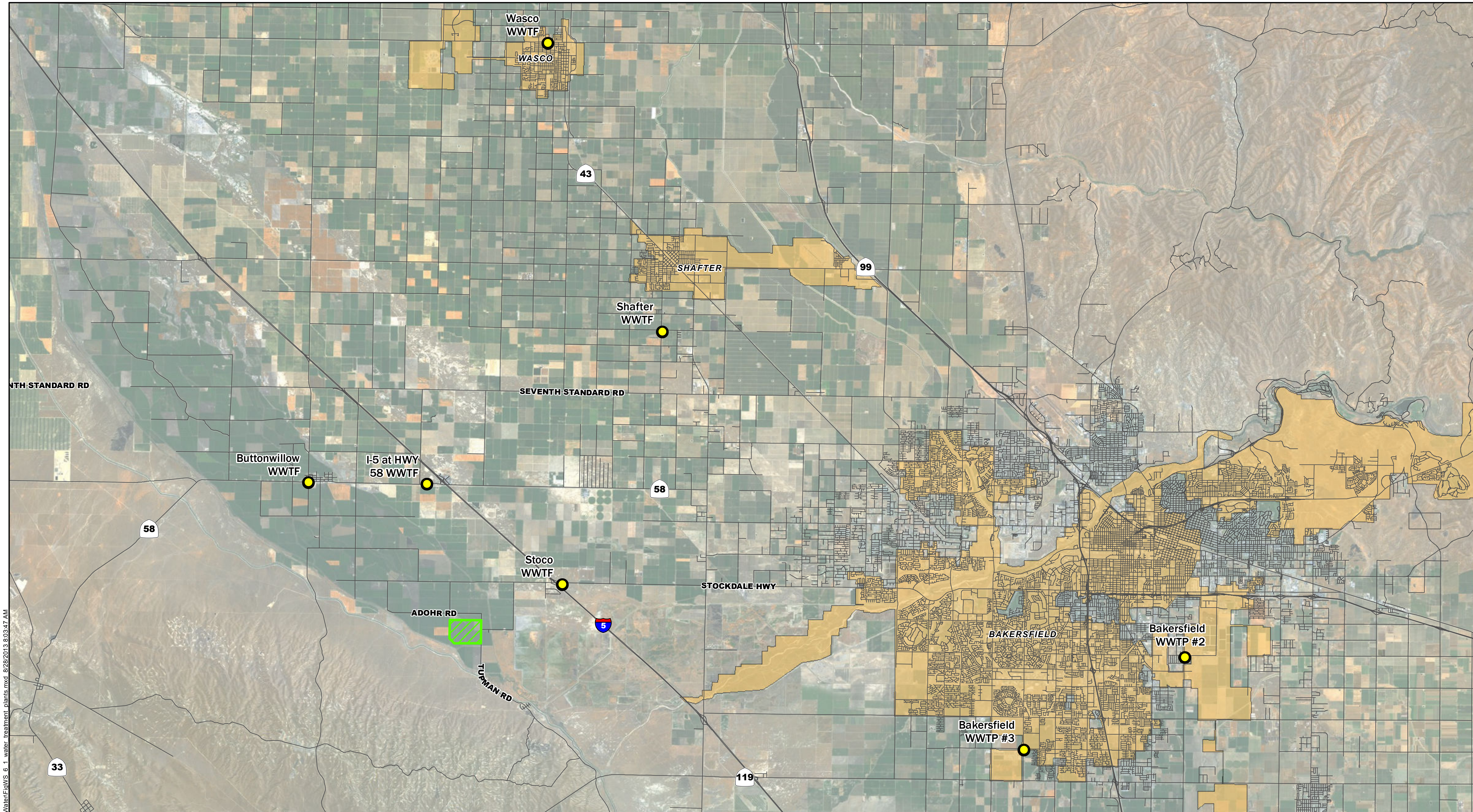
Summary

None of these sources are available in sufficient reliable quantities. Furthermore, it is not practical nor desirable to construct numerous pipelines, with their associated environmental impacts. Each water supply source would require a different treatment system that would be costly to construct, operate, and maintain. Due to the lack of any guarantees to provide a reliable quantity of water—and to the costs associated with constructing, operating, and maintaining a complex system—it is not economically viable to use any of these alternative water supplies alone or in combination.

References

CVRWQCB (Central Valley Regional Water Quality Control Board), 2009a. Order No. R5-2009-0087, Waste Discharge Requirements for City of Bakersfield Wastewater Treatment Plant No. 3. August 13.

CVRWQCB (Central Valley Regional Water Quality Control Board), 2009b. Order No. R5-2009-0122, Waste Discharge Requirements for City of Bakersfield Wastewater Treatment Plant No. 2. December 10.



Wastewater Treatment Plant (WWTP) / Wastewater Treatment Facility (WWTF)

Project Site

N

0 2 4 MILE

WASTEWATER TREATMENT PLANTS

August 2013
28068052

Hydrogen Energy California (HECA)
Kern County, California

URS

FIGURE WS-6-1

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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INFORMATION REQUEST

WS-7. The applicant has also neglected to adequately consider a dry-cooled project alternative. As stated in this analysis, in some cases the impact to water resources may be proportional to the volume pumped, and likewise, any decrease in water use could contribute to a lessening of the impact, proportional to the decrease. It is reasonable to consider dry cooling to reduce the potential project's water consumption. Dry cooling has the potential to: a) reduce project water demand to roughly 17 percent of the currently proposed amount, and thereby b) reduce untreated water costs by approximately $70,000,000 over a 25-year period.

RESPONSE

The Applicant recognizes the need to evaluate different alternatives to reduce water use for power plant projects under the CEC's jurisdiction. HECA was designed to minimize water use to the extent practicable, and to rely on degraded water supplies. When considering alternatives to HECA's water use, such as dry cooling, it is important to consider the relative water use of the Project. Although the PSA/DEIS indicated that HECA's water use is "high," the Applicant provides the following clarification to put HECA's water use in context:

- Notably, the HECA Project Site will *remove* 453 acres from agricultural production, which will result in a relative decrease in water use compared to existing conditions. In the water acquisition agreement with BVWSD, HECA waived its water service rights and groundwater rights for use on the Project Site. Those relinquished service rights average 1.8 acre-feet per acre (or approximately 815 afy for the 453-acre site). The relinquished groundwater rights average approximately 335 afy, so the total amount of water that the project would no longer be using is approximately 1,150 afy.[13] For CEQA and NEPA purposes, when comparing HECA's water use against existing water use, eliminating the water service rates with the agricultural production reduces the relative net water use.

- The overall raw water use can be allocated at 57 percent for power generation, and 43 percent for fertilizer production. Therefore, the total estimated amount of water associated with power production is about 3,870 afy.

- Approximately 36 percent, or approximately 2,700 afy, is used in the cooling tower associated with power generation (see Figure 2-10 and Table 5.14-5 in the Amended AFC).

- If the current water use of the site is accounted for, the net water use would be approximately 6,250 afy instead of 7,400 afy. Proportioning the use associated with the power block cooling towers results in approximately 2,280 afy instead of 2,700 afy.

In terms of considering a dry-cooling alternative, as explained in the Applicant's response to the Sierra Club's Data Request 127, docketed on November 30, 2012, and in the response to CEC Data Request A203, docketed on January 16, 2013, the Applicant has considered and evaluated the dry-cooling alternative. The Applicant has rejected this alternative because its

[13] See February 18, 2013, letter from Dan Bartel, included with BVWSD's Response to CEC Staff's Preliminary Water Supply Analysis, docketed on March 22, 2013.

impact to plant efficiency and the resulting impact on Project cost rendered it infeasible. A dry-cooling alternative would result in a relative increase in air emissions, because the overall efficiency of the project would decrease.

Specifically, the Applicant evaluated the suitability of air cooling for heat rejection. The Project does use heat integration and/or air cooling to reduce process stream temperatures to 140 degrees Fahrenheit wherever it is effective to do so. A water trim cooler is used to provide further cooling where necessary to meet process requirements. Approximately eight air coolers and extensive process heat integration have been incorporated into the plant design, thus conserving water. Air cooling was not selected for the steam turbine surface condenser because it results in a substantial increase in parasitic electrical demand and a dramatic decrease in power output. These effects result in a markedly negative impact on the cost and availability of electricity.

In a typical Natural Gas Combined-Cycle (NGCC) plant, about one-third of the gross power output is generated by the steam turbine and the other two-thirds is generated by the gas turbine. NGCC plants in California and Nevada typically use evaporative cooling to chill the inlet air to the gas turbine, which increases gas turbine output on hot days. Using air-cooled condensers in NGCC plants imposes a substantial output penalty on the project that is most pronounced on hot days. However, the penalty is only on the steam turbine output, which may make the choice economically feasible.

The output, cost, and efficiency penalties associated with using only air cooling are much more significant for the HECA Project than for a typical NGCC project. This is because for an NGCC, the efficiency impact is confined to the steam turbine; whereas in the HECA process units (gasification, gas treatment, and manufacturing complex), the impacts occur to many pieces of equipment, most of which are significantly more sensitive to heat rejection temperature than the steam turbine. The efficiency loss (increase in auxiliary load) and capital cost impacts associated with implementing air cooling in the process portion of the plant is real and large, but much more pervasive and difficult to quantify than in the power block. The loss of revenue caused by a lower net power output is large and would outweigh any net capital cost change. Just for the combined-cycle portion of the facility alone, comparison to CEC studies would indicate that the efficiency loss results in reduced power output of more than 15 MW. This loss of efficiency equates to an economic impact of approximately $175 million over the life of the Project.

From a thermodynamic point of view, air cooling requires the heat rejection temperature to be above the ambient dry bulb temperature. Using mechanical draft cooling towers allows the heat rejection temperature to be below the ambient dry bulb temperature and approaching the ambient wet bulb temperature. As indicated on Figure 127-1 (see the response to Sierra Club Data Request 127), an additional 30 to 40 degrees of temperature-driving force is available using water cooling, because the difference between the dry bulb temperature and the wet bulb temperature is much higher on hot summer days than the annual average day. Because the need for power and the price for power is much higher on hot summer days, the loss in power output comes precisely when it is most valuable and needed in the CAISO grid. The process areas associated with an integrated gasification combined-cycle facility have many pieces of equipment in comparison to a power block, which only has a final condenser serving the steam turbine generator. Figure 127-1 illustrates how the heat rejection temperature penalty for air cooling increases on hot days.

A dry-cooling alternative would result in a relative increase in air emissions, because the overall efficiency of the project would decrease.

ENGINEERING ASSESSMENT

Technical Area: Power Plant Reliability

BACKGROUND

PSA/DEIS page 5.4-9:

Under the present system design, the industrial water supply requirements for HECA would be 7,416 acre-feet per year (afy) which would come from existing aquifers under the jurisdiction of BVWSD. Currently the water system modeling indicates that drawdown of some of the wells will have an effect on water quality. Staff cannot verify that the use of the proposed groundwater satisfies state and Energy Commission policies regarding the use and conservation of water resources (see the Water Supply section of this document). Since staff is relying on the applicant to consider or implement recommendations proposed in the Water Supply section of this document, staff will continue to consider this irresolution a significant impact until water system modeling could demonstrate otherwise.

PSA/DEIS page 5.14-12:

Staff considers the issue of water supply pumping, which draws down some aquifers and affects water quality, has a potentially significant impact on the reliability of the facility's industrial water supply. Staff reserves an opinion on this impact until the applicant has the opportunity to undertake a more extensive modeling and review of the aquifers that are under consideration and potentially available for this project, and evaluate alternative water use efficiency technologies.

Pending the determination of the adequacy of the project's industrial water supply and completion of analysis to determine the reliability of the gasification systems, staff cannot conclude that the Hydrogen Energy California Project (HECA) would be built and operated in a manner consistent with industry norms for reliable operation. No conditions of certification are currently proposed.

INFORMATION REQUEST

PPR-2. The applicant has failed to demonstrate adequate reliability of the project's industrial water supply,… Staff has requested additional information to address these issues.

RESPONSE

With respect to CEC Staff's opinion of pumping effects on water quality (unchanged since the February 20, 2013, Water Workshop), the Applicant disagrees with PSA Figure 14, *Conceptual illustration of up-coning beneath partially penetrating water supply wells*. Although movement of water below the screened interval of the planned BGRP Area B well field will take place, both the Applicant and BVWSD have documented why the CEC's evaluation of up-coning is inaccurate, based on BVWSD data and observations on tangible hydraulic parameters. For further information, see BVWSD's Response to CEC Staff's Preliminary Water Supply Analysis, docketed on March 22, 2013 (see Robert A. Crewdson Memorandum, dated March, 18, 2013, Potential Impact 2 – Aquifer Water Quality Degradation Due to Interzonal Flow).

The Applicant notes that in BVWSD's Responses to CEC's Data Requests docketed on August 21, 2013, TDS concentrations in BGRP Target Area B are estimated to range from

3,000 to 5,000 mg/L. Amended AFC Figure 5.14-12 illustrated TDS mass removal in U.S. tons per year for a range of TDS concentrations. The BVWSD sees this type of positive impact as a BGRP objective in its goals to improve local groundwater quality through the removal of salts, improve local water quality, improve soil quality through the use of crop irrigation with groundwater of lesser TDS concentrations, and improve crop yield and diversification beyond that of salt-tolerant crops such as pistachios. As outlined in the response to Information Request WS-2, the Target Area B BGRP well field design may be further refined based on additional data gathered during the completion of a test well program. The conceptual design for the BGRP Target Area B well field (for HECA process water supply) is for a linear well field along the BVWSD BSA western boundary in the area just south of 7th Standard Road. The design includes five wells (three pumping and two redundant) that are spaced at 0.25- to 0.5-mile intervals, with screened intervals between first water (encountered at approximately 40 feet bgs) and 400 feet bgs, capable of pumping up to 4,650 gpm (i.e., 7,500 afy, with each well capable of pumping up to 1,550 gpm). The test well program calls for four exploratory borings (one to 1,000 feet bgs and three to 600 feet bgs), geologic and geophysical logging, evaluation of TDS stratification within the local aquifer system, and geotechnical testing of geologic samples. The test well program is planned to be implemented during Project construction. The objective of the BGRP Target Area B well field is to build a well field to optimize the removal of elevated TDS groundwater from the local aquifer system, while being able to efficiently provide on-demand groundwater at rates up to 4,650 gpm (i.e., 7,500 afy) for the HECA process water supply.

With respect to the BGRP Target Area B aquifer system's ability to provide the HECA project with a reliable supply of water (in volume and pumping rates), BVWSD has more than 200 wells in the BSA that demonstrate that the aquifer system is prolific. This is supported by the data collected from various well and geophysical logs that have been provided to the CEC that show the permeable nature of the aquifer materials. More recently, short- and long-term pumping tests conducted during the HDAR Field Program (HECA HDAR Draft Report [URS, 2010a] and the Draft HDAR Addendum [URS, 2010b]) indicate that local wells (even those that are old and less efficient) are capable of pumping at high rates while exhibiting quick water level recovery and drawdown that is limited in areal extent. As outlined in the March 19, 2013, letter to CEC (docketed on March 22, 2013) and Responses to CEC's Data Requests docketed on August 21, 2013, the BVWSD provided information as to the isolation (complete or partial depending on location) of the Buttonwillow Subbasin and the BVWSD BSA from the larger Kern County Groundwater Basin to the east, concluding that "…the operation of the proposed project well field located on the west side of the BSA must be in complete isolation from the main basin to the east, and that the operation of the proposed well field averaging 10 cubic feet per second for years will have no observable impact at any location in the main basin, which begins on the opposite side of the [groundwater] barrier 4 miles to the northwest." In addition, the BVWSD provided information to the CEC as to their historical water budget (inflow, outflow, storage outside the Buttonwillow Subbasin but within the larger Kern Basin). This information documents that the Buttonwillow Subbasin and the BVWSD BSA (with a calculated recharge amount of 36,964 afy) is in positive balance and not in a state of overdraft, with or without the planned BGRP Target Area B pumping.

References

URS (URS Corporation), 2010a. Draft Hydrogeologic Data Acquisition Report. Groundwater Monitoring and Process Water, Well Field Development Project, Hydrogen Energy California LLC. March.

URS (URS Corporation), 2010b. Draft HDAR Addendum. April.

ALTERNATIVES

Technical Area: Alternatives

INFORMATION REQUEST

ALT-3. The reduced project alternative: Alternatively, under the No Fertilizer Manufacturing Complex (Reduced Project) Alternative, the applicant could buy the same gasifier and only operate it at 75 percent of its rated capacity. This would lower the fuel delivery and ash removal trains/trucks. However, staff does not know if the gasifier can turndown that much and still operate, or what are its operating characteristics (efficiency, syngas and slag composition, etc.) at 75 percent capacity.

RESPONSE

The No Fertilizer Complex is not a viable alternative for the HECA Project. The Integrated Manufacturing Complex is a fundamental and essential part of the facility, and its operation allows for the Project to generate the minimum required return necessary to attract investors. That is, the revenues from the manufacture and sale of fertilizer are critical for the economic viability of the Project. However, in response to the question posed, the gasifier could operate at about 70 percent of its design capacity. As a result:

- The auxiliary loads associated with the fertilizer complex would be eliminated.
- The CO_2 production for enhanced oil recovery (EOR) would be about 17 percent less.
- The CO_2 Compression auxiliary load would be reduced, but less than 17 percent.
- The emissions of oxides of nitrogen from nitric acid production would be reduced by about 17 tons per year.
- There would be a nominal reduction in particulate matter emissions from the Process Cooling Tower.
- The reduction in capital cost is small relative to the loss of revenue from fertilizer sales.

INFORMATION REQUEST

ALT-6. HECA has not shown that their project would produce oil reserves that could not otherwise be produced by other means.

RESPONSE

As described in the MRV Plan prepared by OEHI and docketed with the CEC on June 13, 2012 (see docket # 65780), "CO_2 EOR is a well-established EOR technique used in mature oil fields. It is often known as "tertiary recovery" because it is typically applied after gas injection or water flooding has been employed, to further enhance the recovery of oil."

As explained by OEHI at the June 20, 2012, CEC workshop, the EHOF is a mature oil field that still has a lot of oil in place. The EHOF has been producing oil for almost 100 years. Other oil recovery methods have been used, such as water flooding. Laboratory and field tests to assess miscibility have been performed, and the results indicate that oil recovery would be responsive to CO_2 EOR. To date, the lack of viable CO_2 has been a barrier to the next step of using CO_2 for EOR.

INFORMATION REQUEST

ALT-7. The No Project Alternative: Staff cannot currently assess the significance of impacts on historic built environment resources in the proposed EOR area. Therefore, the significance of impacts on historic built environment resources in the proposed EOR area under the No Project Alternative is unknown.

RESPONSE

Please see OEHI's responses to CEC Data Requests A85 through A88, submitted confidentially to CEC on July 25, 2013.