

Appendix B Air Quality Technical Information

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The purpose of this technical appendix is to describe the modeling techniques used to estimate criteria pollutant and greenhouse gas (GHG) emissions associated with construction and operation of the Proposed Action.

B.1 Project Construction

B.1.1 Criteria Air Pollutants

Construction of the Proposed Action would generate short-term emissions of reactive organic gases (ROG), oxides of nitrogen (NO_x), carbon monoxide (CO), particulate matter 10 microns in diameter or less (PM₁₀), and particulate matter 2.5 microns in diameter or less (PM_{2.5}). These emissions were estimated using the URBEMIS2007, Version 9.2.4 model. It was assumed that construction of each well would begin in June 2010 and last approximately 2 months.¹

Construction is expected to occur in four phases, and none would occur concurrently. Each phase has the following estimated duration:

- Site Preparation—1 day
- Well Drilling—14 days
- Well Consturction—30 days
- Pump Installation—7 days

Based on the information summarized in the project description, the following assumptions were made for the emissions modeling:

- Each well would disturb an area of approximately 0.23 acres (100 feet by 100 feet)
- A daily maximum of 0.06 acres would be disturbed (a default assumption of one-quarter the total acreage; this ensures a conservative analysis of a worst-case scenario).

Table A-1 summarizes the pieces of diesel-powered construction equipment assumed in the emissions modeling. URBEMIS default values were used for equipment horsepower and load factors.

¹ While construction of each individual well will require approximately 2 months, not all 32 wells will be built concurrently. Rather, construction of the proposed wells will occur over a 6-24 month period.

Table A-1. Diesel-Powered Construction Equipment

Equipment	Number	Hours/day	Horsepower	Load Factor
Site Preparation				
Backhoe	1	12	108	0.55
Well Drilling				
Drill Rig	1	24	291	0.75
Well Construction				
Crane	1	4	339	0.43
Backhoe	1	4	108	0.55
Pump	1	24	53	0.74
Water Truck	1	8 ^a	189	0.5
Pump Installation				
Backhoe	1	8	108	0.55
Crane	1	8	339	0.43
Other Equipment	1	8	190	0.62
Water Truck	1	8 ^a	189	0.50
^a URBEMIS default.				

In addition to the diesel-powered construction equipment summarized in Table A-1, one light-duty gasoline-powered truck will travel one mile onsite per day during all construction phases. Emissions associated with this vehicle were quantified using URBEMIS.

Emissions from on-road workforce traffic and off-road diesel-powered delivery trucks were estimated using the number of workers per phase and the estimated delivery truck vehicle miles traveled (VMT). It was assumed that each phase would require 5 employees and that each employee would make 2 trips per day to the construction site (total of 10 trips per day). During the well construction and installation phases, it was assumed that one diesel-powered delivery truck would travel 40 miles offsite per day.

Because 32 wells would be construction under the Proposed Action, the emissions estimated by URBEMIS for the construction of a single well were multiplied by 32 to obtain total emissions..

B.1.2 GHG Emissions

GHG emissions from construction activities are primarily the result of fuel use by construction equipment and worker trips. The primary GHG emissions generated

by construction activities are carbon dioxide (CO₂), methane (CH₄), and nitrous oxides (N₂O).

CO₂ emissions were estimated using URBEMIS2007 and the assumptions described above. URBEMIS does not quantify CH₄ and N₂O emissions from off-road equipment or worker commutes. Emissions of CH₄ and N₂O from diesel equipment were determined by scaling the construction CO₂ emissions predicted by URBEMIS by the ratio of CH₄/CO₂ and N₂O/CO₂ emissions expected per gallon of diesel fuel according to the California Climate Action Registry (CCAR) (CCAR 2009). GHG emissions from worker and vendor commutes were determined by dividing the annual CO₂ emissions from construction worker and vendor commutes by 0.95. This statistic is based on the U.S. environmental Protection Agency's (EPA's) recommendation that CH₄, N₂O, and other GHG emissions account for 5% of on-road emissions (EPA 2009).

In order to simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the "global warming potential" (GWP) methodology defined in the Intergovernmental Panel on Climate Change (IPCC) reference documents (IPCC 1996, 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO₂ equivalents (CO₂e), which compares the gas in question to that of the same mass of CO₂ (CO₂ has a GWP of 1 by definition).

Calculated emissions of CO₂, CH₄, and N₂O were converted to CO₂e and multiplied by 32 to obtain total construction emissions for the Proposed Action.

B.2 Project Operations

B.2.1 Criteria Air Pollutants

Given the limited nature and extent of maintenance activities, criteria pollutant emissions associated with operation of the Proposed Action were assumed to be minimal and were not quantified.

B.2.2 GHG Emissions

Operational-GHG emissions would be produced by electricity usage required for well pumping. The water-related energy proxy for the San Joaquin River (California Energy Commission 2006) was used to estimate annual electricity usage for each well based on their yearly production capacity (Table A-2).

Table A-2. Yearly Production Capacity and Estimated Annual Electricity Usage for Region 1 Wells

Well ID	Production (AF/Yr)	Electricity (MW/Yr)	Well ID	Production (AF/Yr)	Electricity (MW/Yr)
5	750	219	78	360	105
28	1,260	368	80	400	117
29	200	58	82	317	93
31	1,260	368	84	345	101
32	1,260	368	86	460	134
33.1	1,260	368	90	350	102
33.2	1,260	368	91	230	67
35	1,260	368	94	172	50
14	500	146	96	230	67
38	340	99	97	290	85
50	270	79	101	700	204
51	430	126	102	450	131
54	425	124	120	500	146
55	225	66	121	600	175
59	80	23	122	550	161
64	500	146	78	360	105
67	450	131	Total		5,164

Because the project would receive electricity generated by Pacific Gas and Electric Company (PG&E), the PG&E CO₂ emission factor was used to calculate CO₂ emissions (PG&E 2007). State-specific emission factors for CH₄ and N₂O were obtained from CCAR as PG&E currently does not calculate these emission factors (CCAR 2009). Table A-3 summarizes the GHG emission factors used in this analysis.

Table A-3. GHG Emission Factors for Electricity Consumption

Greenhouse Gas	Emission Factor (pounds per mega-hour)
Carbon Dioxide	635.67
Methane	0.0302
Nitrous Oxide	0.0081
Sources: PG&E 2007; CCAR 2009.	

The emissions calculated for each well were converted to CO₂e and summed to obtain total operational emissions.

B.3 References

- California Climate Action Registry. 2009. Climate Action Registry General Reporting Protocol Version 3.1. January. Available: <http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf>. Accessed: April 19, 2010.
- California Energy Commission. 2006. *Refining Estimates of Water-Related Energy Use in California*. (CEC-500-2006-118). December. Available: <<http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF>>. Accessed: April 19, 2010.
- Intergovernmental Panel on Climate Change. 1996. 1995: Science of Climate Chang. (Second Assessment Report). Cambridge University Press. Cambridge, U.K
- Intergovernmental Panel on Climate Change. 2001. Atmospheric Chemistry and Greenhouse Gases. In: *Climate Change 2001: Working Group I: The Scientific Basis*. Available: <http://www.ipcc.ch/ipccreports/tar/wg1/pdf/TAR-04.PDF>. Accessed: September 22, 2009.
- Pacific Gas and Electric Company, The. 2007. Annual Emissions Report. Accessed: June 26, 2009.
- U.S. Environmental Protection Agency. 2009. *Emission Facts. Greenhouse Gas Emissions from a Typical Passenger Car*. Last Revised: November 24, 2009. Available: <<http://www.epa.gov/OMS/climate/420f05004.htm>>. Accessed: January 13, 2010.

Appendix C USFWS and CNDDB Special-Status Species Lists

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 100514032505

Database Last Updated: April 29, 2010

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Branchinecta lynchi

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardii

vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris

green sturgeon (T) (NMFS)

Hypomesus transpacificus

Critical habitat, delta smelt (X)

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)

Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Rana draytonii

California red-legged frog (T)

Critical habitat, California red-legged frog (X)

Reptiles

Gambelia (=Crotaphytus) sila

blunt-nosed leopard lizard (E)

Thamnophis gigas

giant garter snake (T)

Birds

Vireo bellii pusillus

Least Bell's vireo (E)

Mammals

Dipodomys nitratooides exilis

Fresno kangaroo rat (E)

Neotoma fuscipes riparia

riparian (San Joaquin Valley) woodrat (E)

Sylvilagus bachmani riparius

riparian brush rabbit (E)

Vulpes macrotis mutica

San Joaquin kit fox (E)

Plants

Amsinckia grandiflora

large-flowered fiddleneck (E)

Proposed Species

Amphibians

Rana draytonii

Critical habitat, California red-legged frog (PX)

Quads Containing Listed, Proposed or Candidate Species:

HOWARD RANCH (404A)

CROWS LANDING (424A)

PATTERSON (424B)

NEWMAN (424D)

WESTLEY (443C)

VERNALIS (444A)

TRACY (444B)

SOLYO (444D)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the [National Oceanic & Atmospheric Administration Fisheries Service](#). Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online [Inventory of Rare and Endangered Plants](#).

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our [Protocol](#) and [Recovery Permits](#) pages.

For plant surveys, we recommend using the [Guidelines for Conducting and Reporting Botanical Inventories](#). The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal [consultation](#) with the Service.

During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The

Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our [Map Room](#) page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. [More info](#)

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be August 12, 2010.

California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - Portrait
ARRA Wells Region 1, 5/14/2010

Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1 Actinemys marmorata western pond turtle	ARAAD02030			G3G4	S3	SC
2 Agelaius tricolor tricolored blackbird	ABPBXB0020			G2G3	S2	SC
3 Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	unknown code...	G2G3	S2S3	SC
4 Amsinckia grandiflora large-flowered fiddleneck	PDBOR01050	Endangered	Endangered	G1	S1	1B.1
5 Anthicus sacramento Sacramento anthicid beetle	IICOL49010			G1	S1	
6 Antrozous pallidus pallid bat	AMACC10010			G5	S3	SC
7 Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1			G1T1	S1.1	1B.2
8 Athene cunicularia burrowing owl	ABNSB10010			G4	S2	SC
9 Atriplex cordulata heartscale	PDCHE040B0			G2?	S2.2?	1B.2
10 Atriplex minuscule lesser saltscall	PDCHE042M0			G1	S1.1	1B.1
11 Atriplex persistens vernal pool smallscale	PDCHE042P0			G2	S2.2	1B.2
12 Blepharizonia plumosa big tarplant	PDAST1C011			G1	S1.1	1B.1
13 Branta hutchinsii leucopareia cackling (=Aleutian Canada) goose	ABNJB05035	Delisted		G5T4	S2	
14 Buteo swainsoni Swainson's hawk	ABNKC19070		Threatened	G5	S2	
15 California macrophylla round-leaved filaree	PDGER01070			G3	S3.1	1B.1
16 Caulanthus coulteri var. lemmonii Lemmon's jewel-flower	PDBRA0M0E0			G4T2	S2.2	1B.2
17 Ceratochrysis menkei Menke's cuckoo wasp	IIHYM71050			G1	S1	
18 Cirsium crassicaule slough thistle	PDAST2E0U0			G2	S2.2	1B.1
19 Coastal and Valley Freshwater Marsh	CTT52410CA			G3	S2.1	
20 Coccozyus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Candidate	Endangered	G5T3Q	S1	
21 Coreopsis hamiltonii Mt. Hamilton coreopsis	PDAST2L0C0			G2	S2.2	1B.2
22 Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened		G3T2	S2	
23 Eremophila alpestris actia California horned lark	ABPAT02011			G5T3Q	S3	

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Natural Diversity Database
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ARRA Wells Region 1, 5/14/2010

Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
24 <i>Eriastrum tracyi</i> Tracy's eriastrum	PDPLM030C0		Rare	G1Q	S1.1	1B.2
25 <i>Eryngium racemosum</i> Delta button-celery	PDAPI0Z0S0		Endangered	G2Q	S2.1	1B.1
26 <i>Eschscholzia rhombipetala</i> diamond-petaled California poppy	PDPAP0A0D0			G1	S1.1	1B.1
27 <i>Eumops perotis californicus</i> western mastiff bat	AMACD02011			G5T4	S3?	SC
28 <i>Falco columbarius</i> merlin	ABNKD06030			G5	S3	
29 <i>Falco mexicanus</i> prairie falcon	ABNKD06090			G5	S3	
30 Great Valley Cottonwood Riparian Forest	CTT61410CA			G2	S2.1	
31 Great Valley Valley Oak Riparian Forest	CTT61430CA			G1	S1.1	
32 <i>Lanius ludovicianus</i> loggerhead shrike	ABPBR01030			G4	S4	SC
33 <i>Lasiurus cinereus</i> hoary bat	AMACC05030			G5	S4?	
34 <i>Lytta moesta</i> moestan blister beetle	IICOL4C020			G2	S2	
35 <i>Madia radiata</i> showy golden madia	PDAST650E0			G2	S2.1	1B.1
36 <i>Malacothamnus hallii</i> Hall's bush-mallow	PDMAL0Q0F0			G1Q	S1.2	1B.2
37 <i>Masticophis flagellum ruddocki</i> San Joaquin whipsnake	ARADB21021			G5T2T3	S2?	SC
38 <i>Neotoma fuscipes riparia</i> riparian (=San Joaquin Valley) woodrat	AMAFF08081	Endangered		G5T1Q	S1	SC
39 <i>Perognathus inornatus inornatus</i> San Joaquin pocket mouse	AMAFD01061			G4T2T3	S2S3	
40 <i>Phacelia phacelioides</i> Mt. Diablo phacelia	PDHYD0C3Q0			G1	S1.2	1B.2
41 <i>Phrynosoma blainvillii</i> coast horned lizard	ARACF12100			G4G5	S3S4	SC
42 <i>Pogonichthys macrolepidotus</i> Sacramento splittail	AFCJB34020			G2	S2	SC
43 <i>Rana boylei</i> foothill yellow-legged frog	AAABH01050			G3	S2S3	SC
44 <i>Rana draytonii</i> California red-legged frog	AAABH01022	Threatened		G4T2T3	S2S3	SC
45 <i>Spea hammondi</i> western spadefoot	AAABF02020			G3	S3	SC
46 Sycamore Alluvial Woodland	CTT62100CA			G1	S1.1	
47 <i>Sylvilagus bachmani riparius</i> riparian brush rabbit	AMAEB01021	Endangered	Endangered	G5T1	S1	

California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - Portrait
ARRA Wells Region 1, 5/14/2010

Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
48 Symphyotrichum lentum Suisun Marsh aster	PDASTE8470			G2	S2	1B.2
49 Taxidea taxus American badger	AMAJF04010			G5	S4	SC
50 Tropidocarpum capparideum caper-fruited tropidocarpum	PDBRA2R010			G1	S1.1	1B.1
51 Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2T3	S2S3	

