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DOCKET
08-AFC-11
DATE NOV 24 2009
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November 24, 2009

File No. 030137-0024

VIA FEDEX

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-11
1516 Ninth Street, MS-4
Sacramento, California 95814-5512

Re: CPV Vaca Station Power Plant Project: Docket No. 08-AFC-11

Dear Sir/Madam:

Pursuant to California Code of Regulations, title 20, sections 1209, 1209.5, and 1210, enclosed herewith for filing please find a letter from Steve Hill, Sierra Research, to Gerardo Rios, U.S. EPA, re Response to PSD Application Incomplete Letter.

Please note that the enclosed submittal was filed today via electronic mail to your attention and served on all parties to the above-referenced project.

Very truly yours,

Paul E. Kihm
Senior Paralegal

Enclosure

cc: 08-AFC-11 Proof of Service List (w/encl., via e-mail and U.S. Mail)
Michael J. Carroll, Esq. (w/encl.)
Marc T. Campopiano, Esq. (w/encl.)

OC\1039796.1

November 23, 2009

sierra research

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Mr. Gerardo Rios
Chief, Permits Office
USEPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Subject: CPV Vaca Station
Response to PSD Application Incomplete Letter (July 23, 2009)

Dear Mr. Rios:

This is in response to your letter dated July 23, 2009, which was EPA's response to a PSD application submitted on November 26, 2008, and received by the Region 9 Permits Office on December 11, 2008. The purpose of this letter is to provide the items that EPA identified as necessary to complete the PSD application.

PSD Application Elements

Application Signature Page

Your letter indicates that applications must be signed by a responsible official (as defined by Part 70 and 71). In our meeting on July 30, 2009, you corrected this to indicate that the application must be signed by the person required to get a permit, and that you would prefer that the application be signed by a company official.

An application signature page, signed by Peter Podurgiel, Senior Vice President of Competitive Power Ventures, Inc., is attached (Attachment 1).

Applicant Updates

Your letter requested that we provide copies of any correspondence with any California agencies relevant to PSD issues. We understand that the request is intended to ensure that the application being reviewed by the California Energy Commission (CEC) and the Yolo-Solano Air Quality Management District, as revised during the permit evaluation process, is consistent with the application being reviewed by EPA. We also understand that you want to ensure that the record upon which EPA bases its analysis is clear and complete.

Attachment 2 contains the Socioeconomics Section and Environmental Justice Appendix from the Application for Certification (AFC) to the CEC, responses to CEC Data Requests 1 through 53, and additional correspondence that we wish to include as part of the record for the PSD analysis.

Best Available Control Technology (BACT)

Startup/Shutdown Emissions from Turbines

Startup and shutdown periods are a normal part of the operation of combined cycle power plants such as CPPVS. BACT must also be applied during the startup and shutdown periods of gas turbine/heat recovery steam generator (HRSG) operation.

During gas turbine startup, there are equipment and process requirements that must be met in sequential order to protect the equipment. Many of these require holding the gas turbine at low loads, where operation is inefficient and emissions are relatively high, to allow the HRSG to warm up and for steam turbine seals and condenser vacuum to be established. At low turbine loads, the combustors are not yet operating in full lean pre-mix mode so turbine-out NOx emission rates are also high during startup. In addition, incomplete combustion at low loads results in higher CO and VOC emission rates. Further, the post-combustion controls that are used to achieve additional emissions reductions (SCR and oxidation catalyst) require specific exhaust temperature ranges to be fully effective. The use of SCR to control NOx is not technically feasible when the surface temperature of the SCR catalyst is below the manufacturer's recommended operating range. When surface temperatures are low, ammonia will not react completely with the NOx, resulting in excess NOx emissions or excess ammonia slip. The oxidation catalyst is not effective at controlling CO emissions when the exhaust temperature is outside the optimal temperature range. Therefore, the BACT determinations for NOx, CO and VOC during normal, steady-state operation are not applicable during startup and shutdown. However, since SO_2 and PM_{10} emission concentrations result from the characteristics of the fuel burned and not from any emissions control system, the BACT determinations for SO_2 and PM_{10} emissions are applicable during startup and shutdown as well.

Because NOx, CO and VOC emissions during startup and shutdown are not fully reduced by combustion controls or add-on control devices, the emission rates themselves cannot be effectively reduced to meet the same emission levels applicable during routine operation. Therefore, the pound per hour NOx, CO and VOC limits proposed by the applicant for startup and shutdown periods represent achievable emissions limits based on experience with other, similar turbine projects and are considered BACT for startup and shutdown.

Since there are no technologies available to effectively reduce emission rates during these periods, startup emissions are most effectively addressed by minimizing the amount of time the gas turbine and HRSG spend in startup. Efforts have been made by turbine and HRSG manufacturers to develop ways of reducing the time required to ramp up the combustion turbine generator (CTG) load to where the dry low NOx (DLN) combustors will be effective and exhaust temperatures will allow the control devices to be effective. CPVVS is proposing to use the following techniques to minimize the amount of time spent in startup:

- HRSG design: The HRSG will be designed to minimize wall thickness and optimize heat transfer to the tubes, which will allow the HRSG to heat up more quickly. This will reduce gas turbine hold time at low load, especially during cold startups.

- Auxiliary boiler: The proposed project includes an auxiliary steam boiler that will provide steam during startup. The auxiliary boiler stem will preheat the HRSG and provide steam turbine sealing steam prior to CTG startup, thereby allowing the condenser vacuum to be established and the condenser be ready to accept steam earlier in the startup cycle.

Both of these project design features are expected to reduce hold times for the gas turbine and therefore to allow the gas turbine/HRSG to reduce startup times, especially for cold and warm startups. However, because these design features have not yet been quantitatively assessed on an operating gas turbine plant, CPVVS cannot predict how much effect they will have on startup times and resulting startup mass emission levels.

Because the design features described above will be implemented, any emission reductions of which such features are capable will occur. Additionally, the inefficiency of low load operation provides a powerful incentive to plant operators to minimize startup times. However, because the emission reductions are uncertain and cannot be quantified, and despite the powerful incentives that exist to claim emission reductions from use of these features, the NOx, CO and VOC emissions limits proposed for the project assume that, as a worst-case scenario, the proposed design features will not result in a significant reduction in startup times and emissions.

Please see also responses to CEC Data Requests 21-25 in the April 6, 2009 Responses to CEC Staff Data Requests 1 through 53 (included in Attachment 2).

CO Emissions from Combustion Turbine Generators

See Attachment 3.

PM/PM_{10}/$PM_{2.5}$ from Cooling Tower

See Attachment 4.

Emission Estimates

PSD Applicability and Pollutant Review of Particulate Matter

You requested that we provide additional analysis for PM (total particulates), including emission estimates, a BACT discussion, and an additional impacts analysis.

All of the particulate emissions from the project are emitted from two types of processes: combustion devices and the cooling tower. All of the particulate matter from the combustion devices is assumed to be fine particulate; therefore emissions of PM = emissions of $PM_{2.5}$ = emissions of PM_{10}. As a result, the emission estimates and BACT analysis for PM and $PM_{2.5}$ are identical to those for PM_{10}.

Not all of the cooling tower PM emissions, however, are PM_{10} or $PM_{2.5}$. The size distribution of PM from the cooling tower is related to the size distribution of water droplets in the cooling tower drift. We have used the droplet size distribution provided by the cooling tower vendor to calculate the size distribution of the resulting particulate matter. The most important assumption in the calculation is that all of the dissolved solids in a single droplet form a single particle when the droplet evaporates. A detailed description of the calculations and their basis is included in Attachment 3.

YSAQMD has reviewed the analysis, and has decided to not use it as a basis for calculation of PM_{10} emissions from the project. As a result, for the purposes of calculating project emissions and offset requirements under YSAQMD rules, cooling tower PM emissions = PM_{10} emissions = $PM_{2.5}$ emissions. We disagree with this approach, and have based the PSD Air Quality Impact Assessment (AQIA) on the particle size distribution methodology described above. However, if EPA declines to accept the particle size distribution methodology, the results of the PM AQIA can be used to determine the impacts for both PM_{10} and $PM_{2.5}$.

Finally, the cooling tower design has been refined during the permitting process. The revised operating parameters are provided in Table 1.

Table 1
Cooling Tower Design Parameters

Parameter	Old value	New value
Model Number	F4910-6.0-12	F4910-6.6-12
Tower width	60.00 ft	60.00
Tower length	720.67 ft	720.67 ft
Tower height	49.84 ft	52.34
Tower water flow	185,000 gpm	142,000
Air flow rate (discharge)	1,686,000 cfm per cell	1,722,000
Discharge velocity	1586 fpm	1727 fpm
Outlet air temperature	89.75 F	93.14 F
Emissions		
PM	4.16 lb/hr	3.19 lb/hr
PM_{10}	1.83 lb/hr	1.40 lb/hr
$PM_{2.5}$	0.62 lb/hr	0.48 lb/hr

The maximum cooling tower water throughput has been reduced from 185,000 gpm to 142,000 gpm. This will reduce cooling tower PM emissions by 23% from the previous emission estimates. The building and stack parameters have been revised as well. After we received revised performance data for the Siemens turbines, the cooling tower design was revised to match the new Siemens data (the Siemens turbines control the cooling tower design because they have higher heat rejection rates).[1]

The supplemental BACT analysis for the cooling tower (including PM emissions) is provided in Attachment 4. PM impacts on soil, vegetation, and visibility are addressed in the additional impacts analysis (Attachment 5).

[1] Although the revised Siemens performance data impacted the cooling tower design and associated modeling analysis, they did not affect the gas turbine modeling analysis because the GE performance data (also used) remained the controlling parameters for dispersion modeling.

Federal $PM_{2.5}$ Implementation Status

EPA's letter referred to recent EPA actions to reconsider aspects of the $PM_{2.5}$ NSR Implementation Rule (73 FR 28321 May 31, 2008) (specifically, the Administrator's decision to stay the grandfathering provisions for $PM_{2.5}$). As we discussed at our meeting on July 29, the recent EPA action did not affect our project, because the project was not subject to the grandfathering provision.

In the course of the meeting, EPA clarified its comment as having two goals: first, to alert us to the fact that YSAQMD's attainment status with regard to $PM_{2.5}$ might change during the period that the PSD application was being reviewed; and second, to notify us that a full impact analysis for $PM_{2.5}$ was required.

At the meeting, EPA staff members indicated that they expected to see an air quality analysis that includes dispersion modeling of nearby stationary sources that might affect the project's impact area. The basis for this expectation is the analytical methodology described in the 1990 draft NSR Workshop Manual.

A modeling protocol for this project was submitted to EPA for review on May 12, 2008. The protocol stated that the data to be used to characterize the background concentrations for each pollutant would be taken from the closest monitoring station with complete contemporary data. For NO_2, the closest station is located at UC Davis. For PM_{10}, the closest station is in Vacaville. For $PM_{2.5}$, the closest station is in Vallejo.

Representativeness has been defined in the PSD Monitoring Guideline (USEPA, 1987a) as data that characterize the air quality for the general area in which the proposed project would be constructed and operated.

In our experience, past practice has been to assume that representative ambient monitoring data represents the impacts of existing sources, not simply the background exclusive of local impacts. If new sources have been permitted or constructed after the period for which ambient data are available, these sources have been modeled and their contribution added to the measured background. Following this practice, the protocol proposed using the monitor data to characterize the local concentrations at the project site, including nearby sources. The monitor data meet the requirements for representativeness, and are consistent with AQIAs prepared for PSD permits in the past. EPA did not object to this approach at the time that the protocol was submitted.

Nevertheless, to address EPA's most recent comments, we are modeling nearby sources in addition to the proposed plant, and will add the combined impacts to measured background for comparison with NAAQS. The results of this work will be provided in a separate report.

Additional Impact Analysis

Soils and Vegetation

See Attachment 5.

Visibility Impairment

See Attachment 5.

Growth Analysis

See Attachment 5.

Biological Assessment

EPA's July 23 letter notes that the portions of the AFC submitted to the CEC may not comprise a complete Biological Assessment for the purposes of a Section 7 Endangered Species Act consultation. A new Biological Assessment is being prepared and will be submitted to the Army Corps of Engineering for ESA consultation soon, under separate cover.

Notice List

EPA's July 23 letter requests a list of names and address of a number of entities that are subject to public notice requirements. Based on conversations with staff, we understand this to be a request for information about interested parties of whom we are aware, but that might be unknown to EPA. The requested list was provided via email on October 28, 2009.

Conclusion

We note that 40 CFR § 124.3(c) indicates that PSD applications should be reviewed for completeness within 30 days of receipt. We appreciate your statement at our meeting on July 30 that you expect to review our supplemental information for completeness within that time frame.

Please let us know if there is anything we can do to expedite your review.

Very truly yours,

Steve Hill

cc: Andy Welch, CPV Vaca Station
Mike Carroll, Latham & Watkins
Susan McLaughlin, YSAQMD
CEC Dockets Office (08-AFC-11)

Attachments

1 Application Signature Page
2 Additional Agency Correspondence
3 CO BACT for Combustion Turbine Generators
4 PM/PM10/PM2.5 BACT for Recirculating Wet Cooling Towers
5 Additional Impacts Analysis

Competitive
Power Ventures, Inc.

September 2, 2009

Mr. Gerardo Rios
Chief, Permits Office
USEPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Subject: CPV Vaca Station
Application for a Prevention of Significant Deterioration Permit

Dear Mr. Rios:

The package received by EPA Region 9 on December 11, 2008 from Sierra Research, on behalf of CPV Vacaville LLC, as modified and augmented by subsequent submittals, constitutes our Application for a Prevention of Significant Deterioration (PSD) Permit for the proposed CPV Vaca Station. A related Application for Certification (AFC) was filed with the California Energy Commission on November 18, 2008. The PSD permit application consisted of portions of the AFC materials that are relevant to the PSD permitting process, as well as air quality modeling files on compact disc.

The CPV Vaca Station (CPVVS) will be a 660-megawatt (MW), combined-cycle power generation facility consisting of either two General Electric (GE) Energy Frame 7FA or two Siemens SGT6 5000F natural gas-fired combustion turbine-generators (CTGs), a single condensing steam turbine generator (STG), a 12-cell cooling tower, and associated balance-of-plant equipment. The facility will be in Vacaville, Solano County, California, on a 24-acre parcel (the project site). The project site, formerly agricultural land now zoned for community facilities, is located on property owned by the City of Vacaville (City) and leased to CPVVS. Surrounding land uses include the City's Easterly Wastewater Treatment Plant (EWTP) to the northwest and agricultural land uses to the east, west, and south.

CPV
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T/ 781-848-0253
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The applicant's contact information is provided below.

Andrew Welch, Vice President
CPV Vacaville, LLC
8403 Colesville Road, Suite 915
Silver Spring, Maryland 20910
(240)723-2304
Awelch@cpv.com

If you have any questions regarding this application, please contact the applicant's representative Andrew Welch at 713-275-6147 or our Air Quality Consultants Gary Rubenstein or Steve Hill at Sierra Research (916-444-6666).

Sincerely,

Peter Podurgiel
Senior Vice President
Competitive Power Ventures

5.10 Socioeconomics

This section discusses the environmental setting, consequences, regional and local impacts, and mitigation measures associated with the socioeconomic aspects of the CPV Vaca Station (CPVVS). Section 5.10.1 describes the socioeconomic environment that might be affected by the CPVVS. Section 5.10.2 provides an environmental analysis of the construction and operation of the proposed development. Section 5.10.3 determines whether there will be any cumulative effects from the project. Section 5.10.4 discusses mitigation measures that will be implemented to avoid impacts. Section 5.10.5 discusses the applicable laws, ordinances, regulations and standards (LORS). Section 5.10.6 lists the agencies involved and agency contacts. Section 5.10.7 discusses permits and permit schedules. Section 5.10.8 lists reference materials used in preparing this section. A screening-level environmental justice analysis is provided in Appendix 5.10A.

5.10.1 Affected Environment

5.10.1.1 Population

Solano County (County) lies close to the densely populated San Francisco Bay area. It is bordered by Yolo County to the north and northwest, Napa County to the northeast, the San Pablo Bay to the east, Sacramento County to the west and southwest, and Contra Costa to the south. There are seven incorporated cities in Solano County including Fairfield, Vallejo, and Vacaville.

The City of Vacaville (City), with an estimated January 1, 2007 population of 96,905, is the third largest city in the county, after Fairfield and Vallejo (California Department of Finance [DOF], 2008a). Historical population data for Vacaville, Solano County, and the state of California are summarized in Table 5.10-1. Annual average compounded population growth rates are summarized in Table 5.10-2. During the 1990s, Solano County's population increased at an average annual rate of 1.5 percent, while that of Vacaville increased by 2.2 percent (DOF, 2008b). The average annual growth rate for the first half of the current decade (2000 to 2005) was 1.7 percent for the City and 1.2 percent for the County. Solano County and California are expected to have their greatest population growth from 2000 to 2010. No population projections for the City are available.

TABLE 5.10-1
Historical and Projected Populations

Area	1990	2000	2005	2010(p)	2020(p)	2030(p)
City of Vacaville	71,476	88,642	96,257	N/A	N/A	N/A
Solano County	339,471	394,542	419,162	455,647	555,264	677,628
California	29,758,213	33,873,086	36,743,186	39,246,767	43,851,741	48,110,671

Source: DOF, 2008a; 2008b; 2008c.

Note: Population projections rounded to nearest 100.

(p) = projected

TABLE 5.10-2
Historical and Projected Annual Average Compounded Population Growth Rates

Area	1990-2000 Percent	2000-2005 Percent	2005-2010 Percent	2010-2020 Percent	2020-2030 Percent
City of Vacaville	2.2	1.7	N/A	N/A	N/A
Solano County	1.5	1.2	1.7	2.0	2.0
California	1.3	1.6	1.3	1.1	0.9

Appendix Tables 5.10A-1 and 5.10A-2 (provided in Appendix 5.10A) show the minority (both racial and ethnic) as well as the low-income population distributions for the census blocks and census block groups that are within a 6-mile radius of the CPVVS site. The minority and income data are from the 2000 U.S. Census. Of the overall total population within the 6-mile radius, approximately 29 percent are racial minority, 17 percent are of Hispanic origin[1], and 6.1 percent are low-income. This compares to 28 percent racial minority, 18 percent Hispanic, and 6 percent low-income for Vacaville. Solano County's population is 44 percent minority, 18 percent Hispanic, and 8 percent low-income. Figures 5.10-1 and 5.10-2 show the percent distribution of minority and low-income populations by 2000 census blocks and census block groups within a 6-mile radius of the proposed CPVVS site.

5.10.1.2 Housing

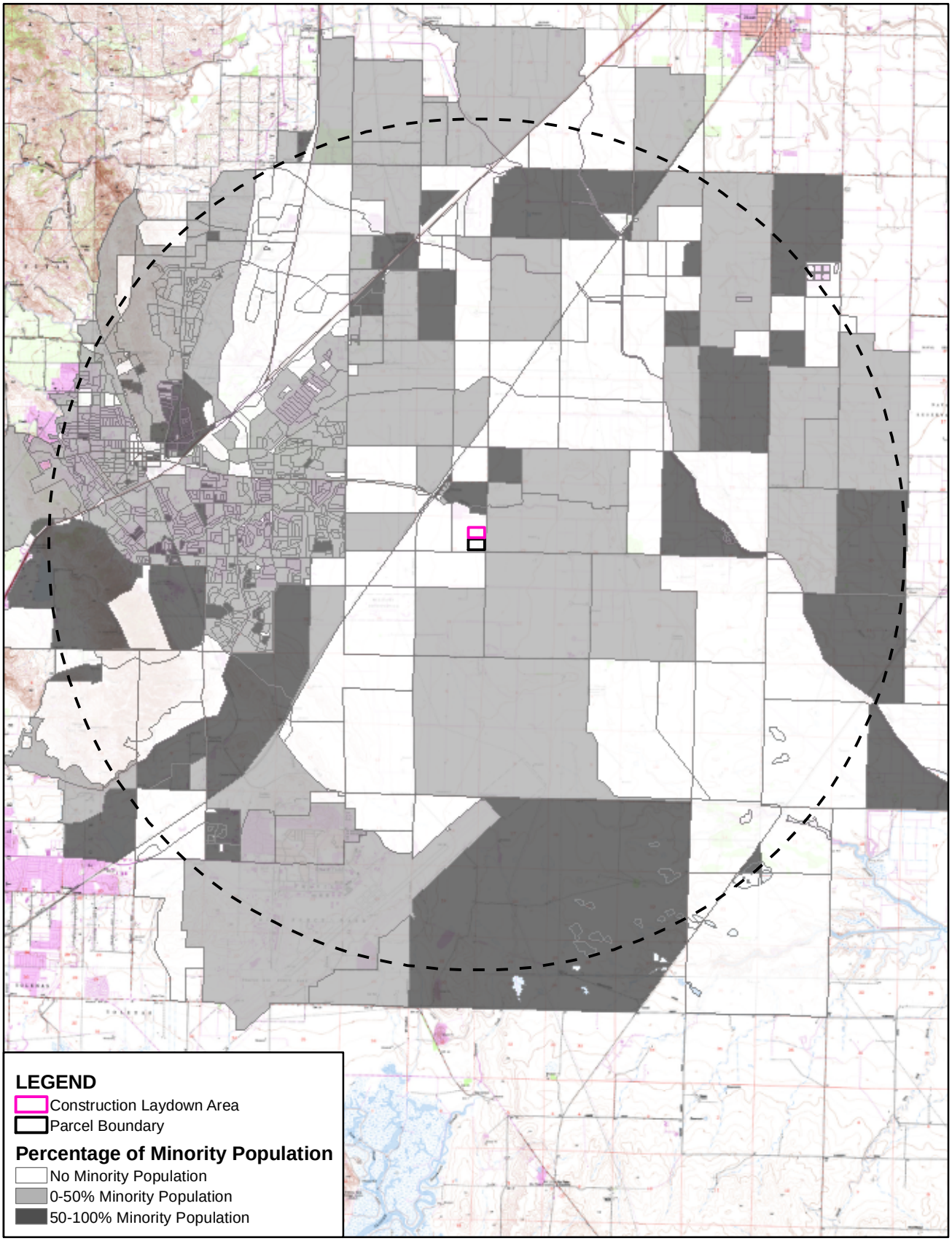
As shown in Table 5.10-3, housing stock for Solano County as of January 1, 2007, was 151,054 units. Single-family homes accounted for 114,981 units, multiple-family dwellings accounted for 31,418 units, and mobile homes accounted for 4,655 units. New housing authorizations for Solano County in 2006 totaled 1,300 units; about 87 percent were single-family units and 13 percent were multi-family units. These authorizations were valued at $332.2 million (DOF, 2008d). The median home price in Solano County in January 2007 was $429,500 (DOF, 2008d). During the 1990s, Solano County's vacancy rate averaged 5.2 percent then remained between 3 and 4 percent from 2000 to 2006 before increasing to the current (January 2007) of 4.1 percent. As such, housing supply is considered to be limited in the County, based on the federal standard vacancy rate of 5 percent.

TABLE 5.10-3
Housing Estimates by City, County, and State, January 1, 2007

Area	Total Units	Single-Family	Multi-Family	Mobile Homes	Percent Vacant
City of Vacaville	32,254	23,461	7,485	1,308	2.1
Solano County	151,054	114,981	31,418	4,655	4.1
California	13,312,456	8,603,213	4,117,587	591,656	5.9

Source: DOF, 2008a

[1] Hispanics or Latinos are those people who classified themselves in one of the specific Spanish, Hispanic, or Latino categories listed on the Census 2000 questionnaire—"Mexican, Mexican Am., Chicano," "Puerto Rican," or "Cuban"—as well as those who indicate that they are "other Spanish/Hispanic/Latino." People who identify their origin as "other Spanish/Hispanic/Latino" may be of any race. Thus, the percent Hispanic should not be added to percentages for racial (i.e., minority) categories.



Notes:
1. Source: American Fact Finder, Census 2000 Summary File 1 (SF 1) 100-Percent Data, U.S. Census Bureau, 2008

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1 2
Miles

FIGURE 5.10-1
MINORITY POPULATION DISTRIBUTION BY CENSUS BLOCKS WITHIN SIX MILES
CPV VACA STATION
VACAVILLE, CA

CH2MHILL

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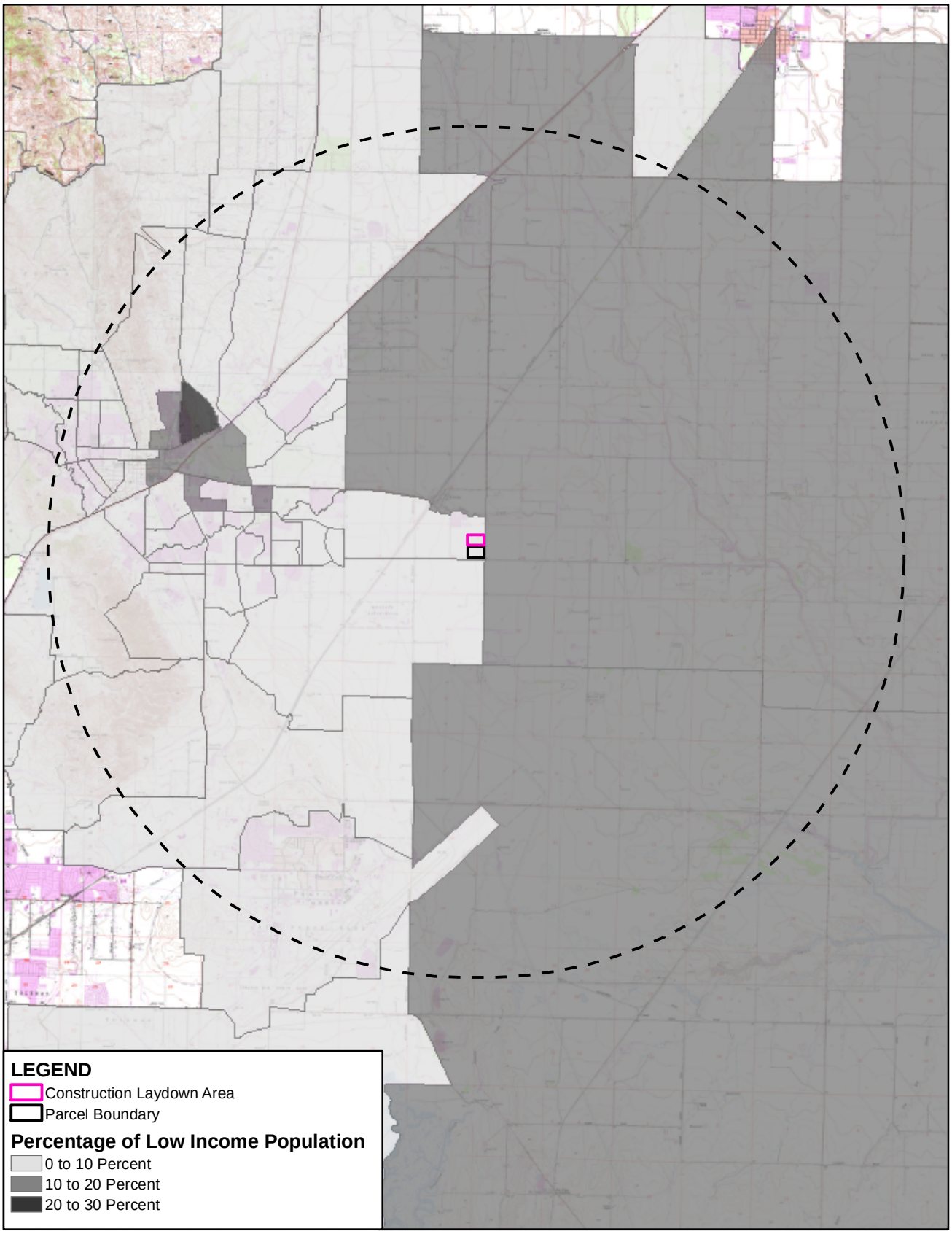

Notes:
1. There are no tracts with more than 30 percent.
2. Source: American Fact Finder, Census 2000 Summary File 1 (SF 1) 100-Percent Data, U.S. Census Bureau, 2008

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1 2
Miles

FIGURE 5.10-2
LOW INCOME POPULATION DISTRIBUTION BY CENSUS BLOCK GROUPS WITHIN SIX MILES
CPV VACA STATION
VACAVILLE, CA

CH2MHILL

SAC\\GLACIER\PROJ\VACAVILLE_AFC_370668\MAPFILES\CENSUSTRACTS_LOWINCOME.MXD MHASKELL 6/11/2008 15:05:30

5.10.1.3 Economy and Employment

Solano County forms the Vallejo-Vacaville Metropolitan Statistical Area (MSA). Between 2002 and 2007, employment in the Vallejo-Vacaville MSA increased by 6,500 jobs, or about one percent in average annual growth. This one percent annual average increase is ten times California's net increase (0.1 percent) during the 2002 to 2007 period (California Employment Development Department [CEDD] 2008a). As shown in Table 5.10-4, on a percent increase basis, transportation and warehousing experienced the largest increase in employment, followed by natural resources and mining. Although the percentage increase in the natural resources and mining sector was the highest between 2002 and 2007, the contribution of this sector to the Vallejo-Vacaville MSA economy remained negligible. By contrast, during the same 5-year period, the construction workforce decreased by 300 workers from 10,900 to 10,600 workers. This construction sector comprises about 8 percent of the total workforce in the Vallejo-Vacaville MSA. Additional employment losses were experienced in the agriculture and information sectors.

TABLE 5.10-4
Employment Distribution in Vallejo-Vacaville MSA, 2002 to 2007

	2002		2007		2002-2007	
Industry	**Number of Employees**	**Employment Share (%)**	**Number of Employees**	**Employment Share (%)**	**Percentage Change (%)**	**Average Annual Compound Growth Rate (%)**
Agriculture	2,000	1.6	1,500	1.2	-25.0	-5.6
Natural Resources, Mining	200	0.2	300	0.2	50.0	8.4
Construction	10,900	8.9	10,600	8.2	-2.8	-0.6
Manufacturing	9,500	7.8	9,700	7.5	2.1	0.4
Wholesale Trade	4,000	3.3	4,200	3.3	5.0	1.0
Retail Trade	17,700	14.5	18,400	14.3	4.0	0.8
Transportation, Warehousing and Utilities	3,000	2.5	4,600	3.6	53.3	8.9
Information	1,800	1.5	1,600	1.2	-11.1	-2.3
Financial Activities	4,700	3.8	5,700	4.4	21.3	3.9
Services	42,200	34.5	45,700	35.5	8.3	1.6
Government	26,400	21.6	26,600	20.6	0.8	0.2
Total Employment	**122,400**	**100.0**	**128,900**	**100.0**	**5.3**	**1.0**

Source: CEDD, 2008a

Table 5.10-5 provides detail on the characteristics of the labor force. It shows 2007 employment data for the Vallejo-Vacaville MSA and Vacaville compared to California. The Vallejo-Vacaville MSA's average annual unemployment rate was the same as the state average. However, Vacaville's average unemployment rate was lower than the MSA average or the state average. CEDD does not project future unemployment rates.

TABLE 5.10-5
Employment Data, 2007

Area	Labor Force	Employment	Unemployment	Unemployment Rate (%)
City of Vacaville	45,600	43,800	1,800	3.9
Vallejo-Vacaville MSA (Solano County)	211,800	200,400	11,400	5.4
California	18,188,100	17,209,900	979,200	5.4

Source: CEDD, 2008b

5.10.1.4 Fiscal Resources

The local agencies with taxing power include Solano County and the City of Vacaville. Solano County's General Fund expenditures and revenues are presented in Table 5.10-6. The County's General Fund revenues increased by about 12.1 percent from fiscal year (FY) 2005-06 to FY 2006-07. However, in fiscal year 2007-08 revenues only increased by 7.6 percent.

TABLE 5.10-6
Solano County Revenues and Expenditures ($ thousands)

	FY 2006	FY 2007	FY 2008
Expenditures:			
General Government ($M)	$216.2	$211.5	$199.3
Salaries and Employee Benefits	$34,141	$36,100	$39,285
Services and Supplies	$21,213	$25,970	$26,743
Other Charges	$17,381	$11,645	$13,115
Capital Outlay	$1,809	$46	$551
Other Financing Uses	$105,684	$117,233	$142,953
Total Expenditures	$180,228	$190,993	$222,646
Revenues:			
Taxes	$68,020	$115,291	$123,336
Licenses, Permits & Franchises	$5,295	$5,616	$6,078
Fines, Forfeitures, and Penalties	$2,983	$2,756	$2,511
Use of Money and Property	$1,485	$2,258	$4,071
Aid from Other Government Agencies	$50,634	$19,236	$22,054
Charges for Current Service	$35,536	$36,870	$37,206
Other Revenue	$6,029	$8,572	$9,819
Total Revenue	$169,983	$190,599	$205,074

Source: Solano County, 2008a; 2008b.

Numbers may not add up due to independent rounding.

In FY 2006, tax revenues comprised 40 percent of the County's total General Fund revenue. However, during fiscal years 2007 and 2008, tax revenues had become a major source of

funds, comprising about 60 percent to the County's General Fund revenue. This change was primarily the result of a reduction in the "Aid from Other Government Agencies" category during FY 2007 and 2008.

As shown in Table 5.10-7, the General Fund revenue for the City of Vacaville has been growing somewhat steadily over the last few fiscal years. Although no particular revenue item has consistently been responsible for the observed growth during this period, taxes have continued to be the major contributor to the City's revenues. Tax revenues have averaged 78 percent of the City's General Fund revenues during the period shown in the table. During the periods shown, tax revenues from sales, property, and businesses contributed about 27 percent, 19 percent and 33 percent, respectively, of the overall General Fund revenues.

TABLE 5.10-7
City of Vacaville Revenues and Expenditures ($ Million)

	2004/05 Actual	2005/06 Projected	2006/07 Projected
Expenditures:			
General Fund[a]	NA	$54.8	$59.2
Special Revenue Funds[b]	NA	$23.7	$25.8
Enterprise Funds[c]	NA	$31.6	$32.3
Redevelopment Agency[d]	NA	$26.0	$24.6
Total Expenditures	NA	$136.1	$141.9
Revenues:			
Taxes	$39.8	$43.7	$47.8
Taxes, Property Taxes	$9.6	$10.7	$11.6
Taxes, Sales	$14.0	$14.8	$16.2
Taxes, Other	$16.2	$18.1	$20.0
Intergovernmental[e]	$1.1	$1.1	$1.0
Departmental Fees & Charges[f]	$7.1	$7.5	$8.5
Other Revenue	$2.1	$2.3	$2.4
Transfers In	$0.8	$0.8	$1.0
Total Revenue	$50.9	$55.3	$60.6

Source: City of Vacaville, 2006

Numbers may not add up due to independent rounding.

[a] General Fund expenditures includes the budget for City Staff including City Council, City Attorney, City Manager's Office, Dept. Of Housing & Redevelopment, Police Department, Fire Department, Public Works, Community Services and Non-Departmental.

[b] Special Revenue Funds expenditures include housing services (non General Fund), public works, gas tax, park maintenance districts, engineering services and TSM, and building related (commercial development)

[c] Enterprise Funds expenditures include sewer utility systems, water utility systems, and transit

[d] Redevelopment Agency expenditures combined housing set aside, community redevelopment area, I-505/80 redevelopment area

[e] Intergovernmental revenues include motor vehicle in-lieu, state reimbursements, homeowner subvention, state and federal grants, school reimbursements, and tobacco settlement

[f] Departmental Fees and Charges revenues include recreation and facilities, emergency medical fees, in lieu DIF, police and fire fees, and other departments.

5.10.1.5 Education

There are a total of 6 public unified school districts with 101 elementary, middle and high schools in Solano County. The CPVVS site is in the Vacaville Unified School District and the Travis Unified School District. Past and current enrollment figures for the school districts are presented in Table 5.10-8. Projected enrollment figures are not available.

TABLE 5.10-8
Current and Projected Enrollment by Grade

	Vacaville Unified School District			Travis Unified School District		
Grade Level	**Enrollment (2005-06)**	**Enrollment (2006-07)**	**Current Enrollment (2007-08)**	**Enrollment (2005-06)**	**Enrollment (2006-07)**	**Current Enrollment (2007-08)**
Kindergarten	871	832	897	423	399	394
First	920	909	886	407	427	406
Second	950	912	922	404	393	397
Third	925	925	924	422	404	406
Fourth	952	913	967	432	396	397
Fifth	1,028	954	932	427	416	397
Sixth	1,010	1,028	935	391	415	433
Seventh	1,065	990	1,032	421	407	427
Eighth	1,142	1,058	990	426	428	422
Ninth	1,478	1,491	1,405	427	442	426
Tenth	1,188	1,252	1,248	452	385	425
Eleventh	1,162	1,043	1,128	391	431	384
Twelfth	1,013	961	920	312	356	402
Total	13,704	13,268	13,186	5,335	5,299	5,316

Source: California Department of Education CDE, 2007.

5.10.1.6 Public Services and Facilities

This section describes public services in the project area.

5.10.1.6.1 Law Enforcement

The project site comes under the jurisdiction of the Solano County Sheriff. The Sheriff's Department is located at 530 Union Avenue, Suite 1100, Fairfield, CA 94533, approximately 15 miles from the project site. There are 122 officers, all serving Solano County from this one station (DuClair, 2008).

The Solano County Sheriff has a priority system to respond to emergencies within the County. Average response time to priority one (emergency) calls is about 5 to 7 minutes; whereas, for priority two (urgent) calls response time depends on officer availability and the seriousness of the call (Powell, 2008).

The California Highway Patrol is the primary law enforcement agency for state highways and roads (i.e., Interstate 5). Services include law enforcement, traffic control, accident investigation, and the management of hazardous materials spill incidents.

5.10.1.6.2 Fire Protection

The project site is within the City of Vacaville Fire Department (VFD) jurisdiction. VFD has four fire stations. The primary response station to the CPVVS is Station No. 72, located at 2001 Ulatis Drive, Vacaville, California. Station No. 72 is headed by three battalion commanders, staffed with an engine and medic unit, and is approximately 3 miles to the northwest of the project site. The response time to an emergency at the project site from Station No. 72 is approximately 6 to 7 minutes. Mutual aid would come from other Vacaville City Fire Stations as well as the Vacaville Fire Protection District (Kendrick, 2008).

5.10.1.6.3 Emergency Response

The VFD is responsible for commanding all hazardous materials incidents in the City of Vacaville except for those occurring on a freeway. All emergency response personnel are trained and certified at the first-responder operations level (City of Vacaville, 2008b).

The Solano County Department of Environmental Health Hazardous Materials Program (HMP) responds to hazardous materials emergency incidents and provides technical assistance to the incident commander. The (HMP) capabilities include some hazard categorization. The HMP does not have a hazardous materials team capable of Level A entry into a hot zone. The nearest resources with these capabilities include UC Davis and the Sacramento City Fire Department (Solano County, 2008d)

5.10.1.6.4 Hospitals

The nearest hospital with an emergency room is Vaca Valley Hospital, located at 1000 Nut Tree Road in Vacaville. Vaca Valley Hospital is the sister facility of North Bay Medical Center in Fairfield The hospital has a 24-hour Emergency Service, 44 medical-surgical beds, a six-bed intensive care unit, two surgery suites, a laboratory, pharmacy, and a fully equipped radiology department, including a computerized tomography scanner (CT scan). Vaca Valley Hospital staffs approximately 200 physicians. Although Vaca Valley Hospital operates a 24-hour emergency department it does not have a trauma center (Roerden, 2008). The nearest hospital with a trauma center is the University of California, Davis (UCD) Medical Center. UCD Medical Center serves as the Regional Trauma Center for the citizens of 33 counties, more than 65,000 square miles and 6 million residents. It is located at 2315 Stockton Blvd., Sacramento. UCD Medical Center is designated as Northern California's only Level I[2] Trauma Center. The UCD Trauma Center includes 10 trauma surgeons and 13 trauma nurses. UCD Medical Center is approximately 36 miles from the proposed project site. In addition to the above hospitals, there are a number of medical centers within 5 to 20 miles of the project site that provide emergency care. These include: North Bay Medical Center (~13 miles) and Sutter Davis Hospital (~20 miles).

[2] Level I has 24-hour neuro/open heart/all other surgeries plus research capabilities. Level II has 24-hour neuro/open heart/all other surgeries.

5.10.1.7 Utilities

This section describes utilities in the area.

5.10.1.7.1 Electricity and Gas

The bulk of the electric power produced by the facility will be transmitted to the electrical grid through the 230-kV connection with a new substation to be constructed about one mile west of the CPVVS, adjacent to the existing 230 kV Vaca-Dixon to Birds Landing transmission line. A small amount of electric power will be used onsite to power auxiliaries such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning. A station battery system will also be used to provide direct current (DC) voltage to be used as backup power for control systems and other uses.

Natural gas will be delivered to the site via a new 1.03-mile-long connection to the PG&E transmission pipeline located along Fry Road. At the plant site, the natural gas will flow through a flow-metering station, gas scrubber/filtering equipment, a gas pressure control station, and a fuel gas heater prior to entering the combustion turbines.

5.10.1.7.2 Water

The CPVVS will use secondary-treated recycled water provided by the City of Vacaville from the Easterly Wastewater Treatment Plant. The project will access this water through a new 20-inch-diameter pipeline in the utility corridor connecting the CPVVS and the treatment plant. Potable water and sanitary sewer connections will also be provided through connections in this utility corridor to the treatment plant. Because the facility will use a zero liquid discharge unit it will recycle reclaimable process wastewater onsite.

5.10.1.7.3 Wastewater Discharge

The primary wastewater collection system will collect stormwater runoff from the plant site and route it to the stormwater retention basin. Equipment drains will be routed to the oil/water separator and wastewater lift station for testing before discharge to the sanitary wastewater system. The secondary wastewater collection system will collect sanitary wastewater from sinks, toilets, showers, and other sanitary facilities, and discharge it via the facility's sanitary sewer collector system.

5.10.2 Environmental Analysis

This section assesses the potential environmental impacts of the project and linears.

5.10.2.1 Potential Environmental Impacts

Local environmental impacts were determined by comparing project demands during construction and operation with the socioeconomic resources of the region of influence (i.e., Solano County). A proposed power-generating facility could impact employment, population, housing, public services and utilities, and/or schools. Impacts could be local and/or regional, though generally impacts tend to be more local (city/county) than regional (outside the county).

5.10.2.2 Significance Criteria

The criteria used to determine the significance of project-related socioeconomic impacts are as suggested in the California Environmental Quality Act Checklist. Project-related impacts from construction and operations of the plant are determined to be significant if they:

- Induce substantial growth or concentration of population
- Displace a large number of people or impact existing housing
- Result in substantial adverse impacts to the local economy and employment
- Create adverse fiscal impacts to the community
- Result in substantial adverse impacts to educational facilities
- Result in substantial adverse impacts to the provision of utility services
- Result in substantial adverse impacts associated with the provision of public services

Other impacts may be significant if they cause substantial change in community interaction patterns, social organization, social structures, or social institutions; substantial conflict with community attitudes, values, or perceptions; or substantial inequities in the distribution of project cost and benefit.

5.10.2.3 Construction Impacts

Construction will take approximately 24 months, from first quarter 2011 to second quarter 2013. Personnel requirements will be minimal during the mobilization and site grading period (i.e., during the first 3 months of the construction period) and during the startup and testing period (i.e., during the last 3 months of the construction period).

5.10.2.3.1 Construction Workforce

The primary trades required for construction will include boilermakers, carpenters, electricians, ironworkers, laborers, millwrights, operators, and pipefitters. Table 5.10-9 provides an estimate of construction personnel requirements for the plant. Total construction and demolition personnel requirements will be approximately 7,159 person-months, or 597 person-years. Construction personnel requirements will peak at approximately 664 workers in month 14 of the construction period. Average workforce over the 24-month construction period is 298 workers.

Available skilled labor in the Vallejo-Fairfield MSA was evaluated by surveying the Building and Trades Council (Table 5.10-10) and contacting CEDD (Table 5.10-11). Both sources show that the workforce in Vallejo-Fairfield MSA will be adequate to fulfill CPVVS's construction labor requirements. Therefore, the project will not place an undue burden on the local workforce. Although, as shown in Table 5.10-4, the construction workforce in the MSA has been declining over the last 5 years, at an annual rate of 0.6 percent, the additional workforce requirement by the CPVVS is still not expected to place undue burden since Vacaville is close to both the Bay Area and the Sacramento region, both of which have large construction workforce. In addition, the CPVVS peak construction needs are less than 0.16 percent of the total workforce shown in Table 5.10-4. As a result, the project will not result in a significant adverse impact on the construction workforce in the area.

TABLE 5.10-9
Construction and Demolition Personnel by Month

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	TOTAL
Boilermakers	-	-	-	-	-	9	17	29	39	50	57	59	62	50	40	22	20	13	4	-	4	2	2	2	481
Carpenters	3	4	12	20	27	38	50	63	68	68	67	66	60	36	35	30	25	16	11	7	5	3	3	3	720
Electricians	1	1	2	2	3	10	11	11	16	14	58	78	98	146	150	165	154	130	62	55	33	10	7	6	1,223
Ironworkers	-	4	13	14	24	41	44	29	14	12	10	9	8	3	1	1	-	-	-	-	3	2	2	2	236
Laborers	9	12	19	26	29	39	43	44	44	48	54	61	68	67	65	64	59	45	32	17	11	10	9	9	884
Pipefitters	1	1	2	2	3	4	5	42	64	91	120	148	162	157	147	116	54	24	12	9	24	10	5	4	1,207
Painters/Insulation Workers	-	-	-	-	-	-	-	-	-	-	6	6	10	12	14	14	10	8	6	6	-	-	-	-	92
Bricklayers/Masons	-	3	9	21	24	28	36	33	21	10	9	9	7	5	4	3	1	-	-	-	-	-	-	-	223
Millwrights	-	-	-	-	-	-	-	-	13	26	43	59	76	85	97	97	79	46	26	20	12	6	1	1	687
Operating Engineers	8	11	16	21	24	29	30	31	31	35	45	50	55	55	52	51	40	27	19	8	6	4	4	3	655
Total Craft	**22**	**36**	**73**	**106**	**134**	**198**	**236**	**282**	**310**	**354**	**469**	**545**	**606**	**616**	**605**	**563**	**442**	**309**	**172**	**122**	**98**	**47**	**33**	**30**	**6,408**
Contractor Staff	14	18	23	26	27	32	38	43	43	43	44	44	48	48	46	46	45	45	32	30	9	3	2	2	751
Total Site Staff	**36**	**54**	**96**	**132**	**161**	**230**	**274**	**325**	**353**	**397**	**513**	**589**	**654**	**664**	**651**	**609**	**487**	**354**	**204**	**152**	**107**	**50**	**35**	**32**	**7,159**

TABLE 5.10-10
Labor Union Contacts in Solano County

Labor Union	Contact	Phone Number
Napa/Solano Building Trades Council	Lou Franchimon, Business Manager	(707) 426-6454

TABLE 5.10-11
Available Labor by Skill in Vallejo-Fairfield MSA, 2004-2014

Occupational Title	Annual Averages		Absolute Change	Percentage Change	Average Annual Compounded Growth Rate (%)
	2004	2014			
Carpenters	4,150	5,730	1,580	38.1	3.3
Cement Masons & Concrete Finishers	400	520	120	30.0	2.7
Painters, Construction & Maintenance	650	810	160	24.6	2.2
Sheet Metal Workers	540	610	70	13.0	1.2
Electricians	390	510	120	30.8	2.7
Industrial Truck & Tractor Operators	480	560	80	16.7	1.6
Operating Engineers and Other Construction Equipment Operators	430	510	80	18.6	1.7
Helpers, Construction Trades	530	770	240	45.3	3.8
Construction Laborers	1,830	2,320	490	26.8	2.4
Plumbers, Pipefitters, & Steamfitters	720	940	220	30.6	2.7
Administrative Services Managers	150	180	30	20.0	1.8
Mechanical Engineers	60	70	10	16.7	1.6
Electrical Engineers	60	70	10	16.7	1.6
Engineering Technicians	90	110	20	22.2	2.0
Plant & System Operators	380	400	20	5.3	0.5

Source: CEDD, 2008c

5.10.2.3.2 Population Impacts

It is anticipated that most of the construction workforce will be drawn from Solano County. However, a portion of the construction workforce could also be drawn from other nearby counties. For the purposes of analysis, because of the size of the local construction workforce, it was assumed that 90 percent of the construction workers will be from the local area. Since most workers are expected to commute to the project site, they will not contribute to a significant increase in the population of the area.

5.10.2.3.3 Housing Impacts

The construction workforce will most likely commute daily to the project site; however, if needed, there are about 55 hotels/motels with 4,103 rooms in Solano County (Smith Travel

Research, 2008) to accommodate workers who may choose to commute to the project site on a workweek basis. The average daily room rate is $75. Hotel occupancy rates for the period April 2007 through March 2008 averaged about 43 percent (Smith Travel Research, 2008). In addition to the available hotel/motel accommodation, there are 10 recreational vehicle parks within 5 miles of the project site. As a result, construction of the proposed project is not expected to significantly increase the demand for housing.

5.10.2.3.4 Impacts to the Local Economy and Employment

The cost of materials and supplies required for construction of the CPVVS project is estimated between $371.25 and $412.5 million. The estimated value of materials and supplies that will be purchased locally during construction and demolition is $3.7 to $4.1 million. All cost estimates are in constant 2008 dollars as are the economic benefits figures cited later in this section.

CPVVS will provide about $78.75 to $87.5 million in construction payroll, at an average rate of $63.5 to $70.5 per hour, including benefits. The anticipated payroll for employees, as well as the purchase of materials and supplies during construction, will have a slight beneficial impact on the area. Assuming, conservatively, that 60 percent of the construction workforce will reside in Solano County, it is expected that approximately $47.3 to $52.5 million will stay in the local area during the 24-month construction period. These additional funds will cause a temporary beneficial impact by creating the potential for other employment opportunities for local workers in other service areas, such as transportation and retail. No significant adverse impacts are expected to result related to the local economy and employment.

Indirect and Induced Economic Impacts from Construction

Construction and demolition activities would result in secondary economic impacts (indirect and induced impacts) within Solano County. Indirect and induced employment effects include the purchase of goods and services by firms involved with construction, and induced employment effects include construction workers spending their income within the County. In addition to these secondary employment impacts, there are indirect and induced income effects arising from construction.

Indirect and induced impacts were estimated using an IMPLAN Input-Output model of the Solano County economy. IMPLAN is an economic modeling software program. The estimated indirect and induced employment within Solano would be 60 and 169 jobs, respectively. These additional jobs result from the $4.1 million in annual local construction expenditures as well as the $18.4 million in spending by local construction workers. The $18.4 million represents the disposable portion of the annual construction payroll (here assumed to be 70 percent of $26.3[3] million). Assuming an average direct construction employment of 298, the employment multiplier associated with the construction phase of the project is approximately 1.8 (i.e., [298 + 60 + 169]/298). This project construction phase employment multiplier is based on a Type SAM model.

Indirect and induced income impacts were estimated at $2,251,050 and $5,686,850, respectively. Assuming a total annual local construction expenditure (payroll, materials and

[3] Annual local portion of construction payroll = $87.5 million / 2 x 60% = $26.25 million. The disposable portion of the annual local construction payroll = $26.25 million x 70% = $18,375,000.

supplies) of $30.35 million ($26.25 million in payroll + $4.10 million in materials and supplies), the project construction phase income multiplier based on a Type SAM model is approximately 1.3 (i.e., [$30,350,000 + $2,251,050 + $5,686,850]/$ 30,350,000).

Assuming that annual local construction expenditures are only $3.7 million instead of $4.1 million and that annual construction payroll is $23.63 million results in indirect and induced employment estimates within Solano County of 54 and 152 jobs, respectively. Based on the same average construction employment of 298, the construction phase employment multiplier is approximately 1.7.

Indirect and induced income impacts based on the total annual construction expenditure of $27.33 million ($23.63 million in payroll + $3.7 million in materials and supplies) were estimated at $2,037,460 and $5,645,180, respectively. Based on these estimates, the construction phase income multiplier was estimated at approximately 1.3.

5.10.2.3.5 Fiscal Impacts

Based on recent construction of projects in the region, CPVVS initial total capital cost is estimated to be $450 to $500 million; of this, materials and supplies are estimated at approximately $371.25 to $412.5 million. The estimated value of materials and supplies that will be purchased locally (within Solano County) during construction of CPVVS (and demolition of the existing plant) is be $3.7 to $4.1 million. The effect on fiscal resources during construction will be from sales taxes realized on equipment and materials purchased in the County and from sales taxes from expenditures. The purchase of these equipment and materials are assumed to be made in Vacaville, the nearest town to the project site. The sales tax rate in Vacaville is 7.375 percent (as of April 1, 2008). Of this, 5.50 percent goes to the state; the local rate is 1 percent; the Proposition 172 public safety sales tax rate is 0.50 percent; the Transportation Development Act rate is 0.25 percent and the Solano County Library rate is 0.125 percent (BOE, 2008 and City of Vacaville, 2008a). The total local sales tax expected to be generated annually during construction is $272,875 to $302,375 (i.e., 7.375 percent of local sales). Assuming all local sales are made in Vacaville, the maximum sales tax the City could receive would be between $37,000 and $41,000 (1.0% of $3.7 to $4.1 million) during the construction period. No significant adverse fiscal impacts are expected to result from project construction.

5.10.2.3.6 Impacts on Education

The schools in the Vacaville Unified School District and the Travis Unified School District are currently not considered overcrowded (Flores, 2008; Hatcher, 2008). Construction of CPVVS will not cause significant population changes or housing impacts to the region because most employees will commute to the site from areas within the County, as opposed to relocating to the area. As a result, CPVVS construction will not cause a significant increase in demand for school services.

5.10.2.3.7 Impacts on Public Services and Facilities

The construction of the project may have minor impacts on police, fire, or hazardous materials handling resources. However, it is not expected to place a burden on public service providers. Copies of the records of conversation with the Sheriff and Fire departments are included in Appendix 5.10B. Construction sites may hold a higher risk of emergency due to the types of activities taking place. However, with the project implementing safety procedures for the construction site, as required by applicable

regulations and standards, CPVVS construction is not expected to create significant adverse impacts on medical resources in the area since minor injuries could be treated at the Vaca Valley Hospital in Vacaville.

5.10.2.3.8 Impacts on Utilities

CPVVS construction will not make significant adverse demands on local water, sanitary sewer, electricity, or natural gas. Impacts will involve the extension of existing utility lines. Water requirements for construction are relatively small. Given the number of workers and temporary duration of the construction period, the impacts on the local sanitary sewer system would not be significant.

5.10.2.4 Operational Impacts

This section discusses the changes to the local economy as a result of bringing CPVVS online.

5.10.2.4.1 Operational Workforce

The proposed CPVVS facility is expected to begin commercial operation in second quarter 2013. It is expected to employ up to 31 full-time employees who will be contract employees. Anticipated job classifications are shown in Table 5.10-12. The entire permanent workforce is expected to commute from within Solano County.

TABLE 5.10-12
Typical Plant Operation Workforce

Department	Personnel	Shift	Workdays
Operations	1 Engineer	Standard 8-hour days as needed	5 days a week
	1 Operations Supervisor		
	4 Lead Power Plant Technicians		
	13 Power Plant Technicians		
	2 Instrument and Control Technicians		
	1 EH&S Coordinator		
	1 Chemist		
	1 Mechanic		
	1 Electrician		
Maintenance	1 Maintenance Supervisor	Standard 8-hour days as needed	5 days a week (Maintenance technicians will also work unscheduled days and hours as required [i.e., weekends])
	1 Maintenance Safety Engineer		
Administration	1 Plant Manager	Standard 8-hour days as needed	5 days a week
	1 Administrative Supervisor		
	1 Administrative Assistant		
	1 Procurement Specialist		

Facility employees will be drawn from the local workforce. Consequently, no population increase is anticipated as a result of this project. There will be no significant impact on local employment.

5.10.2.4.2 Population Impacts

It is anticipated that most of the operational workforce will be drawn from the local population (Vacaville and elsewhere in Solano County). However, assuming all 31 employees were to relocate to Solano County and assuming an average family size of 2.76 (DOF, 2008a), it would result in an increase in the County's population of only 0.02 percent (0.0002). Consequently, plant operations will not create a significant influx of new workers to the community.

5.10.2.4.3 Housing Impacts

Since it is anticipated that most of the operational workforce would be local residents, significant impacts to housing are not anticipated. Based on the housing vacancy data in Table 5.10-3, there are approximately 663 and 6,137 available housing units within the City and county limits, respectively. Thus, even if all 31 workers were to relocate to Solano County, there would be adequate housing supply. Hence, the project would not create a significant impact to housing.

5.10.2.4.4 Impacts on the Local Economy and Employment

CPVVS operation will generate a small, permanent beneficial impact by creating employment opportunities for local workers through local expenditures for materials, such as office supplies and services. The average salary per operations employee is expected to be $80,000 per year, excluding benefits. For the assumed average of 31 full-time employees, this will result in an approximate operation payroll of $2.48 million per year. There will be an annual operations and maintenance budget of approximately $1.5 million, of which $50,000 is estimated to be spent locally, (i.e., within Solano County). These additional jobs and spending will generate other employment opportunities and spending in Solano County and the City of Vacaville. The addition of 31 full-time jobs would not significantly reduce unemployment rates. All cost estimates are in constant 2008 dollars as are the economic benefits noted in this section. No adverse impacts to the local economy and employment are expected to result from project operations.

Indirect and Induced Economic Impacts from Operations

The operation of the proposed project would result in indirect and induced economic impacts that would occur within Solano County. These indirect and induced impacts represent permanent increases in the county's economic variables. The indirect and induced impacts would result from annual expenditures on payroll as well as those on operations and maintenance (O&M).

Estimated indirect and induced employment within Solano County would be 0 and 14 permanent jobs, respectively. These additional 14 jobs result from the $2.53 million ($2.48 million in payroll, $50,000 in materials and operations) in annual operational budget. The operational phase employment multiplier is estimated at 1.4 (i.e., [31 + 0 + 14]/31) and is based on a Type SAM multiplier.

Indirect and induced income impacts are estimated at $6,210 and $468,000, respectively. The income multiplier associated with the operational phase of the project is approximately 1.2 (i.e., [$2,530,000 + $6,210 + $468,000]/$ 2,530,000) and is based on a Type SAM model.

5.10.2.4.5 Fiscal Impacts

The annual operations and maintenance budget is expected to be approximately $1.5 million (in 2008 dollars), of which $50,000 is assumed would be spent locally within Solano County. As stated earlier, CPVVS will bring about $3.15 million per year in operational payroll to the region.

During operations, additional sales tax revenues will be obtained by the City of Vacaville and Solano County. Increased payroll will be $3.15 annually, and additional O&M expenses spent locally will be approximately $50,000 annually. Based on the assumed local O&M expenditures of $50,000, the estimated sales taxes will be approximately $3,687. The overall anticipated increase in sales tax revenue will be beneficial but will not be significant, since it would constitute such a small percent of total City and County revenues.

CPVVS is expected to bring increased property tax revenue to the City of Vacaville. The California State Board of Equalization (BOE) has jurisdiction over the valuation of a power-generating facility for property tax purposes, if the power plant produces 50 megawatts (MW) or more. For a power-generating facility producing less than 50 MW, the County has jurisdiction over the valuation (Young, 2007). Since the CPVVS project is a nominal 660 MW power-generating facility, BOE is responsible for assessing property value. Although, the BOE assesses the property value, the property tax rate is set by the Solano County Assessors Office. For the current property, this rate is 1.088644 percent for the most recent fiscal year (FY 2007–08). Assuming a capital cost of $450 to $500 million, CPVVS will generate between $4.9 million and $5.4 million in property taxes annually. Since the property taxes are collected at the county level, their disbursement is also at the county level.

In FY 2008, the County's total revenues were estimated at $205.1 million (see Table 5.10-6). Of this amount, $123.3 million was in tax revenues. The increase in property taxes resulting from the CPVVS would be 3.9 to 4.4 percent of the County's total FY 2008 tax revenue. No significant adverse fiscal impacts are expected to result from project operations.

5.10.2.4.6 Impacts on Education

The schools in the Vacaville Unified School District and the Travis Unified School District are currently not considered overcrowded (Flores, 2008; Hatcher, 2008). Even assuming that all 31 operational employees reside within the City of Vacaville, CPVVS operation is not expected to create any significant adverse impacts to the local school system. Assuming an average family size of 2.76 persons per household for Vacaville (DOF, 2008a) would imply the addition of approximately only 24 children to the local schools. This would constitute a negligible percent increase in school enrollment. Any industrial development within the Vacaville Unified School District, in addition, is currently charged a one-time assessment fee of $0.33 per square foot of principal building area (Flores, 2008). Any development (industrial or residential) within the Travis Unified School District is currently charged a one-time assessment fee of $0.42 per square foot of principal building area (Hatcher, 2008). Based on 7,500 square feet of occupied structures, CPVVS will pay $5,625 in school impact fees. With the payment of these fees, impacts will be less than significant, as described in Section 5.10.4.

5.10.2.4.7 Impacts on Public Services and Facilities

Project operation will not make any new significant demands on public services or facilities even if all of the operational employees move to Vacaville. The Solano County Office of Emergency Services did not express any concerns about increased service demands during plant operations (Ives, 2007). The CPVVS's operation is not expected to result in significant impacts to the Solano County Office of Emergency Services. Copies of the records of conversation with the Office of Emergency Services are included in Appendix 5.10B. CPVVS's operation would not create significant adverse impacts on medical resources in the area due to the safety record of power plants and few operations staff.

5.10.2.4.8 Impacts on Utilities

CPVVS operation will not make significant adverse demands on local water, sanitary sewer, electricity, or natural gas because adequate supply and capacity currently exist.

5.10.2.4.9 Environmental Justice

President Clinton's Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed on February 11, 1994. The purpose of this Executive Order is to consider whether a project may result in disproportionately high and adverse human health or environmental effects on any minority or low-income population.

The federal guidelines set forth a three-step screening process:

1. Identify which impacts of the project are high and adverse.
2. Determine whether minority or low-income populations exist within the high and adverse impact zones.
3. Examine the spatial distribution of high and adverse impact areas to determine whether these impacts are likely to fall disproportionately on the minority and/or low-income population.

According to the guidelines established by the U.S. Environmental Protection Agency (EPA, 1996) to assist federal agencies to develop strategies to address this circumstance, a minority and/or low-income population exists if the minority and/or low-income population percentage of the affected area is 50 percent or more of the area's general population. The guidance suggests using two or three standard deviations above the mean as a quantitative measure of disparate effects.

A screening-level analysis of environmental justice is presented in Appendix 5.10A. According to that analysis, the CPVVS does not create significant and adverse impacts. Therefore, there are no environmental impacts that are likely to fall disproportionately on minority and/or low-income members of the community.

5.10.3 Cumulative Effects

A cumulative impact refers to a proposed project's incremental effect together with other closely related past, present, and reasonably foreseeable future projects whose impacts may compound or increase the incremental effect of the proposed project (Pub. Resources Code § 21083; Cal. Code Regs., tit. 14, §§ 15064(h), 15065(c), 15130, and 15355). Cumulative socioeconomic impacts may occur when more than one project has an overlapping

construction schedule that creates a demand for workers that cannot be met by local labor, resulting in an influx of non-local workers and their dependents.

There are currently no other applications for power plants on the scale of the CPVVS that are before the Energy Commission and proposed for the Solano County area and that could compete with CPVVS for skilled labor. Although several proposed residential projects will require a labor supply for construction, there is a sufficient supply of skilled labor in Solano County, however, such that significant cumulative impacts are unlikely to occur as a result of labor demand from the CPVVS combining with demand from other projects. Other kinds of cumulative socioeconomic impacts are also unlikely, as the CPVVS's effects on housing, schools, and public services would be negligible. For these reasons, the CPVVS will not cause any adverse cumulative socioeconomic impacts.

5.10.4 Mitigation Measures

Since there are no significant adverse impacts caused by the project, no socioeconomic-specific mitigation measures are proposed.

However, since the project would be located within the Vacaville Unified School District and Travis Unified School District service area, the project would be subject to school impact fees. Any industrial development within the Vacaville Unified School District is currently charged a one-time assessment fee of $0.33 per square foot of principal building area (Flores, 2008). Any industrial developments within the Vacaville Travis Unified School District are currently charged a one-time assessment fee of $0.42 per square foot of principal building area (Hatcher, 2008). Based on 7,500 square feet of occupied structures, CPVVS will pay $5,625 in school impact fees. These school impact fees are considered full mitigation for any project impacts to these school districts.

5.10.5 Laws, Ordinances, Regulations, and Standards

A summary of the LORS, including the project's conformance to them, is presented in Table 5.10-13.

5.10.5.1 Federal LORS

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires federal agencies to consider whether the project may result in disproportionately high and adverse human health or environmental effects on any minority or low-income population. Although the CEC is not obligated as a matter of law to conduct an environmental justice analysis, since the signing of the Executive Order 12898, the CEC has typically included this topic in its power plant siting decisions to ensure that any potential adverse impacts are identified and addressed.

5.10.5.2 State LORS

Government Code Sections 65996 and 65997 provide the exclusive methods of considering and mitigating impacts on school facilities that might occur as a result of the development of real property. Education Code Section 17620, listed in Government Code Section 65997 as an approved mitigation method, allows school districts to levy a fee or other requirement against construction within the boundaries of the school district for the purpose of funding construction of school facilities.

TABLE 5.10-13
Laws, Ordinances, Regulations, and Standards for Socioeconomics

LORS	Requirements/Applicability	Administering Agency	AFC Section Explaining Conformance
Federal			
Civil Rights Act of 1964	Prohibits discrimination on the basis of race, color, or national origin. Applies to all federal agencies and agencies receiving federal funds.	Office of Civil Rights	Section 5.10.2
Executive Order 12898	Avoid disproportionately high and adverse impacts to minority and low-income members of the community. Applies only to federal agencies.	EPA	Section 5.10.2.4.9
State			
Government Code Sections 65996-65997	Establishes that the levy of a fee for construction of an industrial facility be considered mitigating impacts on school facilities. Vacaville Unified and Travis Unified School Districts may charge a one-time assessment fee to mitigate potential school impacts.	Vacaville Unified and Travis Unified School Districts	Section 5.10.2
Education Code Section 17620	Allows a school district to levy a fee against any construction within the boundaries of the district for the purpose of funding construction of school facilities. Vacaville Unified and Travis Unified School Districts may charge a one-time assessment fee to mitigate potential school impacts.	California Department of Education	Section 5.10.2
Local			
Solano County General Plan (1980 and 2008 Draft)	Comprehensive long-range plan to serve as the guide for the physical development of the County. Applies to facilities constructed and operated within Solano County boundaries.	Solano County	Section 5.10.5.3

5.10.5.3 Local LORS

5.10.5.3.1 Solano County

The existing Solano General Plan (Solano, 1980) does not contain an economic development element and does not have specific goals and policies that pertain to socioeconomics. However, Solano County is currently updating its general plan and as part of this process has issued the 2008

Components of the 2008 Draft General Plan (Solano, 2008c) relevant to socioeconomics include Chapter 6, Economic Development. Fifteen policies have been identified in the Draft General Plan including encouraging growth of businesses and attracting new business to locate within Solano County, locating these new developments within near proximity to residents and workers, targeting economic development toward particular industries or services areas with special importance to the future of Solano County's economy, encouraging industrial development to locate in areas with adequate services (including appropriate infrastructure), and improving infrastructure to support economic development.

5.10.6 Agencies and Agency Contacts

Table 5.10-14 provides a list of agencies and contacts of potentially responsible agencies. Copies of records of conversation are provided in Appendix 5.10B.

TABLE 5.10-14
Agency Contacts for Socioeconomics

Issue	Agency	Contact
Property valuation	California Board of Equalization 3321 Power Inn Road Suite 210 Sacramento, CA 95826	David Young Senior Specialist Property Appraiser (916) 445-4982
Property tax rate	Solano County Assessor/Recorder 675 Texas Street, Suite 2700 Fairfield, CA 94533	Lance Houser Assistant Assessor Recorder (707) 784-6202 rlhouser@solanocounty.com
School impact fees, School enrollment data, Potential enrollment impacts	Vacaville Unified School District 751 School St. Vacaville, CA 95688	Theresa Flores (707) 403-6121
School impact fees, School enrollment data, Potential enrollment impacts	Travis Unified School District 2751 De Ronde Dr. Fairfield, CA 94533	Kelly Hatcher Administrative Assistant for Business & Operations (707) 437-8229 khatcher@travisusd.k12.ca.us
Available resources, potential impacts to resources and average response times	Vacaville Fire Department 650 Merchant St. Vacaville, CA 95668	Staci Kendrick Management Analyst (707) 447-2252
Available resources, potential impacts to resources and average response times	Solano County Sheriff's Department 530 Union Avenue, Suite 1100 Fairfield, CA 94533	Paulette DuClair Sheriff Secretary (707) 421-7030

TABLE 5.10-14
Agency Contacts for Socioeconomics

Issue	Agency	Contact
Available resources, potential impacts to resources	Solano County Office of Emergency Services 530 Clay Street Fairfield, CA 94533	Kevin Ives Emergency Services Technician (707) 784-1600 knives@solanocounty.com
Availability of labor	Napa Solano Building Trade Council 2540 North Watney Way Fairfield, CA 94533	Lou Franchimon Business Manager (707) 426-6454

5.10.7 Permits and Permit Schedule

Permits dealing with the effects on public services are addressed as part of the building permit process. For example, school development fees are typically collected when the Applicant pays in-lieu building permit fees to the County. No permits are required to comply with the socioeconomic impacts of the project.

5.10.8 References

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APPENDIX 5.10A

Environmental Justice Analysis

APPENDIX 5.10A

Environmental Justice

Introduction

This report was prepared in compliance with Presidential Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (EO 12898), dated February 11, 1994. The purpose of this report is to determine whether or not disproportionately high and adverse human health or environmental effects of the proposed CPV Vaca Station (CPVVS) project are likely to fall on minority and/or low-income populations. This report focuses on the populations that are located within the area potentially affected by the CPVVS project. In accordance with EO 12898, this report documents where minority and low-income populations reside and examines if there are high and adverse impacts identified(as reported in the various environmental analysis sections of this AFC) where these impacts fall relative to these populations. This report also discusses the specific outreach efforts made to involve minority and low-income populations in the decision-making process. No high and adverse impacts are expected as a result of this project; therefore, no high and adverse human health or environmental effects of this project are expected to fall disproportionately on minority or low-income populations.

Studies Performed and Coordination Conducted

Overview of Executive Order 12898

EO 12898, issued by President Clinton in 1994, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…." In his memorandum transmitting EO 12898 to federal agencies, President Clinton further specified that, "each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the National Environmental Policy Act of 1969." Guidance on how to implement EO 12898 and conduct an Environmental Justice analysis has been issued by the President's Council on Environmental Quality (CEQ, 1997).

Methodology and Approach

The CPVVS project was evaluated for compliance with EO 12898. For this type of analysis, three fundamental evaluation measures are used.

1. *A determination is made as to which impacts of the project are high and adverse.*

The series of environmental analyses prepared for the CPVVS AFC were reviewed, and discussions with the environmental professionals who prepared these sections were

conducted to determine which environmental or human health impacts could reach the level of high and adverse after proposed mitigation measures were implemented. Neither EO 12898, nor any of the environmental justice guidance documents, contain official guidance on the definition of "high and adverse." For purposes of this analysis, adverse impacts identified by the professional analysts working on this AFC as "significant" under CEQA were considered to be synonymous with high and adverse impacts as described in EO 12898.

2. *A determination is made as to whether minority or low-income populations exist within the high and adverse impact zones.*

For information on the distribution of minority and low-income populations in the CPVVS project area, 2000 Census data were used. Race/ethnicity and income data were reviewed at the finest level available from the Census (i.e., Census Blocks for race/ethnicity and Census Block Groups for income). Tables 5.10A-1 and 5.10A-2 show the distribution of the population within the 6-mile radius by race/ethnicity and income, respectively. These tables are located at the end of this appendix.

3. *The spatial distribution of high and adverse impacts is reviewed to determine if these impacts are likely to fall disproportionately on the minority or low-income population.*

Since there is no specific guidance in EO 12898, the test of disproportionately is made on the basis described in the U.S. Environmental Protection Agency's (USEPA) *Draft Revised Guidance for Investigating Title VI Administrative Complaints Challenging Permits* (USEPA, June 2000). This guidance suggests using two to three standard deviations above the mean as a quantitative measure of disparate effect.

While the first two elements of this approach were conducted, no detailed distribution analysis was required to make a final determination. This was because professional analysts in each environmental and human health discipline reviewed for this AFC determined that no high and adverse (i.e., CEQA significant) human health or environmental effects were expected to remain after implementation of proposed mitigation measures.

Outreach to Minority and Low-Income Populations

EO 12898 requires Federal agencies to ensure effective public participation and access to information. Consequently, a key component of compliance with EO 12898 is outreach to the potentially affected minority and/or low-income population to discover issues of importance that may not otherwise be apparent.

As part of the AFC process, the California Energy Commission will provide information to residents in the area and provide opportunities for their involvement.

The California Energy Commission typically:

- Mails written notice to all property owners within 1,000 feet of the site and within 500 feet of the centerline of all linear corridors
- Publishes notice in the local newspaper announcing public workshops and hearings
- Provides access to information by submitting copies of key documents to local libraries and providing materials via a web page

- Holds hearings and workshops in the local community
- Assigns a public advisor to assist the public in participating in the process

Demographic Analysis

Distribution of the Minority Population

Based on the 2000 Census, the total population within a 6-mile radius of the CPVVS site is approximately 100,710. The racial minority population, in the Census Blocks within the 6-mile radius of the CPVVS site, comprises approximately 29 percent of this total population while the ethnic minority (as represented by individuals of Hispanic origin) comprises about 17 percent (see Table 5.10A-1). Figure 5.10-1 (figures are in Volume I, Section 5.10) identifies the non-White racial and ethnic minority population percentages of Census Blocks in the vicinity of the CPVVS based on 2000 Census data. As shown in Figure 5.10-1, about 12 percent the Census Blocks in the vicinity of the CPVVS are above 50 percent minority. These Census Blocks have minority population densities high enough (i.e., greater than 50 percent) to be considered minority populations based on the guidance contained in CEQ (1997).

Distribution of the Low-Income Population

Based on the 2000 Census, the total population for whom poverty status is determined within a 6-mile radius of the CPVVS site was approximately 110,290. The low-income population, in the Census Block Groups within the 6-mile radius of the CPVVS site, comprised approximately six percent of this total population (see Table 5.10A-2). Figure 5.10-2 in Volume I, Section 5.10, identifies the low-income population percentages of Census Block Groups in the vicinity of CPVVS based on 2000 Census data. Unlike the CEQ (1997) guidance on minority population, none of the environmental justice guidance documents contain a quantitative definition of how many low-income individuals it takes to comprise a low-income population. In the absence of guidance, for this analysis the density used to identify minority populations (i.e., 50 percent or greater) was also used to identify low-income populations. As shown on Figure 5.10-2, there are no Census Block Groups in the project vicinity with 50 percent or more low-income population.

Results and Conclusion

As discussed in the *Methodology and Approach* section above, for purposes of this analysis, CEQA-significant adverse impacts are considered synonymous with high and adverse impacts as described in EO 12898. As reported in the series of environmental analyses prepared for the CPVVS AFC, and further confirmed through discussions with the environmental professionals who prepared those sections, no significant adverse impacts are expected as a result of this project after proposed mitigation measures are implemented. Consequently, none of the impacts of this project can be described as high and adverse in the context of EO 12898. As there are no high and adverse impacts expected as a result of this project, this analysis concludes that no high and adverse human health or environmental effects of this project are expected to fall disproportionately on minority or low-income populations. The CPVVS project can, therefore, be considered to be consistent with the policy established in EO 12898.

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TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952533001080	84	68	16	19.0	15	17.9
060952529042005	166	150	16	9.6	4	2.4
060952529042006	108	93	15	13.9	17	15.7
060952534015038	21	17	4	19.0	2	9.5
060952533001084	181	145	36	19.9	31	17.1
060952533001085	156	131	25	16.0	22	14.1
060952534024016	6	6	0	0.0	0	0.0
060952529041037	58	47	11	19.0	1	1.7
060952529041038	45	22	23	51.1	17	37.8
060952533001079	2	2	0	0.0	0	0.0
060952529042008	110	105	5	4.5	21	19.1
060952529042010	2	2	0	0.0	0	0.0
060952529042009	118	95	23	19.5	5	4.2
060952533001075	19	15	4	21.1	14	73.7
060952529041036	152	135	17	11.2	28	18.4
060952533001029	7	2	5	71.4	5	71.4
060952533001030	11	7	4	36.4	6	54.5
060952533001026	7	6	1	14.3	1	14.3
060952533001025	17	11	6	35.3	5	29.4
060952533001024	16	5	11	68.8	11	68.8
060952529033016	132	114	18	13.6	24	18.2
060952529042037	1	0	1	100.0	0	0.0
060952529033015	38	36	2	5.3	0	0.0
060952533001033	9	5	4	44.4	6	66.7
060952532024000	9	9	0	0.0	0	0.0
060952532021001	18	12	6	33.3	6	33.3
060952532021000	27	27	0	0.0	8	29.6
060952532024001	13	13	0	0.0	2	15.4
060952532021002	7	0	7	100.0	7	100.0
060952532021003	47	44	3	6.4	10	21.3
060952529042032	31	14	17	54.8	14	45.2
060952529042033	103	84	19	18.4	16	15.5
060952529043003	7	7	0	0.0	0	0.0
060952529043004	22	18	4	18.2	3	13.6
060952533001098	59	41	18	30.5	8	13.6
060952532021004	127	120	7	5.5	13	10.2
060952529043008	10	5	5	50.0	0	0.0
060952533001034	2	2	0	0.0	0	0.0
060952533001037	8	3	5	62.5	4	50.0
060952532021005	75	72	3	4.0	8	10.7
060952529043005	4	4	0	0.0	0	0.0

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532024002	1,198	926	272	22.7	199	16.6
060952533001097	33	32	1	3.0	0	0.0
060952532021011	757	561	196	25.9	98	12.9
060952532024003	47	30	17	36.2	6	12.8
060952532021006	50	47	3	6.0	9	18.0
060952532024004	31	23	8	25.8	2	6.5
060952532021007	95	68	27	28.4	0	0.0
060952532024005	112	72	40	35.7	7	6.3
060952532024007	282	199	83	29.4	21	7.4
060952532021019	82	68	14	17.1	23	28.0
060952532024006	217	162	55	25.3	25	11.5
060952529042034	18	18	0	0.0	3	16.7
060952529043010	2	2	0	0.0	0	0.0
060952532021008	37	30	7	18.9	1	2.7
060952529043022	15	7	8	53.3	3	20.0
060952529043012	48	41	7	14.6	2	4.2
060952532021009	29	10	19	65.5	3	10.3
060952532021010	26	24	2	7.7	10	38.5
060952529043014	10	10	0	0.0	0	0.0
060952532024008	241	197	44	18.3	28	11.6
060952532021014	219	182	37	16.9	29	13.2
060952532021017	68	40	28	41.2	9	13.2
060952532021018	27	20	7	25.9	2	7.4
060952532024009	82	76	6	7.3	8	9.8
060952532021016	27	22	5	18.5	6	22.2
060952532021015	65	54	11	16.9	4	6.2
060952532021013	105	89	16	15.2	10	9.5
060952532021012	106	81	25	23.6	26	24.5
060952532024010	138	127	11	8.0	17	12.3
060952529043015	17	10	7	41.2	8	47.1
060952532021023	122	104	18	14.8	15	12.3
060952532021020	191	160	31	16.2	9	4.7
060952532021021	118	96	22	18.6	20	16.9
060952533001073	4	4	0	0.0	0	0.0
060952532021022	40	26	14	35.0	0	0.0
060952532024011	166	133	33	19.9	15	9.0
060952532021024	72	61	11	15.3	16	22.2
060952533001025	17	11	6	35.3	5	29.4
060952533001072	2	2	0	0.0	0	0.0
060952532021026	39	33	6	15.4	0	0.0
060952532021025	68	53	15	22.1	9	13.2

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532024013	127	114	13	10.2	0	0.0
060952532021028	51	49	2	3.9	6	11.8
060952532021027	222	179	43	19.4	34	15.3
060952532024012	142	116	26	18.3	8	5.6
060952532021032	84	71	13	15.5	5	6.0
060952532024015	137	109	28	20.4	22	16.1
060952532024014	184	176	8	4.3	2	1.1
060952533001042	6	0	6	100.0	6	100.0
060952532024016	49	39	10	20.4	3	6.1
060952529043016	16	14	2	12.5	1	6.3
060952529043017	232	186	46	19.8	45	19.4
060952532021029	74	56	18	24.3	6	8.1
060952532021030	39	34	5	12.8	1	2.6
060952532021031	237	207	30	12.7	18	7.6
060952533001096	4	4	0	0.0	1	25.0
060952529033018	54	52	2	3.7	5	9.3
060952532021035	113	102	11	9.7	11	9.7
060952532024026	25	24	1	4.0	4	16.0
060952532021034	104	80	24	23.1	23	22.1
060952532024017	105	76	29	27.6	12	11.4
060952529022002	1,059	982	77	7.3	37	3.5
060952533001047	9	9	0	0.0	7	77.8
060952529043018	142	114	28	19.7	47	33.1
060952533001065	5	4	1	20.0	1	20.0
060952532021033	111	93	18	16.2	30	27.0
060952533001063	25	15	10	40.0	9	36.0
060952532021036	133	100	33	24.8	8	6.0
060952529043021	162	152	10	6.2	15	9.3
060952529043019	3	3	0	0.0	0	0.0
060952529043023	6	6	0	0.0	0	0.0
060952529043020	53	40	13	24.5	6	11.3
060952533001099	2	2	0	0.0	0	0.0
060952532012002	151	134	17	11.3	12	7.9
060952532012000	4	3	1	25.0	0	0.0
060952532021037	70	45	25	35.7	13	18.6
060952532024018	51	44	7	13.7	10	19.6
060952533001043	8	7	1	12.5	0	0.0
060952533001044	27	13	14	51.9	11	40.7
060952532024019	256	226	30	11.7	18	7.0
060952529022021	33	31	2	6.1	0	0.0
060952532024024	8	8	0	0.0	0	0.0

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532024023	12	12	0	0.0	1	8.3
060952532024025	14	12	2	14.3	1	7.1
060952532012003	15	9	6	40.0	2	13.3
060952532021038	50	35	15	30.0	23	46.0
060952532021039	87	78	9	10.3	12	13.8
060952532012004	25	23	2	8.0	1	4.0
060952529022020	36	34	2	5.6	1	2.8
060952532024027	2	1	1	50.0	0	0.0
060952532024028	13	13	0	0.0	0	0.0
060952532021040	34	34	0	0.0	4	11.8
060952532012005	256	228	28	10.9	21	8.2
060952532024022	6	3	3	50.0	2	33.3
060952532021041	27	21	6	22.2	6	22.2
060952529022017	203	199	4	2.0	4	2.0
060952532024029	35	31	4	11.4	4	11.4
060952529022004	37	35	2	5.4	5	13.5
060952532023000	680	397	283	41.6	420	61.8
060952532012006	56	47	9	16.1	1	1.8
060952529023000	255	235	20	7.8	5	2.0
060952532011005	26	20	6	23.1	0	0.0
060952532012007	59	58	1	1.7	10	16.9
060952532012011	85	85	0	0.0	3	3.5
060952532012012	48	45	3	6.3	2	4.2
060952529022016	58	58	0	0.0	1	1.7
060952529022005	53	52	1	1.9	0	0.0
060952529043024	7	5	2	28.6	0	0.0
060952533001066	19	15	4	21.1	4	21.1
060952532012008	59	54	5	8.5	2	3.4
060952529022006	45	45	0	0.0	3	6.7
060952532024030	10	3	7	70.0	0	0.0
060952529022007	32	30	2	6.3	0	0.0
060952532024020	70	33	37	52.9	20	28.6
060952532024021	109	81	28	25.7	39	35.8
060952529022008	61	61	0	0.0	0	0.0
060952532022006	130	95	35	26.9	30	23.1
060952532012009	102	91	11	10.8	10	9.8
060952532022000	1,093	624	469	42.9	671	61.4
060952529023001	69	64	5	7.2	1	1.4
060952529022015	68	68	0	0.0	0	0.0
060952529022009	59	56	3	5.1	6	10.2
060952532022005	103	55	48	46.6	45	43.7

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532012010	41	41	0	0.0	0	0.0
060952532024031	106	78	28	26.4	26	24.5
060952529043025	37	27	10	27.0	12	32.4
060952529022014	71	66	5	7.0	5	7.0
060952532013001	282	248	34	12.1	21	7.4
060952532013000	40	34	6	15.0	4	10.0
060952532022004	102	64	38	37.3	31	30.4
060952532031000	75	66	9	12.0	1	1.3
060952532032000	189	165	24	12.7	10	5.3
060952529022010	69	62	7	10.1	1	1.4
060952532032001	3	3	0	0.0	0	0.0
060952532031004	67	64	3	4.5	8	11.9
060952532022003	105	80	25	23.8	24	22.9
060952532022002	69	36	33	47.8	36	52.2
060952529024000	192	150	42	21.9	16	8.3
060952529021001	1	1	0	0.0	0	0.0
060952529022011	73	70	3	4.1	3	4.1
060952533001071	3	3	0	0.0	0	0.0
060952532022007	173	100	73	42.2	112	64.7
060952532013007	57	55	2	3.5	7	12.3
060952532022008	235	115	120	51.1	149	63.4
060952529022012	66	65	1	1.5	0	0.0
060952532013006	154	133	21	13.6	23	14.9
060952532031002	2	0	2	100.0	0	0.0
060952532031003	259	189	70	27.0	39	15.1
060952532031007	7	7	0	0.0	1	14.3
060952532022009	541	264	277	51.2	336	62.1
060952532032004	111	99	12	10.8	25	22.5
060952532032003	32	26	6	18.8	4	12.5
060952532032009	42	37	5	11.9	3	7.1
060952529022013	63	57	6	9.5	4	6.3
060952532023002	460	204	256	55.7	316	68.7
060952529021002	767	529	238	31.0	107	14.0
060952529023002	194	156	38	19.6	26	13.4
060952532032005	112	90	22	19.6	23	20.5
060952532031008	110	83	27	24.5	26	23.6
060952532031006	73	68	5	6.8	21	28.8
060952532031005	75	71	4	5.3	4	5.3
060952532032006	123	101	22	17.9	16	13.0
060952529023003	204	177	27	13.2	21	10.3
060952532032007	70	62	8	11.4	5	7.1

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532032008	75	52	23	30.7	19	25.3
060952532031010	71	50	21	29.6	13	18.3
060952532032018	56	43	13	23.2	15	26.8
060952532032014	59	50	9	15.3	13	22.0
060952532032013	56	46	10	17.9	10	17.9
060952532032012	48	46	2	4.2	0	0.0
060952532032011	72	56	16	22.2	12	16.7
060952532032010	74	70	4	5.4	4	5.4
060952532023004	293	174	119	40.6	167	57.0
060952529024001	40	33	7	17.5	7	17.5
060952532023003	56	39	17	30.4	33	58.9
060952532031009	95	75	20	21.1	25	26.3
060952529024011	222	169	53	23.9	16	7.2
060952529021003	234	167	67	28.6	26	11.1
060952531051002	38	37	1	2.6	4	10.5
060952532032016	29	29	0	0.0	1	3.4
060952532032017	39	37	2	5.1	2	5.1
060952532022010	129	81	48	37.2	52	40.3
060952532013008	82	78	4	4.9	3	3.7
060952532031012	72	61	11	15.3	5	6.9
060952532013009	65	63	2	3.1	1	1.5
060952529024002	54	41	13	24.1	6	11.1
060952529024003	72	56	16	22.2	4	5.6
060952532031011	65	56	9	13.8	18	27.7
060952529021004	295	234	61	20.7	37	12.5
060952529024004	61	49	12	19.7	5	8.2
060952531011000	176	124	52	29.5	83	47.2
060952529024008	63	57	6	9.5	10	15.9
060952531016010	33	32	1	3.0	1	3.0
060952529024010	211	176	35	16.6	19	9.0
060952532013010	73	65	8	11.0	9	12.3
060952529024009	38	35	3	7.9	0	0.0
060952532031013	71	67	4	5.6	10	14.1
060952532032015	184	156	28	15.2	14	7.6
060952532031014	61	56	5	8.2	7	11.5
060952532032019	79	69	10	12.7	23	29.1
060952532013011	50	39	11	22.0	9	18.0
060952532031016	75	58	17	22.7	16	21.3
060952532031015	76	71	5	6.6	16	21.1
060952532013014	21	21	0	0.0	0	0.0
060952532013013	29	29	0	0.0	1	3.4

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532031017	159	93	66	41.5	66	41.5
060952532031018	72	48	24	33.3	23	31.9
060952532013012	89	79	10	11.2	7	7.9
060952531016001	488	419	69	14.1	31	6.4
060952531011001	198	118	80	40.4	97	49.0
060952532014013	34	21	13	38.2	15	44.1
060952529024005	68	60	8	11.8	2	2.9
060952529024007	117	111	6	5.1	7	6.0
060952532022001	20	17	3	15.0	4	20.0
060952532031020	219	101	118	53.9	85	38.8
060952532031019	72	63	9	12.5	7	9.7
060952531016003	131	121	10	7.6	10	7.6
060952529024006	103	91	12	11.7	15	14.6
060952529021006	111	99	12	10.8	8	7.2
060952532013018	29	25	4	13.8	5	17.2
060952532013017	54	54	0	0.0	4	7.4
060952532033012	361	265	96	26.6	77	21.3
060952529024017	135	92	43	31.9	25	18.5
060952529021005	58	56	2	3.4	12	20.7
060952532013015	111	103	8	7.2	4	3.6
060952529024015	61	42	19	31.1	0	0.0
060952532033011	110	95	15	13.6	10	9.1
060952529024014	142	101	41	28.9	12	8.5
060952529024016	147	102	45	30.6	23	15.6
060952532033010	27	21	6	22.2	3	11.1
060952532014019	49	44	5	10.2	3	6.1
060952532033009	36	31	5	13.9	0	0.0
060952532033008	34	31	3	8.8	12	35.3
060952532033007	53	40	13	24.5	11	20.8
060952532033006	57	46	11	19.3	14	24.6
060952532033005	19	11	8	42.1	3	15.8
060952529024013	54	30	24	44.4	10	18.5
060952532033004	49	39	10	20.4	18	36.7
060952532014018	63	60	3	4.8	8	12.7
060952531011003	25	20	5	20.0	6	24.0
060952529024020	45	28	17	37.8	4	8.9
060952531011002	120	72	48	40.0	48	40.0
060952529024018	115	95	20	17.4	15	13.0
060952529024019	67	54	13	19.4	5	7.5
060952531051007	240	191	49	20.4	63	26.3
060952531051006	3	3	0	0.0	0	0.0

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952532013016	10	10	0	0.0	2	20.0
060952532033014	80	79	1	1.3	15	18.8
060952532033013	46	41	5	10.9	4	8.7
060952529024021	48	35	13	27.1	8	16.7
060952529024022	86	67	19	22.1	7	8.1
060952529043031	50	48	2	4.0	12	24.0
060952531051008	112	71	41	36.6	40	35.7
060952529024024	372	295	77	20.7	44	11.8
060952532033015	6	6	0	0.0	3	50.0
060952529024029	225	158	67	29.8	40	17.8
060952532033016	30	24	6	20.0	9	30.0
060952531011004	13	10	3	23.1	3	23.1
060952531051003	113	107	6	5.3	4	3.5
060952529021007	107	95	12	11.2	2	1.9
060952533001103	6	6	0	0.0	6	100.0
060952531011016	76	55	21	27.6	16	21.1
060952529024028	100	94	6	6.0	0	0.0
060952533001104	95	70	25	26.3	6	6.3
060952529024023	49	41	8	16.3	9	18.4
060952529043027	2	2	0	0.0	0	0.0
060952531051005	1,346	865	481	35.7	295	21.9
060952531013002	55	55	0	0.0	2	3.6
060952531011015	20	19	1	5.0	4	20.0
060952531013001	61	55	6	9.8	3	4.9
060952531014004	57	52	5	8.8	2	3.5
060952531013000	32	30	2	6.3	3	9.4
060952529024041	29	26	3	10.3	0	0.0
060952533001105	2	2	0	0.0	0	0.0
060952531012005	47	37	10	21.3	1	2.1
060952531012000	11	10	1	9.1	2	18.2
060952531014005	74	58	16	21.6	15	20.3
060952533001069	8	2	6	75.0	6	75.0
060952533001068	8	8	0	0.0	0	0.0
060952531011008	52	36	16	30.8	28	53.8
060952531015003	46	42	4	8.7	9	19.6
060952531015004	45	43	2	4.4	1	2.2
060952529024030	101	78	23	22.8	15	14.9
060952531014006	55	47	8	14.5	7	12.7
060952531051010	57	37	20	35.1	21	36.8
060952531011010	12	12	0	0.0	8	66.7
060952531051009	78	52	26	33.3	18	23.1

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952531011011	32	13	19	59.4	8	25.0
060952531012012	6	5	1	16.7	0	0.0
060952531015005	194	141	53	27.3	27	13.9
060952531016000	110	94	16	14.5	20	18.2
060952531013004	59	56	3	5.1	6	10.2
060952531013005	83	67	16	19.3	10	12.0
060952531013003	36	35	1	2.8	0	0.0
060952529024027	97	47	50	51.5	10	10.3
060952531014003	48	38	10	20.8	5	10.4
060952529024026	140	113	27	19.3	24	17.1
060952529024044	597	420	177	29.6	66	11.1
060952531012006	22	22	0	0.0	1	4.5
060952531015002	189	164	25	13.2	14	7.4
060952531012009	4	4	0	0.0	3	75.0
060952531014008	44	27	17	38.6	8	18.2
060952531012010	13	9	4	30.8	4	30.8
060952531012011	20	20	0	0.0	2	10.0
060952531013008	38	35	3	7.9	7	18.4
060952531013007	61	54	7	11.5	9	14.8
060952529024039	394	305	89	22.6	42	10.7
060952531051011	18	9	9	50.0	5	27.8
060952529024040	29	19	10	34.5	3	10.3
060952531014007	61	53	8	13.1	1	1.6
060952531013006	73	62	11	15.1	14	19.2
060952531051012	1	1	0	0.0	0	0.0
060952531051013	484	232	252	52.1	86	17.8
060952531014002	63	58	5	7.9	12	19.0
060952531013009	65	56	9	13.8	12	18.5
060952531012016	59	49	10	16.9	12	20.3
060952531012015	71	54	17	23.9	21	29.6
060952531012014	47	32	15	31.9	15	31.9
060952531014009	72	66	6	8.3	10	13.9
060952531012013	15	9	6	40.0	6	40.0
060952529024032	161	125	36	22.4	24	14.9
060952529024031	78	52	26	33.3	20	25.6
060952531016006	46	42	4	8.7	2	4.3
060952531053007	875	554	321	36.7	174	19.9
060952531013010	72	61	11	15.3	14	19.4
060952531013011	71	61	10	14.1	13	18.3
060952529024043	61	45	16	26.2	9	14.8
060952529024038	56	41	15	26.8	5	8.9

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952531012025	35	33	2	5.7	6	17.1
060952529043035	2	1	1	50.0	0	0.0
060952531052004	239	176	63	26.4	63	26.4
060952531013013	29	27	2	6.9	1	3.4
060952531013012	47	40	7	14.9	9	19.1
060952531014001	48	40	8	16.7	2	4.2
060952531012024	29	22	7	24.1	8	27.6
060952531052005	102	72	30	29.4	27	26.5
060952531012017	38	35	3	7.9	13	34.2
060952529024035	56	44	12	21.4	1	1.8
060952531012020	66	49	17	25.8	24	36.4
060952529024033	71	56	15	21.1	3	4.2
060952531071001	200	138	62	31.0	34	17.0
060952531014010	53	40	13	24.5	16	30.2
060952531052003	341	265	76	22.3	62	18.2
060952531052006	112	59	53	47.3	10	8.9
060952529024036	24	20	4	16.7	0	0.0
060952529024034	88	73	15	17.0	4	4.5
060952529024037	27	21	6	22.2	4	14.8
060952531016007	86	76	10	11.6	9	10.5
060952531014011	64	59	5	7.8	6	9.4
060952531052000	90	67	23	25.6	19	21.1
060952529083004	105	89	16	15.2	18	17.1
060952529083003	8	8	0	0.0	0	0.0
060952531015001	39	32	7	17.9	4	10.3
060952529083000	74	50	24	32.4	8	10.8
060952531016008	7	4	3	42.9	0	0.0
060952531014000	30	25	5	16.7	1	3.3
060952529091003	181	126	55	30.4	19	10.5
060952531012018	42	37	5	11.9	21	50.0
060952529091002	183	175	8	4.4	10	5.5
060952531052007	125	97	28	22.4	17	13.6
060952531012019	87	69	18	20.7	29	33.3
060952531015008	41	30	11	26.8	6	14.6
060952529083002	91	70	21	23.1	21	23.1
060952529083001	78	75	3	3.8	7	9.0
060952529091009	111	96	15	13.5	1	0.9
060952531081000	186	152	34	18.3	21	11.3
060952529091010	143	121	22	15.4	32	22.4
060952529091000	272	241	31	11.4	40	14.7
060952531014013	40	34	6	15.0	5	12.5

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529092007	4	4	0	0.0	0	0.0
060952531016009	121	113	8	6.6	8	6.6
060952531012022	53	43	10	18.9	24	45.3
060952529043037	19	14	5	26.3	2	10.5
060952531014012	39	28	11	28.2	9	23.1
060952529043038	10	10	0	0.0	3	30.0
060952531052002	107	83	24	22.4	16	15.0
060952529091004	86	75	11	12.8	5	5.8
060952531052001	73	55	18	24.7	4	5.5
060952529091007	159	127	32	20.1	14	8.8
060952529091005	154	139	15	9.7	15	9.7
060952529043039	44	29	15	34.1	22	50.0
060952531071007	96	68	28	29.2	25	26.0
060952531015006	154	138	16	10.4	22	14.3
060952531052008	108	69	39	36.1	34	31.5
060952533001107	10	7	3	30.0	0	0.0
060952529091001	135	104	31	23.0	19	14.1
060952529083007	86	68	18	20.9	11	12.8
060952529092009	533	406	127	23.8	45	8.4
060952529092008	19	19	0	0.0	3	15.8
060952531012023	30	18	12	40.0	8	26.7
060952531015007	132	102	30	22.7	28	21.2
060952529083005	217	160	57	26.3	35	16.1
060952531015000	16	13	3	18.8	1	6.3
060952529083006	90	63	27	30.0	8	8.9
060952531012021	44	36	8	18.2	15	34.1
060952529043040	30	29	1	3.3	7	23.3
060952531015009	55	45	10	18.2	2	3.6
060952531081001	218	150	68	31.2	54	24.8
060952531052009	100	80	20	20.0	30	30.0
060952531071002	127	87	40	31.5	37	29.1
060952531071003	117	92	25	21.4	14	12.0
060952529092020	107	96	11	10.3	8	7.5
060952529091006	94	60	34	36.2	21	22.3
060952531053010	84	59	25	29.8	23	27.4
060952531053008	82	69	13	15.9	28	34.1
060952533001067	22	20	2	9.1	0	0.0
060952531053009	34	24	10	29.4	13	38.2
060952531053006	55	41	14	25.5	11	20.0
060952531053005	158	96	62	39.2	54	34.2
060952531053003	146	105	41	28.1	35	24.0

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529091008	126	99	27	21.4	7	5.6
060952531053000	159	103	56	35.2	38	23.9
060952529043041	15	15	0	0.0	4	26.7
060952533001115	19	9	10	52.6	18	94.7
060952529083008	65	57	8	12.3	6	9.2
060952531053002	142	82	60	42.3	47	33.1
060952531053004	38	26	12	31.6	11	28.9
060952529092021	214	162	52	24.3	52	24.3
060952531053001	32	27	5	15.6	11	34.4
060952529043042	14	14	0	0.0	0	0.0
060952529092019	38	36	2	5.3	2	5.3
060952533001106	26	25	1	3.8	7	26.9
060952529092005	4	3	1	25.0	0	0.0
060952529083009	59	45	14	23.7	9	15.3
060952531015010	47	33	14	29.8	6	12.8
060952529043043	21	20	1	4.8	4	19.0
060952529092012	139	120	19	13.7	14	10.1
060952531081002	85	68	17	20.0	9	10.6
060952529083010	97	80	17	17.5	18	18.6
060952531071004	154	103	51	33.1	19	12.3
060952531015011	46	45	1	2.2	3	6.5
060952531081003	114	90	24	21.1	14	12.3
060952531082003	21	16	5	23.8	4	19.0
060952531071005	128	83	45	35.2	31	24.2
060952531061002	363	198	165	45.5	64	17.6
060952531061001	129	106	23	17.8	11	8.5
060952531071006	17	17	0	0.0	2	11.8
060952531061000	151	116	35	23.2	18	11.9
060952531081004	76	60	16	21.1	11	14.5
060952529092022	111	96	15	13.5	12	10.8
060952531072000	565	376	189	33.5	88	15.6
060952531062003	147	109	38	25.9	43	29.3
060952531062001	178	127	51	28.7	37	20.8
060952531062000	169	98	71	42.0	37	21.9
060952529082000	430	306	124	28.8	48	11.2
060952529101002	127	100	27	21.3	13	10.2
060952529092010	81	62	19	23.5	2	2.5
060952531062002	44	35	9	20.5	8	18.2
060952529092011	80	65	15	18.8	13	16.3
060952531071009	17	15	2	11.8	2	11.8
060952531062005	96	81	15	15.6	10	10.4

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529101001	36	25	11	30.6	5	13.9
060952531062004	42	31	11	26.2	13	31.0
060952531082002	29	24	5	17.2	1	3.4
060952531081008	88	85	3	3.4	7	8.0
060952529092000	3	0	3	100.0	0	0.0
060952529092013	61	50	11	18.0	9	14.8
060952531081007	108	85	23	21.3	4	3.7
060952531071013	48	39	9	18.8	3	6.3
060952529082002	29	29	0	0.0	0	0.0
060952529101000	462	333	129	27.9	69	14.9
060952529092017	129	114	15	11.6	7	5.4
060952529103004	415	303	112	27.0	48	11.6
060952531071012	111	77	34	30.6	13	11.7
060952531071010	27	23	4	14.8	4	14.8
060952531082005	72	58	14	19.4	8	11.1
060952529092015	141	117	24	17.0	15	10.6
060952529082001	41	25	16	39.0	3	7.3
060952531072002	119	74	45	37.8	26	21.8
060952529092016	45	43	2	4.4	4	8.9
060952531072001	115	78	37	32.2	27	23.5
060952529092014	79	55	24	30.4	13	16.5
060952529103000	212	162	50	23.6	11	5.2
060952531081005	67	52	15	22.4	2	3.0
060952531081006	227	160	67	29.5	29	12.8
060952529092018	6	6	0	0.0	2	33.3
060952529082010	31	31	0	0.0	2	6.5
060952531071011	88	50	38	43.2	32	36.4
060952531062006	48	37	11	22.9	7	14.6
060952531062007	22	17	5	22.7	5	22.7
060952531081009	178	118	60	33.7	21	11.8
060952531061003	97	74	23	23.7	22	22.7
060952529101005	112	77	35	31.3	23	20.5
060952531072010	105	79	26	24.8	22	21.0
060952529103001	155	126	29	18.7	21	13.5
060952531071014	9	9	0	0.0	3	33.3
060952529101009	83	46	37	44.6	18	21.7
060952531061004	76	53	23	30.3	21	27.6
060952529082009	22	22	0	0.0	0	0.0
060952531063001	20	17	3	15.0	3	15.0
060952529101004	89	60	29	32.6	17	19.1
060952529103003	107	68	39	36.4	25	23.4

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952531016012	8	3	5	62.5	4	50.0
060952531063000	814	497	317	38.9	139	17.1
060952529103002	106	84	22	20.8	21	19.8
060952531016013	13	8	5	38.5	2	15.4
060952531072003	112	92	20	17.9	17	15.2
060952529101003	75	48	27	36.0	7	9.3
060952531082006	5,649	2,856	2,793	49.4	1,433	25.4
060952529104003	294	228	66	22.4	40	13.6
060952531063002	176	115	61	34.7	38	21.6
060952531072009	95	68	27	28.4	25	26.3
060952529082011	76	47	29	38.2	10	13.2
060952529082003	132	83	49	37.1	27	20.5
060952529101010	130	109	21	16.2	22	16.9
060952531072004	165	117	48	29.1	51	30.9
060952531072005	71	63	8	11.3	8	11.3
060952529101008	88	76	12	13.6	6	6.8
060952531082001	180	134	46	25.6	27	15.0
060952531072011	136	100	36	26.5	21	15.4
060952531063003	80	49	31	38.8	18	22.5
060952531063004	156	143	13	8.3	11	7.1
060952529081005	14	14	0	0.0	0	0.0
060952529104002	45	27	18	40.0	3	6.7
060952529082004	19	4	15	78.9	12	63.2
060952529082005	10	4	6	60.0	1	10.0
060952529104000	51	36	15	29.4	6	11.8
060952529101007	74	41	33	44.6	10	13.5
060952529101012	63	51	12	19.0	5	7.9
060952529101011	45	29	16	35.6	0	0.0
060952529082007	121	83	38	31.4	18	14.9
060952529082006	621	433	188	30.3	71	11.4
060952531072012	102	95	7	6.9	8	7.8
060952529081000	369	268	101	27.4	49	13.3
060952529104001	26	18	8	30.8	0	0.0
060952531081010	81	38	43	53.1	32	39.5
060952531072008	137	95	42	30.7	37	27.0
060952529081004	67	52	15	22.4	3	4.5
060952531072006	118	109	9	7.6	3	2.5
060952529103009	88	73	15	17.0	4	4.5
060952529081006	47	36	11	23.4	6	12.8
060952531082021	24	18	6	25.0	1	4.2
060952531081011	104	73	31	29.8	29	27.9

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529101006	77	66	11	14.3	7	9.1
060952531082022	163	127	36	22.1	35	21.5
060952531063005	216	148	68	31.5	27	12.5
060952531073000	184	138	46	25.0	43	23.4
060952529081001	41	26	15	36.6	12	29.3
060952529081003	125	85	40	32.0	22	17.6
060952529081007	31	25	6	19.4	6	19.4
060952531072007	145	109	36	24.8	39	26.9
060952529104004	72	56	16	22.2	17	23.6
060952529103008	169	116	53	31.4	35	20.7
060952533001069	8	2	6	75.0	6	75.0
060952531081012	71	59	12	16.9	10	14.1
060952531082020	62	43	19	30.6	5	8.1
060952531082000	588	380	208	35.4	173	29.4
060952529081002	76	61	15	19.7	11	14.5
060952531063009	134	93	41	30.6	13	9.7
060952529104005	83	63	20	24.1	11	13.3
060952529104006	214	165	49	22.9	20	9.3
060952529103007	78	51	27	34.6	13	16.7
060952529103006	121	83	38	31.4	14	11.6
060952529081008	20	18	2	10.0	0	0.0
060952529104007	38	25	13	34.2	3	7.9
060952531081013	93	67	26	28.0	11	11.8
060952529081009	82	49	33	40.2	12	14.6
060952531073009	717	403	314	43.8	266	37.1
060952529103005	137	102	35	25.5	15	10.9
060952531063010	84	66	18	21.4	15	17.9
060952529102005	129	93	36	27.9	36	27.9
060952531063006	39	24	15	38.5	11	28.2
060952529102000	151	124	27	17.9	21	13.9
060952531073012	33	33	0	0.0	3	9.1
060952529103010	119	69	50	42.0	14	11.8
060952531082019	110	72	38	34.5	43	39.1
060952529103011	213	113	100	46.9	45	21.1
060952529081010	31	12	19	61.3	13	41.9
060952529082008	132	105	27	20.5	31	23.5
060952529102001	92	86	6	6.5	8	8.7
060952531073001	63	38	25	39.7	16	25.4
060952531073003	86	55	31	36.0	6	7.0
060952531073004	248	159	89	35.9	40	16.1
060952529102003	183	139	44	24.0	12	6.6

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529102004	142	99	43	30.3	39	27.5
060952531073013	36	31	5	13.9	0	0.0
060952531063008	101	63	38	37.6	21	20.8
060952529081011	172	129	43	25.0	37	21.5
060952531082018	38	27	11	28.9	3	7.9
060952531073002	56	51	5	8.9	8	14.3
060952531073014	18	15	3	16.7	0	0.0
060952529104009	50	33	17	34.0	12	24.0
060952531082023	42	37	5	11.9	0	0.0
060952529104008	42	32	10	23.8	1	2.4
060952529102002	138	97	41	29.7	19	13.8
060952531073011	28	24	4	14.3	0	0.0
060952531063007	77	53	24	31.2	4	5.2
060952531073015	233	151	82	35.2	116	49.8
060952529081012	113	70	43	38.1	21	18.6
060952531082024	22	17	5	22.7	3	13.6
060952529102008	160	112	48	30.0	27	16.9
060952531073007	74	50	24	32.4	19	25.7
060952529102007	213	168	45	21.1	40	18.8
060952531073006	67	48	19	28.4	28	41.8
060952531073005	104	74	30	28.8	13	12.5
060952531082026	74	54	20	27.0	13	17.6
060952531073010	79	72	7	8.9	3	3.8
060952529102006	98	76	22	22.4	15	15.3
060952529103013	184	132	52	28.3	25	13.6
060952529103012	43	31	12	27.9	10	23.3
060952531073008	81	30	51	63.0	16	19.8
060952531082025	63	42	21	33.3	4	6.3
060952531074005	350	209	141	40.3	56	16.0
060952533001108	32	30	2	6.3	2	6.3
060952531074004	59	33	26	44.1	23	39.0
060952531074002	201	126	75	37.3	69	34.3
060952531074000	210	172	38	18.1	27	12.9
060952533001109	24	23	1	4.2	0	0.0
060952531082015	33	30	3	9.1	0	0.0
060952531082012	82	61	21	25.6	33	40.2
060952531082013	88	66	22	25.0	34	38.6
060952531082014	43	40	3	7.0	16	37.2
060952529071008	72	43	29	40.3	7	9.7
060952529071001	171	129	42	24.6	23	13.5
060952529071009	90	79	11	12.2	6	6.7

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529071000	254	198	56	22.0	33	13.0
060952529073002	320	206	114	35.6	65	20.3
060952529073001	289	176	113	39.1	28	9.7
060952533001110	4	4	0	0.0	0	0.0
060952529073000	53	43	10	18.9	15	28.3
060952529074010	218	181	37	17.0	22	10.1
060952529074006	399	284	115	28.8	61	15.3
060952529074005	2	2	0	0.0	0	0.0
060952529074004	8	8	0	0.0	0	0.0
060952531082016	15	13	2	13.3	0	0.0
060952529071007	177	133	44	24.9	23	13.0
060952531074003	50	41	9	18.0	11	22.0
060952531082017	36	29	7	19.4	2	5.6
060952529073011	278	183	95	34.2	45	16.2
060952529074009	234	175	59	25.2	45	19.2
060952531074001	39	28	11	28.2	6	15.4
060952529073003	143	91	52	36.4	18	12.6
060952529071002	41	20	21	51.2	8	19.5
060952529073010	86	64	22	25.6	6	7.0
060952529073004	24	24	0	0.0	0	0.0
060952530001000	3,390	1,781	1,609	47.5	637	18.8
060952529073006	202	156	46	22.8	43	21.3
060952529073009	20	8	12	60.0	5	25.0
060952529071011	96	62	34	35.4	12	12.5
060952529073005	219	138	81	37.0	31	14.2
060952529074011	145	108	37	25.5	20	13.8
060952529074007	45	43	2	4.4	7	15.6
060952529071010	136	100	36	26.5	17	12.5
060952529074008	150	116	34	22.7	30	20.0
060952529071003	38	30	8	21.1	8	21.1
060952529073008	36	17	19	52.8	3	8.3
060952529073007	97	69	28	28.9	14	14.4
060952529071006	234	190	44	18.8	26	11.1
060952529071012	108	75	33	30.6	12	11.1
060952529071014	159	102	57	35.8	28	17.6
060952529071004	169	146	23	13.6	25	14.8
060952529073015	45	32	13	28.9	6	13.3
060952529071005	67	54	13	19.4	8	11.9
060952529073012	51	21	30	58.8	10	19.6
060952529074014	28	20	8	28.6	0	0.0
060952529073013	131	73	58	44.3	27	20.6

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529073014	28	18	10	35.7	1	3.6
060952529073017	588	370	218	37.1	91	15.5
060952529074016	1	0	1	100.0	0	0.0
060952529074013	28	18	10	35.7	0	0.0
060952529071013	215	147	68	31.6	26	12.1
060952529074012	360	221	139	38.6	54	15.0
060952529073016	86	54	32	37.2	15	17.4
060952529074017	7	7	0	0.0	2	28.6
060952529074019	2	2	0	0.0	0	0.0
060952529071015	123	82	41	33.3	16	13.0
060952529074020	19	13	6	31.6	1	5.3
060952529071018	83	67	16	19.3	8	9.6
060952529074023	256	185	71	27.7	37	14.5
060952529073018	93	50	43	46.2	9	9.7
060952529073020	106	77	29	27.4	14	13.2
060952529073019	174	124	50	28.7	26	14.9
060952529071016	122	82	40	32.8	3	2.5
060952529071019	86	55	31	36.0	10	11.6
060952529071017	133	88	45	33.8	20	15.0
060952529074025	127	82	45	35.4	11	8.7
060952533001114	9	2	7	77.8	7	77.8
060952529074024	132	87	45	34.1	18	13.6
060952529071020	59	36	23	39.0	11	18.6
060952529074026	275	193	82	29.8	37	13.5
060952529072002	44	26	18	40.9	7	15.9
060952529074027	189	106	83	43.9	27	14.3
060952523084000	2	2	0	0.0	0	0.0
060952529074028	241	127	114	47.3	39	16.2
060952529072000	161	125	36	22.4	18	11.2
060952529074029	92	52	40	43.5	3	3.3
060952529072001	126	84	42	33.3	29	23.0
060952529072005	155	108	47	30.3	21	13.5
060952529072003	115	75	40	34.8	17	14.8
060952529072009	394	263	131	33.2	65	16.5
060952529072004	117	85	32	27.4	14	12.0
060952529072007	104	79	25	24.0	21	20.2
060952529074032	102	64	38	37.3	18	17.6
060952529072008	86	72	14	16.3	9	10.5
060952529072006	85	56	29	34.1	10	11.8
060952529074031	286	143	143	50.0	29	10.1
060952529072014	59	36	23	39.0	6	10.2

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952529072013	312	219	93	29.8	35	11.2
060952529074022	56	50	6	10.7	5	8.9
060952529074030	134	91	43	32.1	23	17.2
060952529072015	133	95	38	28.6	19	14.3
060952529072017	179	137	42	23.5	15	8.4
060952529074033	26	21	5	19.2	10	38.5
060952529072016	91	75	16	17.6	9	9.9
060952529074034	125	86	39	31.2	4	3.2
060952529074035	76	42	34	44.7	5	6.6
060952529074037	74	40	34	45.9	4	5.4
060952529072012	54	47	7	13.0	4	7.4
060952529072011	86	68	18	20.9	17	19.8
060952529074036	119	69	50	42.0	16	13.4
060952531082008	8	8	0	0.0	0	0.0
060952523093006	5	3	2	40.0	3	60.0
060952535001031	23	22	1	4.3	0	0.0
060952535001030	4	4	0	0.0	0	0.0
060952523092002	4	0	4	100.0	0	0.0
060952535001028	8	8	0	0.0	0	0.0
060952523092004	6	6	0	0.0	0	0.0
060952535001059	1	1	0	0.0	0	0.0
060952535001058	10	2	8	80.0	8	80.0
060952523092010	179	99	80	44.7	24	13.4
060952523092006	20	7	13	65.0	13	65.0
060952523093010	19	16	3	15.8	3	15.8
060952523092007	28	22	6	21.4	0	0.0
060952523092009	191	114	77	40.3	29	15.2
060952523092008	3	1	2	66.7	0	0.0
060952523093031	174	86	88	50.6	34	19.5
060952535001033	1	0	1	100.0	1	100.0
060952528001000	708	425	283	40.0	92	13.0
060952535001034	11	11	0	0.0	0	0.0
060952528001003	6,140	3,940	2,200	35.8	692	11.3
060952523093014	202	116	86	42.6	26	12.9
060952528001004	3,118	2,117	1,001	32.1	326	10.5
060952535001034	11	11	0	0.0	0	0.0
060952523093018	255	132	123	48.2	17	6.7
060952523093021	161	39	122	75.8	22	13.7
060952523093019	49	7	42	85.7	4	8.2
060952523093022	139	55	84	60.4	20	14.4
060952523093026	6	1	5	83.3	0	0.0

TABLE 5.10A-1
2000 Census Racial/Ethnic Data by Census Block CPVVS 6-mile Radius

Census Block	Population	White	Minority	Percent Minority	Hispanic Origin*	Percent Hispanic
060952523093024	94	44	50	53.2	18	19.1
060952523093020	6	5	1	16.7	1	16.7
060952523093023	49	25	24	49.0	3	6.1
060952523093025	27	10	17	63.0	8	29.6
060952535001033	1	0	1	100.0	1	100.0
060952535001036	3	1	2	66.7	0	0.0
060952535001036	3	1	2	66.7	0	0.0
060952535001033	1	0	1	100.0	1	100.0
060952535001036	3	1	2	66.7	0	0.0
060952535001037	9	9	0	0.0	0	0.0
060952535001037	9	9	0	0.0	0	0.0
060952535001037	9	9	0	0.0	0	0.0
060952535001037	9	9	0	0.0	0	0.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952527025000	11	6	5	45.5	5	45.5
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
060952535001033	1	0	1	100.0	1	100.0
TOTAL	**100,706**	**71,385**	**29,321**	**29.1**	**17,531**	**17.4**

Source: 2000 Census.
* Hispanics or Latinos are those people who classified themselves in one of the specific Spanish, Hispanic, or Latino categories listed on the Census 2000 questionnaire—“Mexican, Mexican Am., Chicano,” “Puerto Rican,” or “Cuban”—as well as those who indicate that they are ”other Spanish/Hispanic/Latino.” People who identify their origin as “other Spanish/Hispanic/Latino” may be of any race. Thus, the percent Hispanic should not be added to percentages for racial (i.e., minority) categories.

TABLE 5.10A-2
2000 Census Low Income Data by Census Block Group CPVVS 6-mile Radius

Census Block Group	Total Population*	Population below Poverty Level	Percent Low-Income
060952523084	3,126	177	5.7
060952523092	3,684	84	2.3
060952523093	931	84	9.0
060952527025	3,373	41	1.2
060952528001	7,915	572	7.2
060952529021	1,555	27	1.7
060952529022	2,090	127	6.1
060952529023	651	0	0.0
060952529024	4,892	145	3.0
060952529033	1,371	40	2.9
060952529041	1,667	101	6.1
060952529042	753	65	8.6
060952529043	998	153	15.3
060952529071	2,603	163	6.3
060952529072	2,300	185	8.0
060952529073	3,101	122	3.9
060952529074	3,896	265	6.8
060952529081	1,168	5	0.4
060952529082	1,750	44	2.5
060952529083	896	154	17.2
060952529091	1,682	0	0.0
060952529092	1,740	30	1.7
060952529101	1,357	65	4.8
060952529102	1,507	150	10.0
060952529103	2,081	38	1.8
060952529104	899	5	0.6
060952530001	0	0	0
060952531011	742	118	15.9
060952531012	667	58	8.7
060952531013	871	49	5.6
060952531014	706	9	1.3
060952531015	1,026	10	1.0

TABLE 5.10A-2
2000 Census Low Income Data by Census Block Group CPVVS 6-mile Radius

Census Block Group	Total Population*	Population below Poverty Level	Percent Low-Income
060952531016	1,094	102	9.3
060952531051	2,282	398	17.4
060952531052	1,289	39	3.0
060952531053	1,831	216	11.8
060952531061	867	14	1.6
060952531062	768	55	7.2
060952531063	1,931	101	5.2
060952531071	1,116	98	8.8
060952531072	2,083	20	1.0
060952531073	2,050	206	10.0
060952531074	870	43	4.9
060952531081	1,681	36	2.1
060952531082	1,985	139	7.0
060952532011	1,349	32	2.4
060952532012	928	54	5.8
060952532013	1,275	8	0.6
060952532014	1,372	11	0.8
060952532021	4,056	72	1.8
060952532022	2,851	487	17.1
060952532023	1,450	404	27.9
060952532024	3,772	349	9.3
060952532031	1,804	111	6.2
060952532032	1,438	33	2.3
060952532033	827	11	1.3
060952533001	1,711	216	12.6
060952534015	3,405	92	2.7
060952534024	1,037	165	15.9
060952535001	1,167	149	12.8
TOTAL	**110,287**	**6,747**	**6.1**

Source: 2000 Census.
* Population numbers are only those for whom poverty was determined and exclude full-time college students.

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April 6, 2009

DOCKET
08-AFC-11
DATE
RECD. APR 06 2009

Mr. Rod Jones
Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: CPV Vaca Station (08-AFC-11)
Response to CEC Staff Data Requests 1 through 53

Dear Mr. Jones:

Attached please find one original and 12 copies of CPV Vaca Station, LLC's responses to California Energy Commission Staff Data Requests 1 through 53 for the Application for Certification for the CPV Vaca Station Project (08-AFC-11).

If you have any questions about this matter, please contact me at (916) 286-0278 or Sarah Madams at (916) 286-0249.

Sincerely,

CH2M HILL

Douglas M. Davy, Ph.D.
AFC Project Manager

Attachment

cc: A. Welch (CPV)
S. Madams

CH2M HILL
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April 6, 2009

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CH2M HILL

Douglas M. Davy, Ph.D.
AFC Project Manager

Attachment

cc: A. Welch (CPV)
S. Madams

Application for Certification

Response to CEC Staff Data Requests 1 through 53

CPV Vaca Station

Submitted by CPV Vacaville, LLC

Submitted to

California Energy Commission

With Technical Assistance by

CH2MHILL

April 2009

ES122007003SAC

Supplemental Filing

Response to CEC Staff Data Requests 1 through 53

In support of the

Application for Certification

for

CPV Vaca Station

Vacaville, California

(08-AFC-11)

Submitted to the:

California Energy Commission

Submitted by:

CPV Vacaville, LLC

With Technical Assistance by:

CH2MHILL

Sacramento, California

April 2009

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Introduction

Attached are CPV Vacaville, LLC's (CPVV's) responses to California Energy Commission (CEC) Staff data requests numbers 1 through 53 for the CPV Vaca Station (CPVVS) project (08-AFC-11). The CEC Staff served the data requests on March 5, 2009, as part of the discovery process for the CPVV project.

The responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as CEC Staff presented them and are keyed to the Data Request numbers (1 through 53). New or revised graphics or tables are numbered in reference to the Data Request number. For example, the first table used in response to Data Request 15 would be numbered Table DR15-1. The first figure used in response to Data Request 28 would be Figure DR28-1, and so on.

Additional tables, figures, or documents submitted in response to a data request (supporting data, stand-alone documents such as plans, folding graphics, etc.) are found at the end of a discipline-specific section and are not sequentially page-numbered consistently with the remainder of the document, though they may have their own internal page numbering system.

Air Quality (1–29)

Combustion Turbine Supplier Schedule

1. *Please describe the anticipated schedule for selecting the supplier of the combustion turbine generators.*

Response: We expect to select the supplier of the combustion turbine generators once the project has been certified. This should not, however, affect the review of the project, because the differences between the two candidate generators are small, and everywhere there is a difference between the two, compliance has been demonstrated for both.

Particulate Emissions During Duct Firing

2. *Please provide vendor specifications confirming the combined-cycle system emission rates and confirming the maximum particulate matter emission rate of 7.5 pounds per hour for the Siemens turbines, compared to 9.0 pounds per hour for the General Electric turbines (as in AFC Tables 5.1A-2A and 5.1A-2B).*

Response: The proposed particulate matter emission rates are not based on vendor specifications. They are based on the Applicant's experience with similar installations in California. The Applicant is willing to accept permit conditions limiting PM_{10} emissions to 7.5 pounds per hour (lb/hr) without duct firing and 9.0 lb/hour with duct firing, for both Siemens and GE turbines.

The emission rate specified in the AFC of 7.5 lb/hr during duct burning for the Siemens turbine is an error; the corrected AFC Tables 5.1A-2A and 5.1A-2B are attached (Attachment DR2-1). The higher PM_{10} emissions for the Siemens duct firing case do not affect the air quality analysis previously provided, because the higher emission rate is identical to the duct firing emissions for the GE turbines, and all analyses were based on worst-case conditions.

Total and Annual GHG Emissions

3. *Please show the total and annual GHG emissions for the construction phase of the proposed project including all activities at the construction site and any construction activities for linear facilities (gas pipeline and transmission lines), worker travel, and trucked material deliveries.*

Response: Greenhouse gas emission estimates are presented in Table DR3-1.

TABLE DR3-1
Construction GHG Emissions

(Metric Tonnes CO_2eq)							
	Fuel	**Fuel Use (Gallons)**	**GHG**	**Emission Factor (kg/gallon)**	**Emissions (MT)**	**Global Warming Potential**	**Emissions ($MTCO_2$eq)**
Off-road Engines	Diesel	8,056	CO_2	9.96	80	1	80
			CH_4	0.000405	0	21	0
			N_2O	0.000081	0	310	0
Worker Travel	Gasoline	85,120	CO_2	8.55	728	1	728
			CH_4	0.000375	0	21	1
			N_2O	0.000201	0	310	5
Truck Deliveries	Diesel	70,099	CO_2	9.96	698	1	698
			CH_4	0.000281	0	21	0
			N_2O	0.0000257	0	310	1
Total							1,513

Notes: GHG emission factors from CARB Mandatory Reporting Rule, Appendix A, Tables 4-8
Global Warming Potentials form CARB Mandatory Reporting Rule, Appendix A, Table 2
Automobile mileage = 25.5 mpg
Delivery truck mileage = 5.35 mpg

Criteria Pollutants and GHG from Commute and Material Delivery

4. *Please quantify emissions of criteria pollutants and GHG from worker commutes and material deliveries during operation of the proposed project.*

Response: During operation, the project is expected to employ 31 workers. The Applicant estimates an average of one delivery to the site per week. Greenhouse gas emission estimates for these vehicle trips are shown in Table DR4-1.

TABLE DR4-1
Operating GHG Emissions from Vehicles

(Metric Tonnes CO2eq/year)							
	Fuel	**VMT**	**GHG**	**Emission Factor (kg/mile)**	**Emissions (MT)**	**Global Warming Potential**	**Emissions (MTCO2eq)**
Worker Travel	Gasoline	77,500	CO_2	0.3352941	26	1	26
			CH_4	0.0000147	0	21	0
			N_2O	0.0000079	0	310	0
Truck Deliveries	Diesel	520	CO_2	1.8616822	1	1	1
			CH_4	0.0000051	0	21	0
			N_2O	0.0000048	0	310	0
Total							27

Notes: GHG emission factors from CARB Mandatory Reporting Rule, Appendix A, Tables 7 and 8
Global Warming Potentials form CARB Mandatory Reporting Rule, Appendix A, Table 2
Automobile mileage = 25.5 mpg
Delivery truck mileage = 5.35 mpg

Proposed ERCs

5. *Please identify whether the confidential filing dated December 5, 2008 represents the proposed ERCs that would be used for offsets and mitigation.*

Response: The confidential filing described the pool of potential sources of mitigation that had been developed at that time. As described in the filing, the list did not represent the proposed ERCs that would be used for offsets and mitigation but instead represented the pool of ERCs from which mitigation was expected to be drawn.

Since that time, the Applicant has identified additional potential sources of offsets. The Applicant is still identifying and negotiating with potential suppliers of offsets. Once the mitigation package has been finalized, it will be submitted to the Yolo-Solano Air Quality Management District (YSAQMD and the CEC, along with the requested demonstrations of compliance with applicable requirements.

Distance Ratios, Interpollutant Trade Ratios and Transfers of Credits

6. *Please specifically state the proposed distance ratios, interpollutant trade ratios, and transfers of credits from other air districts.*

Response: Please see response to Data Request #5. The requested data will be part of the final ERC submittal.

Sources of PM_{10} Offsets

7. *Please provide a brief description of the PM_{10} sources that were shut down in order to create the ERCs.*

Response: Please see response to Data Request #5.

Demonstration of Compliance: PM_{10} and $PM_{2.5}$ Mitigation

8. *Please provide an analysis of the ERCs that are proposed to be surrendered that demonstrates the expected level of PM_{10} and PM2.5 mitigation provided by the ERCs.*

Response: Please see response to Data Request #5.

Interpollutant Offsets: SOx for PM

9. *Please provide an explanation of whether any SOx ERCs would be used to offset PM_{10} and PM2.5 emissions and, if so, an analysis of the appropriate interpollutant trading ratio.*

Response: Please see response to Data Request #5. The Applicant has not yet ruled out possibility that SOx ERCs might be used to offset PM emissions. The analysis supporting the proposed SO_2 for PM_{10} and $PM_{2.5}$ interpollutant offset ratio will be provided as part of the offset package if interpollutant offsets are proposed.

Demonstration of Compliance: SOx Mitigation

10. *Please provide information showing how the ERCs that are proposed to be surrendered would be of a sufficient quantity to achieve a one-to-one offset of project SOx emissions.*

Response: Please see response to Data Request #5.

Interpollutant Offsets: VOC for NOx Ratio, Justification

11. *Please identify the source of the proposed 1.4-to-1 ratio for VOC to NOx and any technical studies or regional air quality management plans that support use of this ratio.*

Response: The proposed 1.4-to-1 ratio was an estimate based on similar inter-precursor trades approved in the Sacramento Valley Air Basin. Because the offset package has not yet been finalized, it is not certain that inter-precursor offsets will be utilized.

The analysis supporting the proposed VOC for NOx inter-precursor offset ratio will be provided as part of the offset package if inter-precursor offsets are proposed.

Interpollutant Offsets: VOC for NOx Ratio, Prior Approvals

12. *Please identify the circumstances and provide citations to where the YSAQMD or another air quality management agency with jurisdiction in the Sacramento Valley air basin, including the U.S. EPA, approved the proposed VOC to NOx interpollutant offset ratio.*

Response: Colusa County and the CEC approved an inter-precursor offset ratio of 1.4:1 for the Colusa Generating Station (06-AFC-9), located in Colusa County, adjacent to the YSAQMD and within the Sacramento Valley Air Basin. The Colusa County AQMD staff assessment of this approach states (Preliminary Determination of Compliance, April 3, 2007, p. 16.):

> The Applicant has proposed a 1.4:1 ratio as a VOC for NOx interpollutant offset ratio based upon the two nearest relevant studies: the Sacramento Area Ozone Study (CARB, 1995) and the San Francisco Bay Area Ozone Attainment Plan (OAP) (ABAG, BAAQMD, and MTC, 2001). The rate of ozone formation is heavily dependent on initial NOX and VOC concentrations, as well as local meteorological conditions. The relationship between ozone formation and the initial concentrations of NOX and VOC has been the subject of many studies and is often depicted graphically through ozone isopleth diagrams. Ozone isopleth diagrams illustrate the dependence of ozone production on the initial amounts of VOC and NOX. The total 2005 VOC and NOX emissions for Colusa County were 6.81 tons per day VOC and 10.12 tons per day NOX. The peak 1-hour ozone level, used as the background in the AFC was 89 ppb. There is consistency between the peak ozone reading predicted by the Colusa isopleth and the actual peak ozone concentration measured in Colusa. Although theoretically the ratio predicted is 1.4:1 NOx to VOC the Applicant is proposing to reverse the ratio and provide 1.4 tons of VOC emission reductions to offset a 1.0 ton increase in NOx emissions.

Additionally, the CEC and the applicable Districts have approved VOC for NOx offsets for the following projects:

- Blythe Energy Project (Mojave Desert)(99-AFC-8); VOC for NOx ratio of 1.6:1
- Cosumnes (Sacramento); VOC for NOx ratio of 2.6:1
- High Desert (Mojave Desert); VOC for NOx ratio of 1.6:1
- Palomar (San Diego); VOC for NOx ratio of 2.0:1
- Sutter Energy Center (Feather River); VOC for NOx ratio of 2.0:1

Water Droplet Evaporation

13. *Please provide substantiating evidence or copies of technical reports supporting the assumption that "when a water droplet evaporates, the dissolved solids form a single particle" (AFC Appendix 5.1A, p. A-6). This information should address the likelihood of every water droplet remaining coherent through evaporation, rather than breaking up into smaller droplets, as well as the likelihood of different dissolved salts adhering to each other to form the single particle.*

Response: As discussed in the AFC, the exhaust from the cooling tower contains entrained water droplets, called "drift." Drift is minimized through the use of drift eliminators, which rely on inertial separation caused by providing multiple directional changes of airflow to remove water droplets from the air.[1]

Suspended droplets shrink by evaporation.[2] They can also collide with each other with various results. Smaller droplets (200-micron diameter and smaller) can collide, but the mutual collisional kinetic energy of these droplets, or their collisional kinetic energy with respect to anything else, is so low they can't overcome surface tension and shatter into smaller droplets should they chance to collide. More likely, they will deflect off each other, or coalesce.

Much larger colliding drops can create small droplets, however. Studies of the behavior of raindrops indicate that a 4,600-micron drop colliding with a 1,800-micron drop will produce many droplets, some of which may be as small as 20 microns in diameter. Droplets this size, however, are very sparse, so these collisions are exceedingly rare.

When droplets between 200 and 1,000 microns collide, they can bounce off each other, coalesce, or break up into a small number of smaller droplets. If any of the droplets created in this manner are smaller than 60 microns, they may evaporate completely to form PM_{10}. However, the number of large droplets is very small. There are a thousand times more droplets smaller than 60 microns than greater than 60 microns. There are more than 30,000 times more droplets smaller than 200 microns than there are droplets bigger than 200 microns. It is overwhelmingly more likely that two droplets will collide and coalesce (resulting in a larger particle) than it is for two droplets to collide and shatter. Furthermore, as the plume ages, the droplets will continue to shrink by evaporation, further reducing the likelihood that two droplets large enough to shatter will collide.

PM forms from cooling tower drift when a cooling tower droplet evaporates to a salt crystal. As the droplet evaporates, the concentration of dissolved solids increases until the droplet is saturated; further evaporation results in precipitation of dissolved solids as a salt crystal. This process continues until all of the water has evaporated, and all of the solids have crystallized around the initial nucleus. Thus one droplet forms one particle.

AP-42 characterizes the assumption that all solid particles from cooling tower drift are in the PM_{10} range as "conservatively high."[3] An assumption that is conservatively high is appropriate for screening purposes (that is, an analysis that demonstrates compliance using

[1] AP-42 Section 13.4, p. 13.4-3.
[2] AP-42 Section 13.4, p. 13.4-2.
[3] AP-42 Section 13.4 p. 13.4-3.

conservatively high assumptions means that a more detailed analysis, using more realistic assumptions, will also demonstrate compliance), which greatly simplifies the analysis. In this case, however, a more realistic analysis is required to demonstrate compliance.

The analysis in the AFC is based on a droplet size distribution provided by the vendor (see Attachment DR13-1). This distribution is applicable to the cooling tower exhaust far enough after the drift eliminator for turbulence to be damped out. As a result, significant changes to the droplet size distribution (coalescence or shattering) is not expected. Droplets will, of course shrink as the water evaporates.

Diameter of Cooling Tower Droplet

14. *Please provide substantiating evidence or copies of technical reports supporting the equation used for predicting the diameter of a solid particle formed from a cooling tower droplet (AFC Appendix 5.1A, p. A-6).*

Response: See the following article: Reisman, J. and Frisbie, G.; "Calculating Realistic PM_{10} Emissions from Cooling Towers," *Environmental Progress* Vol. 21, Issue 2, pages 127-130 (20 Apr 2004). An earlier version of this paper was prepared in support of the Blythe Energy Project, and presented at the 94th Annual Air & Waste Management Association's Annual Meeting (June 2001). The methodology presented in these papers is identical with the one used in the CPV Vaca Station AFC.

Mathematical Steps Confirmation

15. *Please review the mathematical steps described and confirm that there are no errors or correct the apparent errors.*

Response: There are no mathematical errors. Staff's calculation correctly calculates the ***physical*** diameter of the particle remaining behind when the droplet evaporates. However, as discussed in the AFC, the PM ambient air quality standards utilize ***aerodynamic*** particle diameter, not physical diameter, to classify particle size. The droplet size distribution, and the physical and aerodynamic diameter of the resulting particles, are shown in Table DR15-1.

The equation for deriving aerodynamic diameter from a particle's physical diameter and density is provided in the AFC; the citation for the methodology (EPA) is also provided in the AFC. These are presented here for convenience.

TABLE DR15-1
Droplet and Particle Size Distribution

Percent mass less than droplet size	Droplet diameter, micron	Physical particle diameter, micron	Particle aerodynamic diameter, micron
12	10	1.6	2.4
20	15	2.4	3.6
40	35	5.6	8.3
60	65	10.4	15.4
80	115	18.4	27.3
90	170	27.2	40.3
95	230	36.8	54.6

TABLE DR15-1
Droplet and Particle Size Distribution

Percent mass less than droplet size	Droplet diameter, micron	Physical particle diameter, micron	Particle aerodynamic diameter, micron
99	375	60.0	89.0
99.8	525	84.0	124.5
Interpolated percent			
12.9	10.5	1.7	2.5
44.8	42.2	6.7	10

Water density = 1.0
Particle density = 2.2
Droplet size distribution from cooling tower vendor

The size of the final aerosol particle depends on the volume fraction of solid material and the droplet diameter as follows:

$$D_s = D_d \times (F_v)^{1/3}$$

Where:

D_s = diameter of solid particle
D_d = diameter of liquid droplet
F_v = volume fraction of solid material

This equation can be converted to calculate the resulting particle diameter for a cooling tower by accounting for the density of the particle:

$$D_s = D_d \times (\rho_d/\rho_s \times TDS/1{,}000{,}000)^{1/3}$$

Where:

D_s = diameter of solid particle
D_d = diameter of liquid droplet
ρ_d = density of droplet = 1 g/cm^3
ρ_s = density of solid particle = 2.2 g/cm^3 for sodium chloride
TDS = total dissolved solids, ppmw

The above equation predicts the physical diameter of a particle formed from a cooling tower droplet. This equation assumes that a single particle will be formed when a droplet evaporates, because there is no evidence that multiple particles will be formed.

The term "aerodynamic diameter" has been developed by aerosol physicists in order to provide a simple means of categorizing the sizes of particles having different shapes and densities with a single dimension. The aerodynamic diameter is the diameter of a spherical particle having a density of 1 gm/cm^3 that has the same inertial properties (terminal settling velocity in the gas as the particle of interest). The PM_{10} and $PM_{2.5}$ standards refer to aerodynamic diameter.

Therefore, in order to calculate PM_{10} and $PM_{2.5}$ emissions, the aerodynamic diameter of the cooling tower particles must be calculated as follows:[4]

$$D_a = D_s \times (\rho_s)^{0.5}$$

Airborne Particles Matching Sodium Chloride

16. *Please provide substantiating evidence or laboratory analysis of the proposed cooling water supporting the assumption that the density of the airborne particles would best match that of sodium chloride (AFC Appendix 5.1A, p. A-6).*

Response: It is important to note that the assumed particle density does not have a strong effect on the percent of total PM that is PM_{10} (Table DR16-1). Because the calculation is not sensitive to the density of the particle, any reasonable assumption regarding particle density will serve.

It is unlikely that the particle left behind by evaporation of water from a drift droplet will actually be sodium chloride.[5] The particle should consist primarily of calcium carbonate ($CaCO_3$). This is the principle component of the scale that is deposited when the solids content of boiler water is too high.

Solid calcium carbonate has a density of 2.7.

Because it predicts that more of the PM will have an aerodynamic diameter smaller than PM10, the assumed particle density of 2.2 is a slightly conservative assumption, and tends to overpredict the PM10 emissions from the cooling tower.

TABLE DR16-1
Percent of PM that is Smaller than PM_{10}, by Particle Density

Particle density (water =1)	percent of drift < PM_{10}
1.8	45.7
2	45.2
2.2	44.8
2.4	44.4
2.6	44.0
2.7	43.8

Cooling Tower Drift Droplet Size Assumptions

17. *Please provide substantiating evidence or copies of technical reports supporting the assumptions of mass distribution and various cooling tower drift droplet sizes (AFC Appendix 5.1A, p. A-7).*

Response: The size distribution data provided by the cooling tower vendor is provided as Attachment DR13-1.

[4] http://www.epa.gov/air/oaqps/eog/bces/module3/diameter/diameter.htm accessed August 8, 2008

[5] The density of sodium chloride was used in the AFC for two reasons. First, it was the density assumed by Reisman and Frisbie; second, it is a mildly conservative assumption.

Cooling Tower Assumptions Approval

18. *Please identify whether the assumptions used in the emission calculations for the cooling tower have been reviewed and approved by air management agencies, including U.S. EPA or the California Air Resources Board, and provide the approving documentation or a guidance document supporting use of the assumptions.*

Response: A number of projects have been permitted with PM_{10} to TDS ratios of 50 percent and lower. The CEC is among those agencies approving such calculations. Approved projects include the High Desert Power Project (permit revision) at 50 percent, Mesquite Generating Station (in Arizona) at 31.5 percent, and the Blythe Energy Project at 15 percent. In a November 1, 2001, email sent to the Maricopa County Environmental Services Department related to the permitting of the Arlington Valley Energy Facility (AVEF), the EPA (Scott Bohning) stated that "I am comfortable with the 50 percent figure, " but he wanted to obtain further feedback before accepting the lower levels proposed by the AVEF project.

In support of the Blythe Energy Project, a technical paper was written and presented at the 94th Annual Air & Waste Management Association's Annual Meeting (June 2001). The methodology presented in that paper is identical with the one used in the CPV Vaca Station AFC. Additionally, please see the YSAQMD's Preliminary Determination of Compliance (PDOC).

Reduction of Dissolved Solids

19. *Please describe what steps could be taken to reduce the maximum total dissolved solids from 9,000 parts per million to a lower number.*

Response: The CPV Vaca Station project will use a zero liquid discharge system. These systems, by nature, require a minimization of blowdown flow from cooling system in order to function effectively. The 9,000 parts per million TDS is a result of this minimization of blowdown flow.

BACT for CO

20. *Please explain why a limit of 2.0 ppmvd on an l-hour averaging basis is not being proposed for the CPV Vaca Station project.*

Response: The permit for the Magnolia Power Project was issued at a time when the South Coast Air Quality Management District was not in attainment with federal ambient CO standards, and represented an extraordinary effort to minimize CO emissions due to the extraordinary conditions. Because of the unique situation, most agencies have considered the project to be in a class by itself, and not a precedent for other projects.

In most jurisdictions and situations, including YSAQMD, CO is a pollutant with very low impacts and priority, especially relative to NOx. Because the combustion conditions that minimize CO emissions tend to encourage NOx formation and vice versa, tight NOx limits make it more difficult to comply with tight CO limits. YSAQMD regulations allow the Air

Pollution Control Officer (APCO) to consider that BACT requirements for one pollutant may preclude achieving the lowest possible emissions for another pollutant.[6]

This consideration is relevant to application of the Magnolia permit limits to the current project. Air districts have recognized that NOx and CO BACT levels must be considered together. Specifically, districts have determined that compliance with a CO permit limit that is coupled with a specific NOx limit does not "demonstrate in practice" that CO limit for another more stringent NOx limit.[7]

The NOx limit in the Magnolia permit is 2.0 ppm (3 hour average). The proposed BACT NOx limit for CPV Vaca Station is 2.0 ppm (1 hour average). The difference in averaging time is viewed by the regulatory agencies as a significant tightening of the NOx requirement. Compliance with a CO limit set in conjunction with a NOx limit of 2 ppm (3 hour average) does not establish that the CO limit has been "achieved in practice" for a turbine subject to a more stringent NOx limit.

Review of the other projects listed in AFC Table 5.1E-2 with CO BACT levels of 2.0 ppm (Vernon City Power & Light, Wanapa Energy Center, Berrien Energy) results in the same conclusion: no project subject to a 2 ppm NOx limit (1 hour average) has been subject to, much less demonstrated ongoing compliance with, a 2 ppm CO limit. The level proposed in the AFC is the same as the most stringent level approved to date by the CEC (for the Colusa project, which is currently under construction).

Because a CO limit of 2 ppm has not been achieved in practice on a turbine subject to a 2 ppm (1 hour average) NOx limit, it cannot be deemed BACT on that basis. In fact, Table DR20-1 shows that the "achieved in practice" BACT level for CO is 4.0 ppm. However, a lower value may still be BACT if it is both technically feasible and cost effective.

The reduction in emissions that would be achieved by reducing the CO emission rate from 3 ppm to 2 ppm would be 67.8 TPY. The cost of achieving that reduction would be $32,000 per year[8]. The cost effectiveness of controlling CO is therefore $532/ton, which exceeds the District's $300/ton threshold for cost-effective CO controls. Therefore 2 ppm CO is not BACT for this application, because it is technologically feasible but not cost effective.

TABLE DR20-1
CEC Limits on NOx and CO Since Magnolia

Project	NOx limit	Averaging Time	CO Limit
Magnolia	2.0	3 hours	2.0
Russell City	2.0	1 hour	4.0
Blythe	2.0	3 hour	4.0
Walnut	2.0	1 hour	4.0
Colusa	2.0	1 hour	3.0

[6] YSAQMD Rule 3-4 Sec. 208.2.

[7] See, for example, Bay Area Air Quality Management District. Revised Preliminary Determination of Compliance for Los Esteros. March 14, 2005, p. 18.

[8] YSAQMD guidelines for calculating the annualized cost of capital equipment for BACT determinations use equipment life of 10 years and an interest rate of 10%. The increased capital cost of going from 3 ppm CO to 2 ppm CO is $100,000 per turbine, or $200,000 for the project.

Background Response to Data Requests 21–25

Response: Startup and shutdown periods are a normal part of the operation of combined-cycle natural gas-fired power plants. BACT applies during all modes of operation, including startup and shutdown periods. The BACT limits established for steady-state operation are not technically feasible during startup and shutdown of the CTGs/HRSGs. Therefore, alternate BACT limits must be specified for these modes of operation.

Startup and shutdown periods, when compared to emissions generated at steady-state operation, generate elevated emissions for various reasons. For instance, startups require extended periods of operation at low turbine loads (less than 50 percent), where turbine operation must be tuned for operational stability rather than emissions compliance. Furthermore, during startup and shutdown, exhaust temperatures that fall outside of the optimal temperature range for the control equipment (SCR and oxidation catalyst) may lead to non-operation of the control equipment for all or part of the duration of startup and shutdown periods.

Various approaches to reducing emissions during startups and shutdowns are currently being tested by turbine manufacturers. However, these configurations are not yet reliable enough to be considered BACT—this is clearly demonstrated by the fact that the manufacturer is not willing to guarantee the emission reductions. The emission reductions are promising, not promised.

Proposed Emissions During Startups and Low Loads

21. *Please provide technical information, including vendor specifications that support the proposed emissions during startups and low loads (AFC Tables 5.1A-9A and 5.1A-9B), preferably on vendor letterhead. This information should include enough detail to determine emissions as a function of time in a hot startup and a cold startup and at certain increasing loads. If necessary, proprietary or confidential information may be submitted pursuant to the Energy Commissions siting regulations for the designation of confidential records.*

Response: Proposed maximum hourly emission rates for NOx and CO during startups are based on the Applicant's experience at similar facilities, not vendor guarantees. Startup emissions are not guaranteed by turbine vendors because emissions during startups are a function of integrated plant performance, and not the performance of any individual plant component (such as the gas turbine). Continuous emissions monitoring systems (CEMs) for NOx and CO will ensure compliance with the proposed limits.

Also note that, except for the emission rate (in lb/hour), the emission estimates are **not** predictions of actual emissions per startup or shutdown. They are estimates prepared for the purpose of budgeting annual emission offset requirements. The estimates are not predictions because the duration, and resulting emissions, of any given startup (defined as the length of time between the initiation of fuel flow and reaching compliance with NOx limits) are functions of the conditions (primarily equipment temperatures) at fuel flow initiation, and the firing rate during startup.

Thus, the excess emissions during any single startup event are going to lie anywhere between zero (restart of an already-hot system after a momentary break in power production) and the emissions associated with a completely cold start. For annual

emission/offset budgeting purposes, this spectrum of possible conditions is simplified to two or three representative cases (hot, warm, cold start-ups). The dividing lines between these cases are somewhat arbitrary. In this application, warm starts were assumed to average one hour each. This represents the average time it will take to bring the system up to temperature after being shut down overnight.

From an operating standpoint, however, the only case that is distinctly definable is the cold start; and even that is subject to the seasonal variation of ambient temperature. All other startups are "warm" or "hot" startups of a duration that varies with the amount of residual heat in the combined-cycle system.

For all of the above reasons, the requested information concerning startup emissions is not available.

NOx Emission Limit Specifications

22. *Please provide vendor specifications demonstrating compliance with the 140 lb/hr NOx emission limit in YSAQMD Rule 2.16.*

Response: Proposed maximum hourly emission rates during startups are based on the Applicant's experience at similar facilities, not vendor guarantees. CEMs for NOx and CO will ensure compliance with the proposed limits.

The AFC proposes limiting startup NOx emissions to 140 lb/hr (max) for a 190-MW turbine. The CEC has approved the following projects utilizing similar startup emission rates for similar turbines:

- Delta Energy Center (98-AFC-3); NOx emissions = 80 lb/hot start; 240 lb/cold start (max duration 3 hours)
- Elk Hills (99-AFC-1) NOx emissions = 76 lb/hr
- Metcalf (99-AFC-3) NOx emissions = 80 lb/hr
- Moss Landing (99-AFC-4) NOx emissions = 320 lb/startup; max duration 4 hours
- El Segundo (00-AFC-14) NOx emissions = 80 lb/hr
- East Altamont Energy Center (01-AFC-4) NOx emissions = 240 lb/startup; max duration 3 hours

We understand that the data request has its origins in the CEC's experience with overly optimistic characterizations of startup emissions contained in previous applications. In some cases, applicants needed to have permit conditions adjusted after construction because the emission limits during startup were impossible to meet consistently.

The cost of offsets is a strong incentive for the applicant to minimize its estimate of startup emissions. On the other hand, overly optimistic characterization of startup emissions can result in compliance problems, and insufficient offsets can restrict project operation. The characterization of startup emissions in the AFC represents the applicant's balance of the cost of offsets and minimizing the risk of non-compliance. Experience with similar facilities provides confidence that the 140 lb/hour not-to-be-exceeded level can be met; and that, on

average, warm starts will be at or below 100 lb/startup. Furthermore, the project includes design features that are expected to minimize the duration of (and therefore emissions from) each startup. However, each individual startup's emissions is a strong function of the conditions at the time. All of this means that any emission limit that can be consistently complied with will be meaningless as a tool for ensuring that startup emissions are minimized.

Turbine Load Data

23. *Please provide turbine load data (electrical and percent) for AFC Tables 5.1A-2A and 5.1A-2B, in order to confirm the part-load scenarios analyzed in the dispersion modeling and to evaluate the low-load performance of the proposed power plant.*

Response: The requested information has been added to the revised AFC Tables 5.1A-2A and 5.1A-2B (see Attachment DR2-1).

"Rapid Response" Technologies

24. *Please describe why the proposed project is not incorporating "Rapid Response" technologies (including the GE OpFlex enhancements or the Siemens Flex Plant technology) for controlling and reducing low-load emissions to the extent feasible. Staff is required to ensure that the applicant incorporates into the project all measures that can be shown to be feasible, reasonably necessary, and available to substantially lessen or avoid significant adverse environmental effects (Title 20, California Code of Regulations, section 1741(b)).*

Response: Only significant environmental impacts are required to be mitigated; the Applicant does not believe there are any such impacts related to the proposed project design.

Furthermore, the benefits that these systems might offer in reducing startup emissions are still speculative. The vendors will not guarantee emissions performance for these systems at this time.[9] Startup emissions associated with operation of the Palomar facility are matched by other facilities without enhanced control systems. To our knowledge, no facility that has installed (or proposed to install) these technologies has claimed an enforceable emission reduction as a result.

The CPV Vaca Station project does plan to incorporate plant features that enhance startup flexibility, but even if these systems perform as advertised, the reduction in NOx and CO emissions will be modest.

The duration of and emission rates associated with startups and shutdowns of combined cycle power plants are a function of each plant's unique design, including factors such as the gas turbine model, the heat recovery steam generator manufacturer, the steam turbine manufacturer and model, the plant distributed control system, as well as other balance of plant features. Furthermore, as discussed above, every single startup is a unique event with different initial conditions that affect the time it takes to reach operating conditions. These unique factors make it impossible to establish a single set of emission rates as BACT for these transient conditions. However, there are basic principles of operation, or Best

[9] General Electric guarantees that "base load" emission rates can be achieved at lower loads with some of their OpFlex options, but does not guarantee lower startup emission rates associated with this technology.

Management Practices, that minimize emissions during startups and shutdowns,. These Best Management Practices are as follows:

- During a startup, bring the gas turbine to the minimum load necessary to achieve compliance with the applicable NOx and CO emission limits as quickly as possible, consistent with the equipment manufacturers' recommendations and safe operating practices
- During a startup, initiate ammonia injection to the SCR system as soon as the SCR catalyst temperature and ammonia vaporization system have reached their minimum operating temperatures
- During a shutdown, once the turbine reaches a load that is below the minimum load necessary to maintain compliance with the applicable NOx and CO emission limits, reduce the gas turbine load to zero as quickly as possible, consistent with the equipment manufacturers' recommendations and safe operating practices
- During a shutdown, maintain ammonia injection to the SCR system as long as the SCR catalyst temperature and ammonia vaporization system remain above their minimum operating temperatures

A key underlying consideration of these Best Management Practices is the overall safety of the plant staff by promoting operation within the limitations of the equipment and systems and allowing for operator judgment and response times to respond to alarms and trips during the startup sequence.

Finally, the OpFlex and Flex Plant systems are proprietary process control systems. In order to use one of these control systems, the project must purchase all of the combustion train (gas turbine, steam turbine, HRSG, and controls) from a single vendor, potentially increasing the cost of the project. A more important commercial consideration is the potential risk should a single component of the package be unavailable at the time of purchase (such as the steam turbine)

OpFlex System Feasibility

25. *Please investigate and describe the feasibility of implementing the OpFlex system low load emission reduction controls which have been in use since 2007 at Palomar Energy Center, or similar competing technologies.*

Response: The OpFlex low load emission reduction controls in use at the Palomar energy center are not expected to achieve any operating emission reductions at CPV Vaca Station, because CPV Vaca Station is not expected to operate at the low loads where an emissions benefit might be achieved.

In the background discussion for this data request, staff specifically referred to the use of OpFlex at Palomar to avoid startup events entirely. OpFlex's potential contribution to emission reductions in this mode is to allow more turndown during low load operation, reducing the mass emissions that result from running the turbines during periods of no demand.

The version of OpFlex technology in use at the Palomar Energy Center is the OpFlex – Turndown configuration. According to GE's marketing information, the OpFlex Turndown allows the turbine to meet NOx limits at 40 percent of full load (instead of 50 percent of full load). Palomar was able to operate at 45 percent of full load.[10] NOx emissions associated with operating the unit for 8-16 hours at 40 percent load are 56 to 112 pounds (7 lb/hr NOx emission rate at 40 percent load). This is to be compared to nominal emissions of 100 lb per shutdown/startup cycle assumed in the AFC. Use of OpFlex technology will, at best, reduce project emissions somewhere between 0 and 44 pounds of NOx per hot start if the plant remained in operation throughout the night. The OpFlex technology in use at the Palomar Energy Center will have no material effect on cold-start emissions.

Operating the turbines at night when there is no demand for them, even at low load, will seriously affect the overall efficiency of the operation, wasting fuel and resulting in increased emissions of SO_2, particulate, and GHGs, as well as the nightly emissions of NOx and CO that must be balanced against the reduced emissions from avoiding startups. It is also possible that a day or more may pass when this facility would not be dispatched at all. In that case, the use of OpFlex would require operation at 40 to 45 percent load for 32 hours instead of 8; the resulting NOx emissions would substantially exceed the emissions associated with a single startup.

As discussed previously, use of the OpFlex system requires that all components of the facility (turbines, HRSGs, and controls) be purchased from the only supplier who sells the system. Because of the vendor's monopoly, the system's price is much higher and the potential unavailability of this equipment poses a significant cost and schedule risk.

Because the suggested mode of operation results in increased emissions of PM, SO_2, and GHGs (and, under some circumstance, NOx); because the existing amount of experience with the technology is too small for the manufacturer to be able to guarantee emission reductions; because the burning of fuel to operate the turbines at a time when there is no demand for the power generated is wasteful; and because of the potentially significant cost increase that use of this system would require, the OpFlex system should not be required for this project, and should not be deemed a "feasible alternative" as defined under CEQA.

Automatic Generation Control

26. *Please provide a thorough description of "automatic generation control" and what role the California Independent System Operator (CAISO) has in implementing the automatic generation control.*

Response: Automatic Generation Control (AGC)/Regulation is the online, synchronized, generation capacity that is available to respond to the CAISO's AGC control signals on a second-by-second basis. This capacity enables a continuous balancing of resources and load within the CAISO-controlled grid, as well as maintaining frequency during normal operating conditions.

CAISO AGC is a standard mode of operation that is an ongoing condition for power plants that provide the CAISO with this ancillary service. The proposed project will be providing this service to the CAISO. As such, the CAISO (along with the service utility) will effectively

[10] SDGE letter to SDAPCD Hearing Board (April 11, 2007).

be controlling the routine operation of the proposed project. The onsite operators will mainly be responsibility for monitoring equipment operation and will take over equipment operation if necessary to respond to system alarms and/or during gas turbine startups/shutdowns.

It is the Applicant's understanding that nearly every combined cycle and boiler power plant in California with a rating greater than 50 MW is currently operating under CAISO AGC.

Effect of Automatic Generation Control on Emissions

27. *Please describe what effect, if any, the automatic generation control will have on any aspect of the criteria pollutant emission levels for the project.*

Response: The use of AGC is not expected to have any impacts on the project's ability to comply with all proposed emissions limits. Any AGC control agreement with the CAISO would include a "not-to-exceed" ramp rate that would prevent the CAISO from forcing turbine load changes that would exceed the control system's ability to keep the turbines within their permitted emissions limits. However, it is possible that, under certain conditions, the CAISO may require the plant to change load at the maximum allowable rate which, in combination with other conditions (such as ambient temperature), could result in short-term excursions in excess of the NOx emission limit. This is one of the reasons why the Applicant will be seeking approval for a limited number of NOx excursions similar to conditions approved by the CEC and air regulatory agencies for a number of projects in California over the last 10 years.

Periodic Combustor Tuning

28. *Please describe whether the chosen model combustion turbine would require periodic combustor tuning. If so, then please provide the following information:*

a. The proposed frequency of combustor tuning.

Response: Combustor tuning would be conducted as needed to ensure compliance with operating requirements. Based on the experiences at other plants, the Applicant expects that combustor tuning activities could occur as often as once or twice every calendar year.

b. When tuning would take place, for example during the normal annual maintenance inspection, or at some other manufacturer-specified time period.

Response: Following periodic maintenance on the gas turbine combustion system, it will be necessary to re-adjust fuel and combustion air flows to the combustor cans to minimize NOx and CO at the turbine exhaust. These adjustments are standard in the industry for dry low-NOx combustors, and have been recognized in Commission approvals for the following projects:

- Delta Energy Center (98-AFC-3C); order approving amendment, 9/8/2004
- Metcalf Energy Center (99-AFC-3C); order approving amendment, 3/16/2005
- Moss Landing Power Project (99-AFC-4C); order approving amendment, January 2004
- Mountainview Power Project (00-AFC-2C); order approving amendment, 9/16/2004

- Inland Empire Energy Center (01-AFC-17C); order approving amendment, 5/14/2007
- Russell City Energy Center (01-AFC-7C), Condition AQ-19; order approving amendment, 10/3/2007
- Pastoria Energy Facility Expansion (05-AFC-1), Condition AQ-34; Commission Decision (December 2006)

c. A description of what the combustor tuning process entails.

Response: Combustor tuning entails re-adjustment of fuel and combustion air flows to the combustor cans to minimize NOx and CO at the turbine exhaust.

d. The criteria pollutant emission rates that would occur (concentrations and mass emission levels), and the duration in which emission rates over those of normal steady-state operation would occur.

Response: Gas turbine tuning activities are not expected to occur for more than 12 hours per day or more than 40 hours per year. During these tuning activities, maximum hourly emissions are not expected to be higher than during an extended (six hour) gas turbine startup.

Sources Included in Cumulative Impact Analysis

29. *Please provide the list of cumulative sources to be considered and the cumulative analysis for ambient air quality impacts.*

Response: The Bay Area Air Quality Management District (BAAQMD) and YSAQMD provided lists of all projects under their review for which permits (Authority to Construct or Permit to Operate) have been issued, but whose emissions would not have been part of the measured ambient background. These lists are provided as attachments to this document.

The facilities listed in Table DR29-1 have emission increases in excess of 5 tpy of VOC, NOx, or PM_{10} (CO is not included because the margin of compliance is so great that cumulative impacts are not possible).

TABLE DR29-1
New Emissions Greater Than 5 tpy Within 6 miles of CPVVS

Facility	Source	Distance (miles)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM_{10} (tpy)
Kaiser Health	Boilers, Engines	4.0	-	13.1	-	-
Jepson Prairie	Composting	3.8	1,562	-	-	-
Ramos Oil Co.	Retail Gasoline	9.6	6.03	-	-	-
Norcal Waste	Landfill	3.8	11.4	-	-	-
State Compensation Insurance	Boilers, Engines	4.4	-	6.4	-	-
Alza Corp	Alcohol cleaning	5.3	7.4	-	-	-
CalPeak Power	Utility Power Generation	4.1	5.1	15	5	11.8

TABLE DR29-1
New Emissions Greater Than 5 tpy Within 6 miles of CPVVS

Facility	Source	Distance (miles)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM_{10} (tpy)
Costco	Retail Gasoline	4.3	12.56	-	-	-
CEMEX	Cement Batch Plant	5.6	-	-	-	6.15
TOTAL			**1,694**	**34.5**	**5**	**18.0**

Based on the data in Table DR29-1, emissions from the Kaiser Health Facility at 1 Quality Drive, Vacaville; State Compensation Insurance Fund at 4040 Horse Creek Drive, Vacaville; CalPeak Power project at 5157 Quinn Road, Vacaville; and CEMEX, 4964 Peabody Road Fairfield, will be included with CPVVS project emissions and the cumulative impacts for NOx, PM_{10}, and $PM_{2.5}$ will be determined using the AERMOD dispersion model.

ATTACHMENT DR2-1

Corrected AFC Tables 5.1A-2A and 5.1A-2

Table 5.1A-2 A (revised 4/1/09)
GE 7FA with HRSG
Emissions and Operating Parameters for
CTGs /

Case	Cold Base	Cold Low	Avg. Base	Avg. Low	Avg. Peak	Hot Base	Hot Low	Hot Peak
Turbine Load, MW	190.3	95.2	179.4	88.1	179.4	166.7	73.4	166.7
Ambient Temp, F	26.2	26.2	59	59	59	105.6	105.6	105.6
Turbine Load, %	100%	50%	100%	50%	100%	100%	50%	100%
Chiller On/Off	Off	Off	On	On	On	On	On	On
CTG heat input, MMBtu/hr (HHV)	1902.0	1234.0	1815.0	1171.0	1815.0	1719.0	1040.0	1719.0
DB heat input, MMBtu/hr (HHV)	0.0	0.0	0.0	0.0	512.0	0.0	0.0	512.0
Total heat input, MMBtu/hr (HHV)	1902.0	1234.0	1815.0	1171.0	2327.0	1719.0	1040.0	2231.0
Stack flow, lb/hr	3,832,424	2,473,500	3,621,900	2,388,700	3,808,855	3,418,600	2,256,800	3,581,322
Stack flow, acfm	1,076,770	695,018	1,021,418	672,599	1,053,087	976,059	636,146	1,002,679
Stack flow, dscfm	802,061	517,495	752,663	498,162	780,661	694,289	470,685	716,266
Stack temp, F	195	195	195	195	180	195	195	180
Stack exhaust, vol %								
O2 (dry)	13.80%	13.76%	13.67%	13.86%	11.96%	13.48%	14.28%	11.55%
CO2 (dry)	4.11%	4.14%	4.18%	4.08%	5.16%	4.29%	3.84%	5.39%
H2O	7.60%	7.63%	8.59%	8.12%	10.14%	11.76%	8.21%	13.41%
Emissions								
NOx, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOx, lb/hr	13.81	8.96	13.18	8.50	16.90	12.48	7.55	16.20
NOx, lb/MMBtu	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073
SO2, ppmvd @ 15% O2	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
SO2, lb/hr	5.27	3.42	5.03	3.24	6.44	4.76	2.88	6.18
SO2, lb/MMBtu	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
CO, ppmvd @ 15% O2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
CO, lb/hr	12.61	8.18	12.04	7.76	15.43	11.40	6.90	14.79
CO, lb/MMBtu	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066
POC, ppmvd @ 15% O2	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
POC, lb/hr	4.82	3.12	4.60	2.96	5.89	4.35	2.63	5.65
POC, lb/MMBtu	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
PM10, lb/hr	7.5	7.5	7.5	7.5	9.0	7.5	7.5	9.0
PM10, lb/MMBtu	0.0039	0.0061	0.0041	0.0064	0.0039	0.0044	0.0072	0.0040
PM10, gr/dscf	0.00109	0.00169	0.00116	0.00176	0.00135	0.00126	0.00186	0.00147
NH3, ppmvd@15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH3, lb/hr	12.78	8.29	12.20	7.87	15.64	11.55	6.99	14.99

Table 5.1A-2 B (revised 4/1/09)

Siemens SGT6500F

Emissions and Operating Parameters for CTGs

Case	Cold Base	Cold Low	Avg. Base	Avg. Low	Avg. Peak	Hot Base	Hot Low	Hot Peak
Turbine Load, MW	223	108	206	100	206	193	82	192
Ambient Temp, F	26.2	34.4	59	59	59	105.6	105.6	105.6
Turbine Load, %	100%	50%	100%	50%	100%	100%	50%	100%
Chiller On/Off	Off	Off	On	On	On	On	On	On
CTG heat input, MMBtu/hr (HHV)	2182.6	1289.3	2047.9	1224.4	2078.5	1947.6	1089.1	1961.2
DB heat input, MMBtu/hr (HHV)	0.0	0.0	0.0	0.0	500.0	0.0	0.0	500.0
Total heat input, MMBtu/hr (HHV)	2182.6	1289.3	2047.9	1224.4	2578.5	1947.6	1089.1	2461.2
Stack flow, lb/hr	4,236,856	2,854,325	4,006,679	2,665,485	4,210,055	4,023,569	2,441,375	4,171,263
Stack flow, acfm	1,170,701	843,783	1,107,845	777,295	1,131,327	1,144,745	697,786	1,132,656
Stack flow, dscfm	885,159	600,496	831,584	558,023	862,725	821,306	512,260	839,533
Stack temp, F	184	230	182	219	162	194	206	162
Stack exhaust, vol %								
O2 (dry)	13.51%	14.47%	13.52%	14.33%	11.93%	13.80%	14.54%	12.11%
CO2 (dry)	4.28%	3.73%	4.27%	3.81%	5.18%	4.11%	3.69%	5.08%
H2O	7.78%	7.00%	8.73%	7.68%	10.17%	11.13%	7.40%	12.68%
Emissions								
NOx, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOx, lb/hr	15.85	9.36	14.87	8.89	18.72	14.14	7.91	17.87
NOx, lb/MMBtu	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073
SO2, ppmvd @ 15% O2	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
SO2, lb/hr	6.04	3.57	5.67	3.39	7.14	5.39	3.02	6.81
SO2, lb/MMBtu	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
CO, ppmvd @ 15% O2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
CO, lb/hr	14.47	8.55	13.58	8.12	17.10	12.91	7.22	16.32
CO, lb/MMBtu	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066
POC, ppmvd @ 15% O2	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
POC, lb/hr	5.53	3.26	5.19	3.10	6.53	4.93	2.76	6.23
POC, lb/MMBtu	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
PM10, lb/hr	7.5	7.5	7.5	7.5	9.0	7.5	7.5	9.0
PM10, lb/MMBtu	0.0034	0.0058	0.0037	0.0061	0.0035	0.0039	0.0069	0.0037
PM10, gr/dscf	0.00099	0.00146	0.00105	0.00157	0.00122	0.00107	0.00171	0.00125
NH3, ppmvd@15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH3, lb/hr	14.67	8.66	13.76	8.23	17.33	13.09	7.32	16.54

ATTACHMENT DR13-1

Cooling Tower Droplet Size Distribution

SPX Cooling Technologies
Balcke | Hamon Dry Cooling | Marley

COOLING TOWER DRIFT MASS DISTRIBUTION
TU12 Excel Drift Eliminators

The following table represents the predicted mass distribution of drift particle size for cooling tower drift dispersed from Marley TU12 Excel Drift Eliminators.

Mass in Particles (%)		Droplet Size (Microns)
0.2	Larger Than	525
1.0	Larger Than	375
5.0	Larger Than	230
10.0	Larger Than	170
20.0	Larger Than	115
40.0	Larger Than	65
60.0	Larger Than	35
80.0	Larger Than	15
88.0	Larger Than	10

How to read table: Example – 0.2% of the drift will have particle sizes larger than 525 microns.

Biological Resources (30–35)

Burrowing Owl Surveys

30. *Please conduct additional surveys of western burrowing owl according to the California Burrowing Owl Consortium survey protocol (CBOC 1993) within the CPVVS 1-mile survey area (including project linears, temporary laydown area, and substation) and provide survey results. If owls are found, also report results to the California Department of Fish and Game (CDFG).*

Response: The western burrowing owl survey report is included as Attachment DR30-1.

Swainson's Hawk Survey

31. *Please provide a detailed report of the Swainson's hawk protocol survey, including methodology and results.*

Response: The Swainson's hawk protocol survey report is included as Attachment DR31-1

Project Permits

32. *Please coordinate with USACE, RWQCB, and CDFG (as applicable) to determine the need for project permits. Provide any supporting documents (letter or record of conversation) that result from communication with these agencies.*

Response: The Applicant has been unsuccessful in scheduling discussions with USACE, RWQCB, and CDFG regarding the need for project permits, despite attempts to do so. The Applicant will continue to work with CEC Staff and these agencies to identify and resolve any regulatory or permitting issues for the project and file records of conversation with these agencies as soon as it is possible to do so.

Jurisdictional Delineation of Waters

33. *Please conduct a preliminary jurisdictional delineation of waters of the United States, including wetlands, and waters of the State. The jurisdictional delineation should be conducted within the CPV Vaca Station 1-mile survey area (including project linears, temporary laydown area, and substation). Please provide the survey results and related map delineation.*

Response: The preliminary jurisdictional delineation of waters is included as Attachment DR33-1.

Identified Jurisdictional Wetlands/Waters

34. *If potentially jurisdictional wetlands and/or waters are identified, please coordinate with USACE, RWQCB, and CDFG (as applicable) regarding project permitting requirements. Provide any supporting documents (letter or record of conversation) that result from communication with these agencies, including the permits required for the project, the steps the applicant has taken or plans to take, and the schedule for obtaining the permits.*

Response: Project construction that requires dredging or filling any of the jurisdictional waters or contributes to the loss or degradation of wetlands may require a permit under Section 404 of the Clean Water Act from USACE and water quality certification from the RWQCB under Section 401 of the Clean Water Act, and possibly a Streambed Alteration Agreement from CDFG. The Applicant has contacted these agencies to initiate discussions regarding permitting and expects to meet with these agencies in the near term to identify and resolve any permitting issues.

Temporary disturbance of some of the agricultural ditches will be required to construct the CPVVS natural gas pipeline. However, the ditches will be restored to their original condition after construction. It is therefore possible that a preconstruction notification to USACE will suffice for permitting, if the total disturbance of the agricultural ditches is less than 0.10 acre. If the total disturbance is more than 0.10 acre and less than 0.5 acre, then the project might qualify for coverage under a general, or Nationwide permit held by the USACE Sacramento District. An applicable Nationwide permit would be the Nationwide Permit No. 12 for Utility Line Discharges, which was designed to provide streamlined permitting for projects that would have minor effects to waters of the United States during temporary construction of utility lines such as natural gas pipelines.

Construction of the electrical transmission line would be unlikely to cause any disturbance of jurisdictional waters because agricultural jurisdictional drainages could be avoided by transmission tower placement and conductor stringing, pulling, and tensioning activities.

Supporting Documents

35. *Please provide any supporting documents (letter or record of conversation) that result from communication with U.S. Fish and Wildlife Service (USFWS) and CDFG regarding potential impacts to state and/or federally protected species. Communication should be focused on:*

    a. *Potential impacts and agency approval of applicant-proposed mitigation measures (AFC Sec. 5.2.4, pgs. 5.2-68 through 5.2-73).*

Response: If it is determined that the project will cause impacts to state or federally protected species, the Applicant will work with the applicable agencies to develop appropriate mitigation measures. See also the response to Data Request #32.

    b. *Permits required for the project (e.g., Incidental Take Permits), the steps the applicant has taken or plans to take, and the schedule for obtaining the permits.*

Response: Permits required for the project may include the Incidental Take Permit for federally-protected species or the Individual Take Permit for state-protected species. The Applicant will work with the applicable agencies to develop appropriate mitigation measures. See also the response to Data Request #32.

ATTACHMENT DR30-1

Burrowing Owl Survey Report

CPV Vaca Station Burrowing Owl Surveys

PREPARED FOR:	CPV Vaca Station, LLC
PREPARED BY:	Michael Clary
COPIES:	Debra Crowe, Douglas Davy
DATE:	March 19, 2009
PROJECT NUMBER:	370668

Introduction and Background

This technical memo supplements information previously presented in Chapter 5.2 of the CPV Vaca Station (CPVVS) Application for Certification (08-AFC-11). In response to California Energy Commission Staff Data Request #30, this memo presents the methods and results of additional surveys for western burrowing owl (*Athene cunicularia*) within the proposed CPVVS site. The site was initially surveyed for western burrowing owls on June 13, 2008 and was determined at that time to be too heavily vegetated to provide suitable nesting or forage habitat for western burrowing owl. Subsequent to those surveys the CPVVS site was disked, an event that could have altered habitat suitability for western burrowing owl. Based on clarification from the data request author (Blair, 2008), this memo discusses updated surveys conducted within the disked portion of the CPVVS site only. No additional project areas were observed to provide habitat for western burrowing owl during the updated surveys.

At the time of the initial surveys no western burrowing owls were reported in the CNDDB from within the 1-mile survey area. The CPVVS was determined to be within an area that provides potential western burrowing owl foraging habitat as identified in the Draft Solano MHCP. Western burrowing owl is a California state species of special concern, and it is protected under the Migratory Bird Treaty Act (MBTA) and several of California's Fish and Game codes including 3503, 3503.5, and 3513.

Methods

Prior to the updated site surveys for western burrowing owl, the California Natural Diversity Database (CNDDB, 2009) was queried to identify any new western burrowing owl occurrences, and the western burrowing owl survey recommendations published in *Burrowing Owl Survey Protocol and Mitigation Guidelines* (California Burrowing Owl Consortium [CBOC], 1993) were reviewed for appropriate survey protocols.

The CBOC guidelines advise an initial habitat assessment (Phase I) of all areas of project related activities. If suitable habitat is determined to be present, a burrow survey (Phase II) is necessary. If burrows or burrowing owls are observed on site, then burrowing owl surveys, census and mapping (Phase III) is required. This technical memo serves as the resource summary written report (Phase IV).

The Phase I habitat assessment evaluated the presence of burrowing owl habitat on the project site including a 150-meter (492 foot) buffer zone around the site boundary. For the purposes of the Phase I assessment, burrowing owl habitat was determined to include annual and perennial grasslands characterized by low-growing vegetation, as well as trees and shrubs if the canopy covers less than 30 percent of the ground surface (CBOC 1993).

Phase II burrow surveys were conducted by walking through suitable habitat over the entire CPVVS site and in areas within 150 meters of the area of project-related disturbance. Surveys were conducted for burrows made by fossorial mammals such as ground squirrels, as well as man-made structures such as culverts, debris piles, or openings beneath pavement. Because no burrowing owls or burrows were observed at the site, Phase III surveys were not required.

A western burrowing owl Phase I habitat assessment and Phase II burrow survey were conducted by Mr. Michael Clary on March 17, 2009 within the proposed CPVVS site following the methodology provided in the CBOC guidance. Weather during the surveys was clear and cool, with light winds from the south and 5 to 10 percent cloud cover.

Results

The CNDDB denotes no western burrowing owl occurrences within the proposed CPVVS site. The nearest reported western burrowing owl (CNDDB occurrence #962) is located 1.5 miles north of the CPVVS site at the top of a drainage ditch near the intersection of Lewis and Holdener Roads. No western burrowing owls were observed at the proposed CPVVS site during any of the site surveys.

The Phase I habitat assessment identified marginal nesting and foraging habitat for BUOW. Although the site had been disked subsequent to the June 13, 2008 survey and is currently dominated by annual vegetation, it possesses few areas with the low growing vegetation required to provide suitable foraging habitat (Photo 1). The site is predominantly flat, with a single densely vegetated 3 to 4-foot-high berm along an access road to the west (Photo 2). The site appears to be reestablishing the density of annual vegetation present prior to disking, and no bare areas, trees or shrubs were observed. A list of observed vegetation is provided in Table 1.

Due to the presence of marginal habitat, Phase II burrow surveys were conducted concurrent with Phase I surveys. Burrow surveys did not reveal any burrows or man-made structures that could provide shelter, protection or nesting habitat for western burrowing owls. Several culverts are located beyond the disked areas that were observed to be actively channeling agricultural drainage. No fossorial mammals were observed within the proposed CPVVS site.

TABLE 1
Observed Plant Species at the CPVVS site

Scientific Name	Common Name
Hirschfeldia incana	shortpod mustard
Avena barbata	slender oat
Medicago polymorpha	burclover
Erodium cicutarium	redstem stork's bill
Lolium perenne ssp. multiflorum	Italian ryegrass
Malva parviflora	cheeseweed mallow

Conclusion

The proposed CPVVS survey site does not currently provide suitable nesting or foraging habitat for western burrowing owl, and no burrowing owl occurrences have been reported within the CPVVS site. Due to the lack of suitable habitat for western burrowing owl, the proposed CPVVS project is unlikely to impact western burrowing owl. Per the discussions in the AFC section 5.2, mitigation is unlikely to be required for this species.

References

Blair, Heather. 2008. Pers. Comm. March 10.

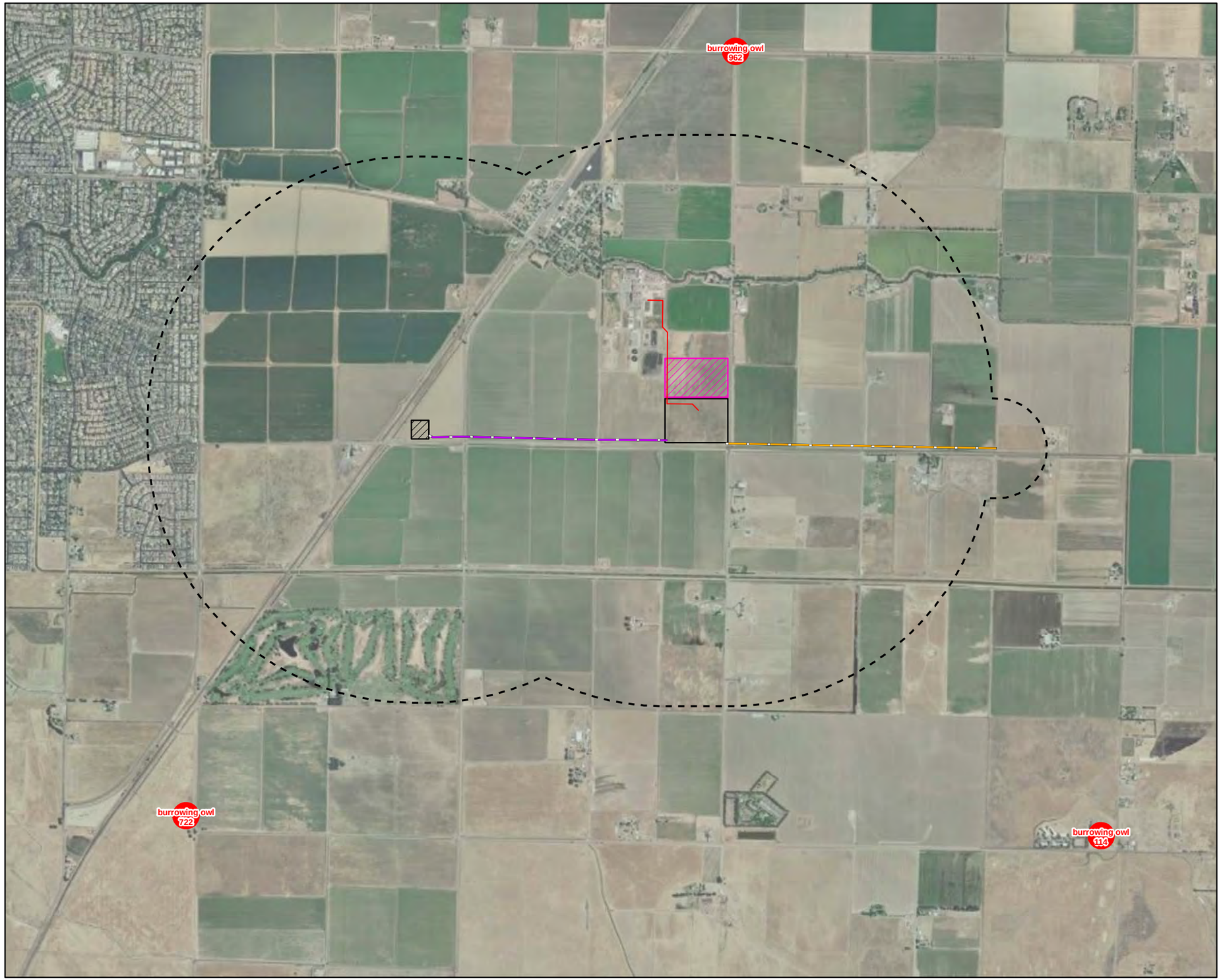
California Burrowing Owl Consortium (CBOC). 1993. Burrowing Owl Survey Protocol and Mitigation Guidelines. April.

California Department of Fish and Game (CDFG). 2008. California Natural Diversity Data Base. Search of the Mt. Vaca, Fairfield North, Fairfield South, Allendale, Elmira, Denverton, Dixon, Dozier, Birds Landing, Saxon, Liberty Island, and Rio Vista 7.5-minute USGS quadrangles

LSA. 2007. Solano Multispecies Habitat Conservation Plan. Version 2.2 Final Administrative Draft. Available online: http://www.scwa2.com/hcp2.2.html

Photo 1 - Site interior, showing shortpod mustard (Hirschfeldia incana) and red-winged blackbird (Agelaius phoeniceus).

Photo 2 - CPVVS site from the northwest showing roadside berm and annual vegetation



LEGEND

- Utility Corridor to WWTP
- Natural Gas Pipeline Route
- Electrical Transmission Line Route
- Drainage
- New Substation
- Laydown Area
- Project Site
- One Mile Buffer

CNDDB April, 2008

- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,000 2,000
Feet

FIGURE 1
BURROWING OWL OCCURRENCES WITHIN THE ONE MILE STUDY AREA
CPV VACA STATION
VACAVILLE, CALIFORNIA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\VACAVILLE_AFC_370668\MAPFILES\BURROWINGOWLOCC.MXD MHASKELL 3/30/2009 12:59:33

ATTACHMENT DR31-1

Swainson's Hawk Survey Report

CPV Vaca Station Swainson's Hawk Surveys

PREPARED FOR: CPV Vaca Station, LLC

PREPARED BY: Michael Clary

COPIES: Debra Crowe, Douglas Davy

DATE: March 19, 2009

PROJECT NUMBER: 370668

This technical memo supplements information previously presented in Chapter 5.2 of the CPV Vaca Station (CPVVS) Application for Certification (08-AFC-11). In response to California Energy Commission Staff Data Request #31, this memo presents the methods and results of a survey for Swainson's hawk (*Buteo swainsoni*) within the proposed CPVVS site and along the alignments of a proposed electrical transmission line and natural gas pipeline that was conducted in June of 2008. Swainson's hawk is listed by the state of California as a threatened species, and it is protected under the federal Migratory Bird Treaty Act (MBTA).

Methods

Prior to site surveys for Swainson's hawk, the California Natural Diversity Database (CNDDB, 2008) was queried and GIS locations of reported Swainson's hawk occurrences were depicted on a paper map for use in the field. The Solano Multi-species Habitat Conservation Plan (SMHCP) was reviewed to determine whether or not the CPVVS 1-mile survey area is within recognized Swainson's hawk habitat (LSA, 2007), and Swainson's hawk survey recommendations published in *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee [SHTAC], 2000) were reviewed for appropriate survey protocols.

The SHTAC methodology advises that Swainson's hawk nests are often well-hidden during the brood period (Survey Period IV) and that surveys should therefore not be conducted during that period. Surveys were delayed until the beginning the fledgling period (Survey Period V), established in the SHTAC methodology as beginning on June 10, 2008. Swainson's hawk young are typically active and visible during the fledgling period, and parents make numerous trips to the nest and can often be seen soaring above nest sites.

The methodology recommends surveys within 0.5 miles of project-related activities; however, CEC AFC requirements dictate surveys within 1.0 mile of the project site and within 1,000 feet of linear appurtenances. Therefore, in order to satisfy both requirements, the surveys of all suitable nesting habitat were conducted within 1.0 miles of the CPVVS facility and within 0.5 miles of the linear appurtenances.

Swainson's hawk surveys were conducted by Mr. Dan Williams and Mr. Michael Clary on June 13, 2008 within the CPVVS 1-mile survey area following the guidance provided in the SHTAC methodology. Weather during the survey was clear and warm, with light winds from the west and 10-30 percent cloud cover.

Both driving and walking surveys of the CPVVS 1-mile survey area were conducted. Driving surveys are preferred in the SHTAC methodology over walking surveys, and driving surveys of suitable nesting habitat did not exceed 5 miles per hour. Walking surveys of the proposed CPVVS site and linear appurtenances were conducted concurrent with a habitat assessment for western burrowing owl (*Athene cunicularia*) and included the use of high quality binoculars.

Results

The CNDDB reports 10 Swainson's hawk occurrences within the survey area (Figure 1). The nearest occurrence to the CPVVS facility (CNDDB occurrence #1303, last observed August 12, 2005) is located 0.5 miles south of the CPVVS site in a Eucalyptus tree adjacent to an alfalfa field. Five nests have been reported along Alamo Creek: CNDDB occurrence 569 was last observed August 8, 2005, and occurrences 860, 990, 996, and 1304 were last observed July 24, 2005. One Swainson's hawk nest has been reported within 250 feet of the proposed natural gas pipeline (CNDDB occurrence #1305, last observed July 23, 2005). Three additional Swainson's hawk nests have been reported to the northeast (CNDDB occurrences 989 last observed August 12, 2005 and CNDDB occurrence 1486, last observed June 24, 2002) and to the southwest (CNDDB occurrence 316, last observed May 18, 1990) of the proposed CPVVS site.

The CPVVS project is within an area identified in the SMHCP as an Irrigated Agriculture Conservation Area. This area encompasses all irrigated, non-irrigated, and some grassland habitat in the northeastern and eastern portions of the SMHCP Plan Area, and contains the majority of known Swainson's hawk records.

Suitable Swainson's hawk nesting and foraging habitat was observed throughout the survey area. The highest concentration of suitable nesting habitat is in large trees in the Alamo Creek riparian woodland north of the proposed CPVVS site, where the five nest occurrences have been reported in the CNDDB. The majority of the survey area is comprised of agricultural lands that provide suitable Swainson's hawk foraging habitat. Except for locations that would cross existing roads and associated drainage ditches, the proposed project site and linear appurtenances is comprised of active and inactive agriculture areas that provide suitable foraging habitat for Swainson's hawk.

No Swainson's hawk nests were observed during the protocol field surveys in June, 2008; however, several adult Swainson's hawk were observed foraging in the parcels to the north and west of the CPVVS site and in the vicinity of the reported nest locations north of the CPVVS site.

Conclusion and Recommendations

The CPVVS survey area is known to provide suitable nesting and foraging habitat for Swainson's hawk. Ten Swainson's hawk nest occurrences have been reported in the CNDDB within the survey area, the project vicinity recognized by the SMHCP as providing suitable habitat, and positive observations of Swainson's hawk presence were made during field surveys.

Due to the proximity of the proposed project to suitable nesting habitat and the presence of suitable foraging habitat at the project site, the CPVVS project has potential to impact Swainson's hawk.

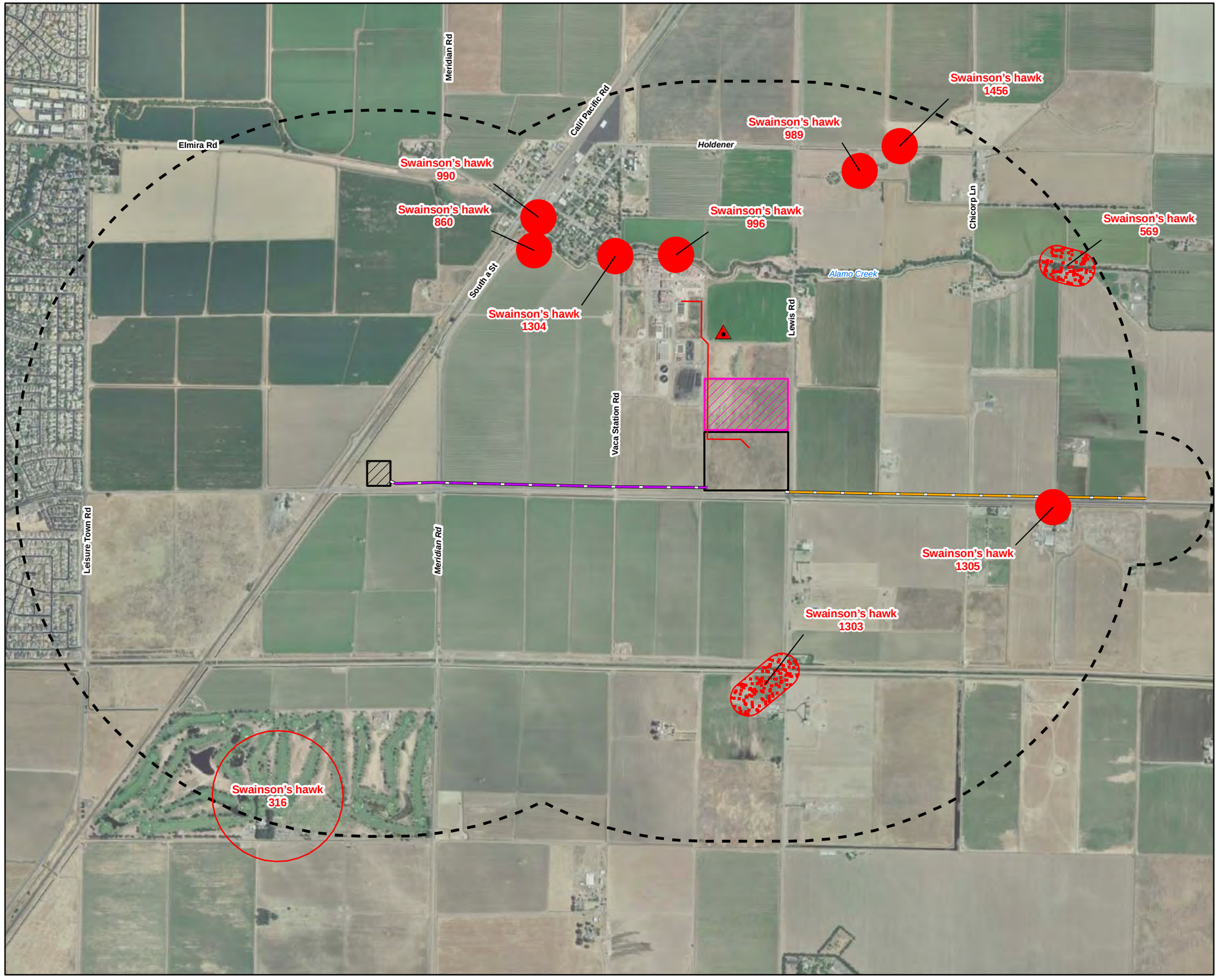
The SHTAC methodology recommends additional surveys at least during the two survey periods immediately prior to a project's initiation. Compensation for the loss of potential forage habitat at the project site will also be required. Mitigation Measure 2 in Section 5.2.4.2.1 of the CPVVS AFC recommends additional preconstruction surveys and compensatory mitigation for Swainson's hawk.

References

California Department of Fish and Game (CDFG). 2008. California Natural Diversity Data Base. Search of the Mt. Vaca, Fairfield North, Fairfield South, Allendale, Elmira, Denverton, Dixon, Dozier, Birds Landing, Saxon, Liberty Island, and Rio Vista 7.5-minute USGS quadrangles

LSA. 2007. Solano Multispecies Habitat Conservation Plan. Version 2.2 Final Administrative Draft. Available online: http://www.scwa2.com/hcp2.2.html

Swainson's Hawk Technical Advisory Committee (SHTAC). 2000. Recommended timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. May 31.



LEGEND

- Observed Special-status Species (Swainson's Hawk)
- Utility Corridor to WWTP
- Natural Gas Pipeline Route
- Electrical Transmission Line Route
- New Substation
- Laydown Area
- Project Site
- One Mile Buffer

CNDDB April, 2008

- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 750 1,500
Feet

FIGURE 1
SWAINSON'S HAWK OCCURRENCES WITHIN THE ONE MILE STUDY AREA
CPV VACA STATION
VACAVILLE, CALIFORNIA

CH2MHILL

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ATTACHMENT DR33-1

Pre-jurisdictional Waters Delineation Study

CPV Vaca Station Pre-jurisdictional Waters Delineation Study

PREPARED FOR: CPV Vaca Station, LLC

PREPARED BY: Michael Clary

COPIES: Debra Crowe, Douglas Davy

DATE: March 19, 2009

PROJECT NUMBER: 370668

Introduction and Background

This technical memo supplements information previously presented in Chapter 5.2 of the CPV Vaca Station (CPVVS) Application for Certification (08-AFC-11). In response to California Energy Commission Staff Data Request #33, this memo presents the methods and results of preliminary jurisdictional determination of Waters of the United States, including wetlands and waters of the State, associated with agricultural drainages present within the proposed CPVVS site and linear appurtenances. These drainage locations were depicted in Figure 5.2-2a-o of the AFC and are represented in Figure 1 of this memo. Additional wetlands and Waters within 1-mile of the project are discussed in AFC Section 5.2.2.2., *Wetlands and Waters of the U.S.*

Methods

Prior to site visits, an aerial image of the proposed CPVVS project site, electrical transmission line and natural gas pipeline was examined to identify aerial signatures consistent with potentially jurisdiction waters of the U.S. associated with the agricultural drainages common in the area. Digitized reaches of drainages previously identified in the AFC were also re-evaluated.

In the field, proposed locations of the electrical transmission line and natural gas pipeline alignments and portions of the CPVVS site were examined from the public roadway to identify and correlate agricultural drainages with signatures identified on the aerial imagery. Hydrological connectivity was evaluated by tracing the routes of each observed drainage downstream to its confluence with Alamo Creek. Field notes and photographs were recorded at each location where a potential agricultural drainage was identified within the proposed project area. Where possible, field notes of each drainage included information on the width, typical vegetation (NRCS, 2009), visible inundation, and hydrologic connectivity with other drainages. Photographs of each secondary drainage were taken to show the overall character of each drainage in the project area, as well as secondary drainage outfall connectivity to primary drainages (see Photos 1-28 below).

Results

A field study of potential USACE and/or state jurisdictional agricultural drainages was conducted by Mr. Michael Clary on March 17, 2009 within the proposed CPVVS site, electrical transmission line and natural gas pipeline as described in the AFC.

A total of eleven secondary agricultural drainages were identified during the field study that would intersect either the proposed electrical transmission line or the natural gas pipeline (Figure 1). Each of these drainages conveys agricultural runoff water to the south, perpendicular to Fry Road. Three irrigation canals (I- 4, I-12, I-13) were visible on aerial imagery and were identified in the field. These distribute water to agricultural fields

All of the agricultural drainages identified eventually confluence with Alamo Creek, a Water of the United States (jurisdictional waters), via one of two primary drains that run parallel to and south of Fry Road. The western primary drainage flows to the east from the Union Pacific Railroad to Lewis Road, and then flows south to New Alamo Creek (Photo 1). The eastern primary drainage flows east from Lewis Road to Old Alamo Creek (Photo 2). New Alamo Creek confluences with Old Alamo Creek approximately 1.5 miles southwest of the proposed CPVVS site.

All 14 agricultural drains and irrigation canals are depicted in Figure 1 and are described in detail below. Table 1 at the end of this memo summarizes the width, typical vegetation and facultative status, and photo number for each drainage and canal.

Agricultural Drainage AD-01

AD-01 is the westernmost agricultural drainage within the proposed CPVVS project area (Photo 3). This drainage is approximately 2 feet wide and is sparsely vegetated with shortpod mustard (*Hirschfeldia incana*). AD-01 runs to the south along the western shoulder of Meridian Road and connects with the western primary drainage through a culvert southwest of the Fry Road/Meridian Road intersection (Photo 4). An associated agricultural drainage that will not be impacted by the project runs parallel to and north of the Fry Road shoulder (AD-01P), confluencing with AD-01 at the culvert inlet (Photo 5).

Agricultural Drainage AD-02

AD-02 is located between Meridian and Vaca Station Roads (Photo 6). Vegetation within this drainage is dominated by poison hemlock (*Conium maculatum*, FACW) and rough cocklebur (*Xanthium strumarium*, FAC+). The AD-02 channel is approximately two feet wide and runs between two agricultural fields. This drainage connects with the western primary drain through a culvert that outfalls beneath an unpaved access road south of Fry Road (Photo 7).

Agricultural Drainage AD-03

AD-03 is located west of Vaca Station Road (Photo 8). It is vegetated with shortpod mustard (*Hirschfeldia incana*) and rough cocklebur (FAC+). AD-03 is approximately 2 feet wide and runs between two agricultural fields. This drainage connects to AD-05 via a perpendicular drainage that will not be impacted by the project (AD-03P, Photo 9). Both AD-03 and AD05 connect to the western primary drainage via a culvert beneath Fry Road.

Irrigation Canal I-04

I-04 is an unvegetated irrigation canal located between AD-03 and AD-05 (Photo 10).

Agricultural Drainage AD-05

AD-05 is located adjacent to the west shoulder of Vaca Station Road and confluences with AD-03P (Photo 11) at the culvert inlet north of Fry Road (Photo 12). AD-05 is 3 feet wide and is vegetated with shortpod mustard and curly dock (*Rumex crispus*, FACW-). The culvert to the western primary drainage is located southwest of the intersection of Vaca Station and Fry Roads. (Photo 13).

Agricultural Drainage AD-06

AD-06 is located adjacent to the west shoulder of Lewis Road (Photo 14). The drainage is 3 feet wide and is dominated by shortpod mustard, poison hemlock, and curly dock (FACW-). The culvert to the western primary drainage is located west of the Lewis Road/Fry Road intersection (Photo 15).

Agricultural Drainage AD-07

AD-07 is located adjacent to the east shoulder of Lewis Road (Photo 16). AD-07 is 2 feet wide, and is vegetated with shortpod mustard and ripgut brome (*Bromus diandrus*). No culvert to the eastern primary drainage is visible to the southwest of the Lewis Road/Fry Road intersection; however, a large block of concrete may be obscuring the outfall at this location (Photo 17).

Agricultural Drainage AD-08

AD-08 is located approximately 1200 feet east of Lewis Road (Photo 18). AD-08 is approximately 4 feet wide, and vegetation is dominated by shortpod mustard and cultivated radish (*Raphanus sativus).* The culvert outfall to the eastern primary drainage is opposite Fry Road (Photo 19).

Agricultural Drainage AD-09

AD-09 is adjacent to the west shoulder of Chicorp Lane (Photo 20). AD-09 is approximately 4 feet wide and is vegetated with shortpod mustard, slender oat (*Avena barbata*), and hummingbird trumpet (*Epilobium canum*). The culvert outfall to the eastern primary drainage is opposite Fry Road (Photo 21).

Agricultural Drainage AD-10

AD-10 is adjacent to the east shoulder of Chicorp Lane (Photo 22). AD-10 is approximately 5 feet wide and is sparsely vegetated with hummingbird trumpet. A concrete headwall is located at the culvert inlet. An outfall to the eastern primary drainage was not found; this drainage may confluence with the AD-09 outfall beneath Fry Road.

Agricultural Drainage AD-11

AD-11 is approximately 1100 feet east of Chicorp Lane (Photo 23). The drainage is approximately 4 feet wide and is vegetated with slender oat and ripgut brome. The culvert outfall to the eastern primary drainage is opposite Fry Road (Photo 24).

Irrigation Canal I-12

I-12 is approximately 1125 feet east of Chicorp Lane (Photo 25).

Irrigation Canal I-13

I-13 is approximately 1125 feet east of Chicorp Lane (Photo 26).

Agricultural Drainage AD-14

AD-14 is approximately 2,600 feet east of Chicorp Lane (Photo 27). The drainage is vegetated with hummingbird trumpet, redstem stork's bill (*Erodium cicutarium*), bristly oxtongue (*Picris echioides*, FAC*), willowleaf lettuce (*Lactuca saligna*), and shepard's purse (*Capsella bursa-pastoris*, FAC-). The culvert outfall to the eastern primary drainage is opposite Fry Road (Photo 28).

Conclusion and Recommendations

Federal USACE jurisdictional waters of the U.S include all rivers and creeks that are tributary to navigable waters as well as wetlands, wet meadows, and seeps that are adjacent to such features. The USACE may take jurisdiction over agricultural drainages that have connectivity to navigable waters. State Water Resources Control Board (SWRCB) jurisdictional waters include all surface waters within the State, including agricultural drainages.

The proposed CPVVS project area contains or its features cross 11 secondary agricultural drainage features that are hydrologically connected to Alamo Creek via two primary drainages (Figure 1). Therefore, these features are likely to be determined jurisdictional waters, based on the connectivity to the navigable waters of Alamo Creek and subject to USACE confirmation. These are designated as Agricultural Drainages (AD) in the descriptions, above. Three irrigation canals within the proposed CPVVS site or that cross its linear appurtenances are not hydrologically connected to jurisdictional waters of the U.S., and are therefore unlikely to be considered under the jurisdiction of the USACE. There is no downstream hydrological connectivity from these waters to jurisdictional ones; rather, the water in these canals is distributed to agricultural fields. These are designated as Irrigation Canals (I-04, I-12, and I-13) in the discussions, above.

TABLE 1
Observed Drainage Features at the CPVVS Site

Drainage/ Irrigation	Width (feet)	Dominant Vegetation	Notes	Photos
AD-01	2	shortpod mustard (*Hirschfeldia incana*, NOL)	Recently dug, very sparsely vegetated. Connects with drainage AD-01P to the west.	3, 5
AD-02	2	poison hemlock (*Conium maculatum*, FACW), rough cocklebur (*Xanthium strumarium*, FAC+)	No inundation	6, 7
AD-03	2	shortpod mustard (*Hirschfeldia incana*, NOL), rough cocklebur (*Xanthium strumarium*, FAC+)	Parallel drains to the West of Vaca Station Road are connected by a perpendicular drain parallel to Fry Road A common culvert is located near the Vaca Station/Fry intersection.	8, 9

TABLE 1
Observed Drainage Features at the CPVVS Site

Drainage/ Irrigation	Width (feet)	Dominant Vegetation	Notes	Photos
I-04	2	shortpod mustard (*Hirschfeldia incana*, NOL), rough cocklebur (*Xanthium strumarium*, FAC+)	Irrigation canal	10
AD-05	3	shortpod mustard (*Hirschfeldia incana*, NOL), curly dock (*Rumex crispus*, FACW-)	Not inundated	11, 13
AD-06	3	shortpod mustard (*Hirschfeldia incana*, NOL), poison hemlock (*Conium maculatum*, FACW), curly dock (*Rumex crispus*, FACW-)		14, 15
AD-07	2	shortpod mustard (*Hirschfeldia incana*, NOL), ripgut brome (*Bromus diandrus*)	Not inundated	16, 17
AD-08	4	shortpod mustard (*Hirschfeldia incana*, NOL), cultivated radish (*Raphanus sativus*, NOL)	Inundated	18, 19
AD-09	4	shortpod mustard (*Hirschfeldia incana*, NOL), slender oat (*Avena barbata*, NOL), hummingbird trumpet (*Epilobium canum*, NOL)		20, 21
AD-10	5	hummingbird trumpet (*Epilobium canum*, NOL)	Sparsely vegetated	22
AD-11	4	slender oat (*Avena barbata*, NOL), ripgut brome (*Bromus diandrus*)	Inundated	23, 24
I-12	2	hummingbird trumpet (*Epilobium canum*, NOL)	Irrigation canal	25
I-13	2	hummingbird trumpet (*Epilobium canum*, NOL)	Irrigation canal, sparsely vegetated	26
AD-14	4	hummingbird trumpet (*Epilobium canum*, NOL), redstem stork's bill (*Erodium cicutarium*), bristly oxtongue (*Picris echioides*, FAC*), willowleaf lettuce (*Lactuca saligna*), and shepard's purse (*Capsella bursa-pastoris*, FAC-)	Inundated	27, 28

[a] National List of Plant Species that Occur in Wetlands, Region 0 [California] (Reed, 1988).
FAC = Facultative Status Species; Estimated probability of 33% to 67% chance of occurring in wetlands.
FAC- = Species not considered to be typically adapted for life in anaerobic soil conditions.
FACW = Facultative Wetland Status; Estimated probability of 67% to 99% chance of occurring in wetlands.
NOL = Not on 1988 List.
+, -, * = Modifiers developed by the National Plant List Panel.

References

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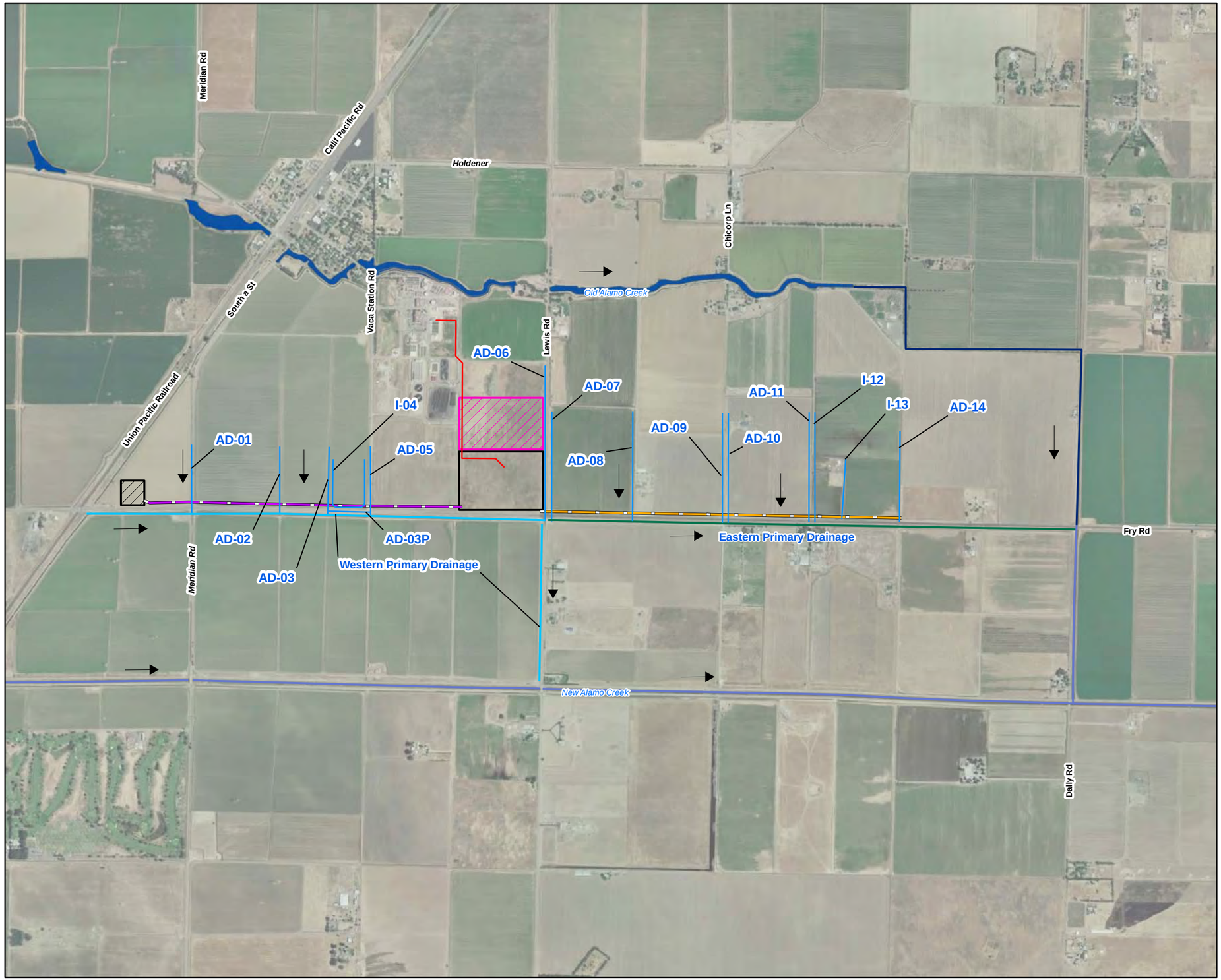

LEGEND

- Utility Corridor to WWTP
- Natural Gas Pipeline Route
- Electrical Transmission Line Route
- Direction of Flow
- Agricultural Drainage Ditch
- Eastern Primary Drainage
- New Alamo Creek
- Old Alamo Creek
- Western Primary Drainage
- New Substation
- Laydown Area
- Project Site

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 750 1,500
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FIGURE 1
POTENTIALLY JURISDICTIONAL AGRICULTURAL DRAINAGES
CPV VACA STATION
VACAVILLE, CALIFORNIA

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Photo 1- Confluence of eastern primary drainage with Old Alamo Creek, to the west.

Photo 2 – Confluence of western primary drainage with New Alamo Creek, to the north

Photo 3- AD-01 to the northeast from Fry Road

Photo 4- AD-01 outfall to the western primary drainage, to the northeast

Photo 5- AD-01P, to the west.

Photo 6- AD-02, to the north

Photo 7-AD-02, showing unpaved access road above culvert to western primary drainage, to the north.

Photo 8- AD-03, to the north.

Photo 9- AD-03P, to the east

Photo 10 - I-04, to the north

Photo 11- AD-03P, to the west.

Photo 12 – AD-03P culvert inlet, to the southwest.

Photo 13- AD-05 outfall to the western primary drainage, to the west.

Photo 14- AD-06, to the north.

Photo 15 - AD-06 outfall to the western primary drainage, to the north.

Photo 16 – AD-07, to the north.

Photo 17- AD-07, possible obscured outfall to the eastern primary drainage, to the north.

Photo 18 – AD-08, to the north

Photo 19 – AD-08 outfall to the eastern primary drainage, to the southwest.

Photo 20 – AD-09, to the north

Photo 21 – AD-09 outfall to the eastern primary drainage, to the east.

Photo 22 – AD-10, to the north.

Photo 23 - AD-11, to the north.

Photo 24- AD-11showing outfall to eastern primary drainage, to the east

Photo 25 – I-12, to the north.

Photo 26 – I-13, to the north.

Photo 27- AD-14, to the north.

Photo 28 – AD-14, showing outfall to the eastern primary drainage, to the northwest.

Cultural Resources (36–41)

Depths of Excavations

36. *Please provide the depths of the excavations, in feet and inches from the ground surface, required for the following foundations for proposed CPVVS equipment, systems, and features:*

a. Combustion turbine generator
b. Steam turbine generator
c. Heat recovery system generator
d. Raw/fire water storage tank
e. Control building
f. Water treatment building
g. Demineralized water storage tank
h. Neutralization tank
i. Feedwater pump enclosure
j. Utility bridge
k. Fire/water pump house
l. Ammonia storage tank
m. Switchyard
n. Air cooled condensers
o. Generator step-up
p. Monopoles for the interconnection transmission line

Response: Table DR36-1 and Figure DR36-1 show the depths of excavations for each of these features. Please note that the project design does not include an air cooled condenser (item n). The table includes a cooling tower and cooling tower pump pit in its place.

TABLE DR36-1
Depths of Excavation (feet)

Equipment	Ground Surface Elevation[a]	Top of Foundation	Depth of Foundation	Bottom of Foundation	Depth of Excavation
Combustion turbine generator	63.3	65.5	6	59.5	3.8
Steam turbine generator	63.3	65.5	9	56.5	6.8
Heat recovery steam generator	62.7	65.5	6	59.5	3.2
Raw/fire water tank	62.5	66.4	5	61.4	1.1
Control building	63.5	64.8	3	61.8	1.7
Demineralized water tank	62.7	66.8	5	61.8	0.9
Neutralization tank	62.5	65.3	5	60.3	2.2
Feedwater pump enclosure	62.7	65.5	3.5	62	0.7

TABLE DR36-1
Depths of Excavation (feet)

Equipment	Ground Surface Elevation[a]	Top of Foundation	Depth of Foundation	Bottom of Foundation	Depth of Excavation
Utility bridge	63.0	65.5	4	61.5	1.5
Fire water pumphouse	62.5	66.3	3.5	62.8	-0.3
Ammonia storage tank	62.3	63.4	3	60.4	1.9
Switchyard	64.5	64.5	3	61.5	3
Cooling tower	62.0	63.8	2.5	61.3	0.7
Cooling tower pump pit	62.0	63.8	25	38.8	23.2
Step up transformer	63.7	64.5	6	58.5	5.2
Transmission line monopoles[b]	various	various	25	25	25

[a]Ground surface elevations based on ALTA Survey
[b]The depths of the independent monopole foundations are highly dependant on the soil, loads, etc. Final determination will be made during final design.

Revised Figure – Project Elevations

37. *Please adapt and provide a revised Figure 2.1-3 (the CPVVS project elevations) to show the expected depths of foundations for the illustrated equipment, pipelines, and underground tank installations at the power plant.*

Response: Please see Figure DR36-1.

Widths and Depths of Conveyance Pipelines

38. *Please provide the maximum widths and depths, in feet and inches from the ground surface, of trenches for the conveyance pipelines for recycled water, potable water, and sewage.*

Response: The location of the recycled water line, potable water line, and sewer line are shown on Figure 2.1-1 of the AFC. All three lines will be under pressure, and will be constructed to minimal depths where possible. In certain locations, the depths of these lines may need to be increased to accommodate underground obstructions. These locations represent the location of the maximum width and depth of the excavation. It is estimated that the maximum width and depth of each excavation is as follows:

Recycled Water: 5′-0″ wide x 12′-0″ deep
Potable Water: 4′-0″ wide x 12′-0″ deep
Sewer Lines: 3′-0″ wide x 12′-0″ deep

Historical Geomorphology of Project Site

39. *Please provide a study of the historical geomorphology of the project site by a professional geoarchaeologist, who, at a minimum, meets the U.S. Secretary of the Interior's Professional Qualifications Standards for a professional in archeology and is able to demonstrate the completion of graduate-level coursework in geoarchaeology, physical geography, geomorphology, or quaternary science. The study should evidence consideration of the*

potential at the CPVVS for buried archaeological deposits from the surface to the maximum depth of excavation proposed for construction. The discussion should include information on the development of local landforms during and subsequent to the Late Pleistocene era, along with the apparent stability of the course of Alamo Creek during the Holocene. The primary grounds for the discussion should be data on the geomorphology, sedimentology, pedology, and stratigraphy of the project area or near the vicinity the Late Quaternary period. The sources of these data may be a combination, as necessary, of extant literature or primary field research.

Response: The major physiographic features of this region are the north-south trending Coast Ranges to the west, and the Great Valley paralleling them to the east in which the CPVVS lies. The Sacramento Valley begins north of the confluence of the Sacramento and San Joaquin Rivers, about 10 miles southeast of the project area. The Montezuma Hills approximately 7 miles south of the CPVVS represent an area of active deformation and a recently upwarped crustal segment (Weber, 2005), with Quaternary sediments exposed by erosion of its flanks.

The proposed CPVVS site lies on the gently sloping alluvial plain that extends southeast and east from the Vaca and English Hills, foothills of the Coast Ranges that lie only about 2.6 miles west-northwest of the project area. These north-south trending hills are the easternmost outcrops of the monoclinal ridges that comprise the Great Valley Complex of Cretaceous and Paleogene marine sediments. Physiographically, the ridges mark the western margin of the Sacramento Valley and the beginning of the Coast Ranges (Graymer et al., 2002; Helley and Harwood, 1985). The alluvial plain that extends from these highlands through the project area slopes at less than 15 feet per mile to the east-northeast.

The project site is about 0.3 mile south of the current course of Alamo Creek, a tributary to Ulatis Creek, which in turn drains southeast to Cache Slough on the northwestern margin of the Sacramento–San Joaquin River Delta. The head of Cache Slough is about 13.5 miles southeast of the project site. The project laterals, which extend approximately 1 mile east and west of the CPVVS plant site, do not encounter topography or subsurface geology substantively different from the vicinity of the proposed plant site. Available data consist of surface geological mapping, and borehole logs completed for geotechnical and environmental investigations. Additional information is provided by remote imagery and in-field examination of drainage channels and shallow road cuts. No Quaternary geological or archaeological investigations with information immediately relevant to the topics and project area are available.

The most detailed geological mapping of the project area was completed by Helley and Harwood (1985), who recognized four Neogene and Quaternary sedimentary units in the vicinity (Table DR39-1).

TABLE DR39-1
Sedimentary Units Mapped in the Vicinity of the Project Area

Symbol	Name	Age and Descriptive Notes*
Qa	Alluvium	Holocene silts, sands, and gravels deposited by present-day stream and river systems. This sedimentary unit lies inboard of the low terraces that flank current stream systems.
Qb	Basin Deposits	Undivided Holocene basin deposits. Fine-grained silt and clay with the distal deposits being very dark gray to black. Thickness is limited (1 to 2 m) on the valley margins, to much greater (60 m) in the valley axis.
Qml	Lower member, Modesto Formation	Late(?) Pleistocene (early to middle Wisconsin?) valley fill consisting of unconsolidated, slightly weathered gravel, sand, silt and clay. The lower member forms terraces that are a few meters higher than the younger, upper member. Upstream of major drainages (such as in the study area), the lower member of the Modesto formation is preserved as isolated terraces. The lower member is much more extensive than the upper member, and soils developed in the lower member have a distinct argillic (clay-rich) B horizon.
Tte	Tehama Formation	Pliocene valley fill, in this area resting unconformably on Cretaceous marine strata. Pale green, gray, and tan sandstone and siltstone derived (in this area) from the Coast Ranges. Tephrachronology securely places the age of the base of the Tehama Formation at about 3.4 million years (Sarna-Wojcicki et al., 1991).

*After Helley and Harwood (1985) unless otherwise noted.

Others have mapped the project area (e.g., Graymer et al., 2002; Wagner et al., 1981), but these do not match the detail that Helley and Harwood (1985) provide. All these mapping efforts agree that the Pliocene Tehama Formation is responsible for the most pronounced topographic highs in the project area, but only Helley and Harwood (1985) differentiate the more subdued terraces attributable to the lower member of the Modesto Formation from later, Holocene alluvium. Their mapping shows that the project site is several hundred feet south of the southern limit of a subdued terrace composed of Lower Modesto Formation sediment (Qml), and is within the limit of an expansive area occupied by Holocene alluvium (Qa; Figure DR39-1). A relatively prominent terrace about 2 miles to the east represents the inverted topography of a Tehama Formation outcrop.

Geotechnical investigations in support of the Easterly Wastewater Treatment Plan Expansion (Kleinfelder, 1999) and the Phase II ESA for this project (CH2M HILL, 2008) provided borehole logs that were examined to better understand the subsurface stratigraphy of the site. These data are consistent with the mapping results of Helley and Harwood (1985) to the extent that boreholes to the north and west of the project site, and within the area mapped as the lower member of the Modesto Formation, show a much greater proportion of clay at depth than those within the project site. Boreholes within the project site record a transition from silty-clay and silt to sand at depths from 4 to 8 feet below the surface. Although pedological analysis is lacking, these differences are consistent with the presence of a well-developed, clay-rich horizon on the older Modesto Formation.

The Holocene-age alluvium of the project site would not possess such a well-developed argillic (clay-rich) soil horizon.

There are no immediately available data that speak to past variations in the position of Alamo Creek, which currently lies about 0.3 mile north of the project area. The very low gradient of the terrain in the area naturally results in a highly meandering stream course, which can easily be seen where the creek remains unchannelized. Meandering streams alter their course frequently, and therefore it is possible that Alamo Creek once flowed closer to the project site that it does at present. There is, however, no available evidence for change in the course of Alamo Creek other than the Quaternary alluvium itself that comprises the near-surface sediment at the site. That alluvium is stream-borne sediment, and therefore likely originated from Alamo Creek or a proto Alamo Creek. Because the subdued topographic high immediately north and west of the project site is a bounding terrace for Holocene streams flowing generally from west to east (Helley and Harwood, 1985), it is possible that in the past Alamo Creek could have flowed south of that terrace on a course that was south of but generally parallel to its current course. That would account for the Quaternary basin deposits about 1 mile south-southeast of the project site (Figure DR39-1).

Few data are available to address the subsurface archaeological potential of the project area. Available information suggests a rather homogenous subsurface environment, which is consistent with the current subdued terrain of the surrounding alluvial plain. The edge of a low terrace is mapped several hundred feet to the north and west of the project site (Figure DR39-1), and borehole logs suggest a lateral change in sediment characteristics consistent with the presence of the lower member of the Modesto Formation there. This terrace is the only potential paleotopographic feature in the project vicinity, although its paleoenvironmental and, therefore, archaeological significance is equivocal given the scant information available on subsurface conditions.

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Geoarchaeologist Resume

40. Please provide the resume of the geoarchaeologist demonstrating his/her qualifications.

Response: Dr. W. Geoffrey Spaulding's resume is included as Attachment DR40-1.

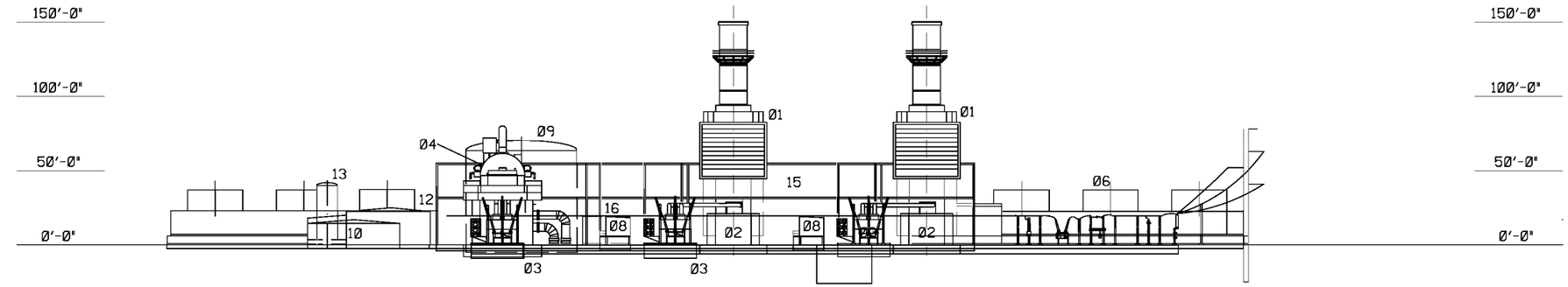
Soil Borrow or Disposal Sites

41. Please indicate whether the proposed project may use any non-licensed, noncommercial soil borrow or disposal sites. If so:

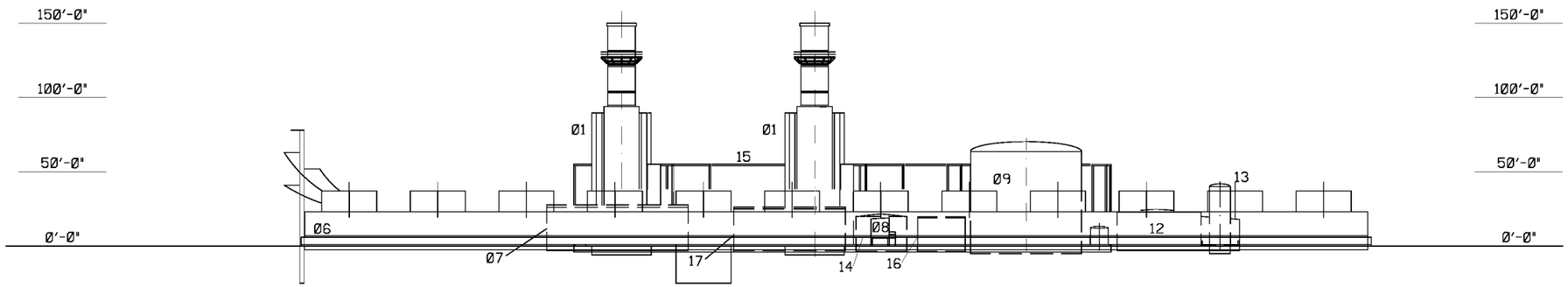
a. Please have a qualified archaeologist survey these sites and record on Department of Parks and Recreation (DPR) 523 forms any cultural resources that are identified; and

b. Please submit to staff a report on the methods and results of these surveys, with recommendations for the treatment of any cultural resources identified in the surveys.

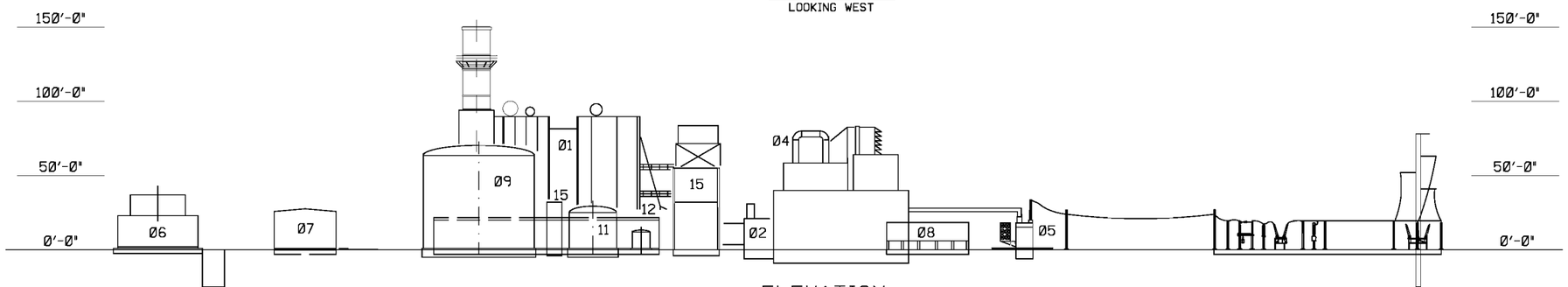
Response: The project does not propose to use any non-licensed, noncommercial soil borrow or disposal sites.



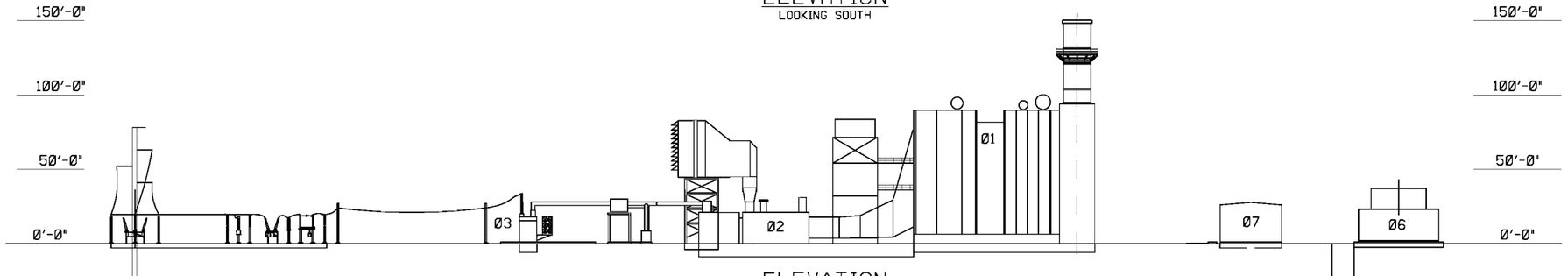
ELEVATION
LOOKING EAST



ELEVATION
LOOKING WEST



ELEVATION
LOOKING SOUTH



ELEVATION
LOOKING NORTH

LEGEND:

- 01- HRSG
- 02- COMBUSTION TURBINE GENERATOR
- 03- CT GENERATOR STEP-UP TRANSFORMER
- 04- STEAM TURBINE GENERATOR
- 05- ST GENERATOR STEP-UP TRANSFORMER
- 06- COOLING TOWER
- 07- COOLING TOWER CHEMICAL FEED BUILDING
- 08- POC
- 09- RAW/FIRE WATER STORAGE TANK
- 10- CONTROL BUILDING
- 11- DEMINERALIZED WATER STORAGE TANK
- 12- WATER TREATMENT BUILDING
- 13- NEUTRALIZATION TANK
- 14- FEEDWATER PUMP ENCLOSURE
- 15- UTILITY BRIDGE
- 16- FIRE WATER PUMP HOUSE
- 17- AMMONIA STORAGE TANK

40 0 40 80 120
SCALE: 1" = 40'

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC.	PROJ ENGR MANAGER	PROJECT MANAGER
C	#3 17 #5	ISSUED FOR REVIEW	KSW			MP	MP	SB
B	#6 25 #8	ISSUED FOR REVIEW	SAB			MP	MP	SB
A	#3 #9 #2	ISSUED FOR REVIEW	RAK			MP	MP	SB

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE M. PELLETIER 04/09/08

APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL

DRAWN BY: RAK
CHECKED BY:
LEAD DESIGNER:
ENGINEER/TECH SPECIALIST:
PROJECT ENGINEERING MANAGER: M. PELLETIER
PROJECT MANAGER: S. BLUE

PROFESSIONAL ENGINEER'S SEAL

Zero Harm — Leadership, No Incidents, Safe Behavior

WORKMANLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

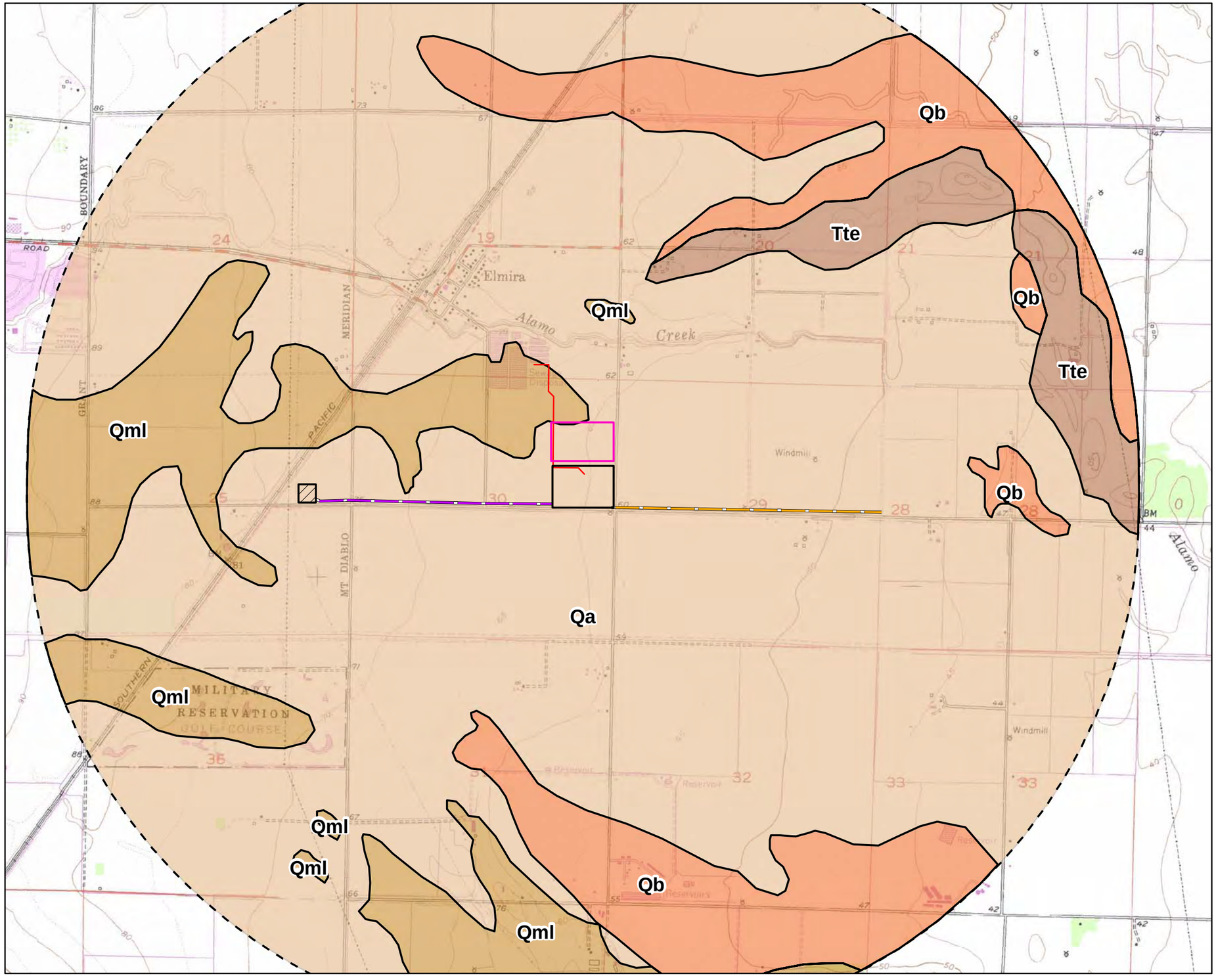
WorleyParsons
resources & energy

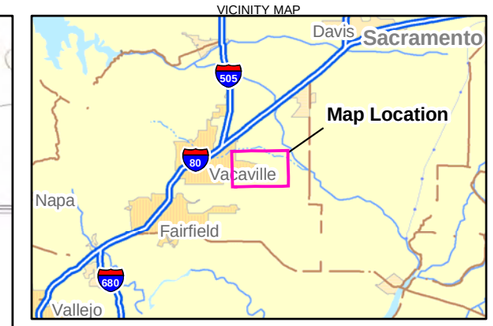
CLIENT/PROJECT TITLE
COMPETITIVE POWER VENTURES
VACAVILLE

GENERAL ARRANGEMENT
ELEVATIONS

SCALE: 1"=40'
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: VACA-0-SK-111-002-102
REV: C

◆◆DESIGN-FILE-NAME◆◆
◆◆◆DATE◆◆◆ ◆◆◆TIME◆◆◆





LEGEND

- Utility Corridor to WWTP
- Natural Gas Pipeline Route
- Electrical Transmission Line Route
- Construction Laydown Area
- Project Site
- New Substation
- Two Mile Buffer

Geology Type

- Geologic Contact (approximate)
- Qa - Quaternary Alluvium
- Qb - Quaternary Basin Deposit
- Qml - Quaternary Modesto Formation, Lower Member
- Tte - Tehama Formation

Notes:
1. Area of interest subject to change.
2. Source: Geologic map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierra Foothills, Califorina. by E.J. Helley and D.S. Harwood, 1985. USGS MF-1790
3. No paleontological sites are recorded within one mile of the project site, or within the map coverage shown here

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,000 2,000
Feet

FIGURE DR39-1
GEOLOGY WITHIN TWO MILES OF SITE
CPV VACA STATION
VACAVILLE, CA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\VACAVILLE_AFC_370668\MAPFILES\GEOLOGYTYPE_PALEO.MXD MHASKELL 4/6/2009 09:22:13

ATTACHMENT DR40-1

Resume of W. Geoffrey Spaulding

W. Geoffrey Spaulding
Paleontological Resources Specialist / Geoarchaeologist

Education

Ph.D., Geology (Paleobiology & Quaternary Geology), University of Arizona, 1981
M. S., Geology (Palynology & Vertebrate Paleobiology), University of Arizona, 1974
B. A., Anthropology (Archaeology), University of Arizona, 1972

Certifications

- California State Bureau of Land Management Paleontological Resources Use Permit CA-07-17
- Approved Paleontological Resources Specialist by the California Energy Commission, State of California
- Qualifications as Paleontological Resources Expert Witness accepted by the Attorney General of the State of Washington

Distinguishing Qualifications

- Specialist in Paleontological Resources Management
- Expert in the Quaternary Paleoenvironments of Western North America
- Specialist in Site Formation Processes, Quaternary Geology, Geoarchaeology, Paleohydrology
- Captain, Signal Corps, U. S. Army Reserve (Retired)

Relevant Experience

Dr. Spaulding is a senior scientist and paleontologist with CH2M HILL with extensive experience in geomorphology, geoarchaeology, paleobiology and paleoecology. He also is accomplished in the study of site formation processes, and in age determinations of archaeological and paleontological sites in the western United States. He has more than three decades of technical experience in the Earth and Life sciences focusing on the Quaternary of western North America including California. Representative projects that he has managed in the last 12 years are listed below. Prior to joining private industry, he was a Research Professor at the University of Washington, Seattle, with his office and laboratory housed in the Quaternary Research Center. During this time he worked with the well-known Quaternary geologists Stephen C. Porter, A. Lincoln Washburn, and Brian Atwater. During his preceding graduate student tenure at the University of Arizona, the pre-eminent PaleoIndian geoarchaeologist C. Vance Haynes sat on Dr. Spaulding's Ph.D. committee, and Spaulding took the opportunity to attend all classes and seminars offered by Dr. Haynes. He also took the geomorphology classes offered by the renowned geomorphologist William B. Bull. Finally, while on contract with the

U.S. Geological Survey and the State of Nevada Dr. Spaulding was fortunate enough to work several times with Roger B. Morrison, one of the best known Quaternary geologists of the late 20th century.

Paleontological Resources Management

California Energy Commission Approved Paleontological Resources Specialist, Multiple Power Generation Projects, California. Conduct literature reviews, records searches, and field surveys to develop Paleontological Resources Assessments, prepare paleontological resources impacts assessment and mitigation measures, for the projects' Application for Certification before the California Energy Commission. Determine the relative levels of paleontological sensitivity of Mesozoic through Quaternary rock units in the context of the geological history of the project areas, direct field surveys, and prepare resource specific documentation for more than 16 separate projects from San Diego in the south to Arcata in the north. Prepare Paleontological Resources Monitoring and Mitigation Plans for construction-phase compliance activities.

Paleontological Resources Specialist, Construction-Phase Mitigation Implementation, Multiple Power Generation Projects, California. Develop and manage paleontological resources monitoring and mitigation programs for the construction of power generation projects including the Walnut Energy Center south of Modesto, the Roseville Energy Park east of Sacramento, and the Gateway generation Station near Antioch. Prepare the Paleontological Resources Module of the worker education program and visual aids for worker education. Direct the recovery of discovered paleontological resources (Quaternary vertebrate and paleobotanical remains), and consult with client representatives and the California Energy Commission on the adequacy of mitigation efforts. Develop site-specific stratigraphic framework to identify paleontologically sensitive sediments, and to provide client and the CEC with guidance regarding what construction activities need and need not be monitored.

Ivanpah Valley Bright-Source Energy EIS/AFC. Conduct records review and literature search, field reconnaissance and subsequent field survey of paleontologically sensitive areas, and recordation of Paleozoic and Quaternary paleontological sites in support of a large solar powered electrical generation facility. Include modeling of pluvial lake highstands to determine maximum elevation of paleontologically sensitive sediments. Prepare appropriate paleontological resources sections for BLM EIS and California Energy Commission Application for Certification.

Salton Sea Ecosystem Restoration Project EIR. Geological and paleontological literature review, records search including consultations with California State Paleontologist, to develop large scale paleontological sensitivity assessment of the Salton Trough. Develop impact assessment and mitigation measures for Environmental Impact Report. Develop mitigation measures for eight different action alternatives, and respond to comments on the PEIR.

Paleontological Resources Assessment for Kinder Morgan's EPX Pipeline, Texas, New Mexico, and Arizona. Literature and records review, remote-sensing and map analyses to characterize the affected environment and environmental impacts for a Bureau of Land

Management Environmental Assessment for the installation of an interstate petroleum products pipeline. Prepare appropriate sections of the EA, and assemble technical information from museums in three states.

Transportation-Related Paleontological Resources Management Services, southern California. Perform paleontological resources assessments, develop management and monitoring plans, prepare, review and amend subconsultant scopes of work, and provide audit services to clients for paleontological resources management work. Multiple contracts for the City of San Diego, the Regional Transportation Commission, and the Counties of Riverside, San Diego and Orange. Formations addressed included Quaternary terrestrial and lacustrine units, and Tertiary marine and estuarine sediments.

Client Task Oversight & Expert Witness Testimony On Paleontological Resources Sensitivity. Review and develop discovery and mitigation plans, and provide testimony to the Attorney General of the State of Washington. On the paleontological data potential and impacts to Middle Tertiary age fossil resources in the Columbia Basin, and on potential project-related impacts pursuant to Washington's Energy Facility Siting & Environmental Certification process, on behalf of Olympic Pipeline Corporation.

Paleontological Resources Assessment & Mitigation Plan Development, McKittrick Tar Pits, central California. Review the extensive literature; develop a resources assessment and preliminary management plan for paleontological resources in the vicinity of the renowned McKittrick Tar Pits in the Central Valley for a confidential client interested in the development of the oil-rich diatomites and sands of the area.

Duke Energy of North America, Paleontological Support Services for The Potrero and Contra Costa Applications For Certification. Conduct literature reviews, record searches, and site surveys; and prepare appropriate sections of Applications for Certification according to the format and data requirements of the California Energy Commission. Respond to CEC staff questions and requests for additional data. Provide cost-control strategies to client. In support of the relicensing efforts for two power plants in the Bay Area of California.

Owens Lake Air Quality Mitigation Program, Paleontological Resources Review and Strategy Development. Review resource assessments and draft mitigation plans on the clients behalf to assure that mitigation measures called for are consistent with the resources that may be found in the project area. Audit of consultant work to assure economy of scale in mitigation requirements.

Cultural Resources Management

Nellis Air Force Range Three Lakes Valley Archaeological Survey & Subsistence Modeling. A multi-phase project involving site formation analysis and paleohydrologic modeling and, in cooperation with project archaeologists, the development of an integrated subsistence and settlement model to predict the occurrence and density of prehistoric sites in a large desert valley. Managed the subsequent survey of an approximately 3,000-acre area to test and refine the predictive model, and relate site occurrences to Holocene pluvial climatic events.

W. Geoffrey Spaulding

Kern River Pipeline Cultural & Paleontological Resources Compliance, California, Nevada, and Utah. Coordination and implementation of cultural resources mitigation and monitoring efforts along a 678-mile pipeline corridor involving up to 160 personnel operating in three states. Consult with state and federal agencies (FERC, Advisory Council on Historic Preservation Bureau of Land Management), and coordinate with client representatives. Direct and participate in state-wide field compliance programs. Participate in and direct technical studies of sites ranging in age from Paleoindian to Formative Periods. Manage the preparation of reports perform the task of senior report editor.

Nellis Air Force Range Complex, General Site & Rock Art Inventories. Manage and participate in the design and execution of a multi-phase archaeological recordation project over an area larger than the state of Vermont. The second phase included the relocation and recording of twelve Archaic to Late Prehistoric rock art sites in remote areas of the U.S. Air Force's Nellis Range. Included in this effort was the contracting and management of specialist subconsultants in rock art, development of illustration techniques, and preparation of draft and final reports in consultation with the Base Archaeologist.

Metropolitan Water District of Southern California, West Valley Lateral and Eastside Reservoir Projects, Cultural and Paleontological Resources Support Services. Design and conduct archaeobotanical, paleoecological, and paleoclimatic studies in support of paleontological and cultural resources testing and mitigation programs for a large reservoir development program. Manage and participate in paleobotanical and archaeobotanical research programs; direct subconsultants in palynological investigations. Develop pioneering reconstructions of inland southern California's climatic and ecological history over the last 40,000 years; consider these in the context of regional environmental changes and the archaeological record.

Nellis Air Force Base Golf Course Expansion, Phase 2 Archaeological Testing. Design, manage and participate in the archaeological and geomorphologic testing of three Archaic sites in the Las Vegas Valley. Develop a site specific formational model to account for the stratigraphic setting of the sites and cultural remains, and to justify the lack of further archaeological potential of the site area.

Los Angeles Department of Water and Power, Mead/McCullough - Victorville/Adelanto Transmission Line. Manage cultural and paleontological resources monitoring and mitigation in conjunction with the construction of a 500 kV power line extending through Nevada and California. Assess levels of significance of paleontological sites discovered during survey and monitoring, implement mitigation measures for affected sites, manage analyses, prepare reports.

City of Mesquite Cultural and Paleontological Resource Compliance. Design and manage resource surveys for linear-facilities rights of way and BLM land exchanges. Bureau of Land Management consultation on mitigation and avoidance measures, coordinate data recovery and analyses, and prepare final reports on discovered Pliocene paleontological sites.

Molycorp, Inc., Ivanpah Valley Geoarchaeological Studies. Plan for and contribute to cultural resources surveys and Phase 2 Testing and Evaluations for a large project involving over

30 Archaic to Late Prehistoric archaeological sites within and on the margins of a presently dry lake bed. Develop and implement special studies in geoarchaeology, paleohydrology, and paleoenvironmental reconstruction. Manage biological resources surveys and monitoring in support of a multiyear remediation effort; consult with land management agencies to assure compliance on behalf of the client.

Pacific Gas & Electric, Pit 3,4,5 Project, Cultural Resources Support Services. Archaeobotanical, paleoecological, and paleohydrologic studies in support of cultural resource mitigation efforts in the vicinity of Lake Britton, California. Develop a 7,000-year paleoecological record directly applicable to the study area. Contract and direct subconsultants in the development of a 1,000-year dendrohydrologic reconstruction of the flow of the Middle Pit River. Compare and contract paleoenvironmental and archaeological records to determine possible environmental drivers of cultural change.

U.S. Geological Survey Yucca Mountain Site Characterization Studies. . Multiple contracts for field and laboratory research, report preparation and review focusing on the timing and magnitude of past hydrologic and climatic changes in the Nevada Test Site, Yucca Mountain, and the Amargosa Desert. Assessment of millennial scale variability of groundwater levels and their potential effect on performance criteria for a high-level nuclear waste repository, as well of geomorphic process affecting paleoenvironmental data.

Yosemite National Park Cultural Resources Management Plan & Research Design. Assist in the preparation of the twenty-year update of the National Park Service's *Archaeological Research Design*. Review, evaluate, and provide a comprehensive summary of research in paleoecology, geoarchaeology, Quaternary geology, and tephrachronology. Prepare chapters on for the *Research Design* for NPS use.

National Academy of Sciences, National Research Council Panel On Coupled Hydrologic, Tectonic, and Hydrothermal Processes. Appointed by the National Academy of Sciences to a three-year tenure as an expert panel member to review research and evaluate evidence for changes in water-table elevation in the vicinity of the proposed Yucca Mountain Nuclear Waste Repository.

Yosemite National Park, Upper Tuolumne Meadows Archaeological Testing and Evaluation Program. Field and laboratory studies, and report preparation, focused on geochronology, tephrachronology, and site formation processes in support of Yosemite National Park's visitor services expansion program. Identification and characterization of accelerated colluvial depositional processes following volcanic ash fall-out in prehistoric times, and possible effects on human occupation of the area.

Other Representative Projects

Southern Nevada Water Authority's Intake No. 3 Clean Water Act Compliance Assistance. Manage and participate in site survey and permit application preparation for a $600 million critical-path water project. The scope of this on-going effort includes the delineation of jurisdictional waters of the U.S., preparation of an Individual Permit application to the U.S.

Army Corps of Engineers including all exhibits and appendices, and preparation of three separate application packages to the Nevada Division of Environmental Protection. Support of the applicant's agency consultations is a continuing component of this work.

Boulder City / U.S. 93 Corridor Study Final Environmental Impact Statement (FEIS). Environmental lead in charge of preparation of an FEIS for a major highway project in southern Nevada. Manage the update of the Draft EIS, provide strategic input to client regarding NEPA, NHPA and ESA compliance strategies. Participate in agency consultations with the Environmental Protection Agency, Nevada Department of Wildlife, U.S. Army Corps of Engineers, and the Nevada Historic Preservation Office on behalf of the FHWA and Nevada DOT. Prepare, update, and gain signatures on a six-agency Programmatic Agreement for project-related cultural resources impacts mitigation.

California Desert District's Imperial Sand Dunes Recreation Area Management Plan NEPA Compliance Program. Manage a complex and fast-track NEPA compliance program, direct and participate in the preparation of a Draft Environmental Impact Statement addressing a highly visible and controversial recreational area management measures proposed by the Bureau of Land Management. Direct the final preparation of a Biological Assessment of the project. Organize and attend public meetings as a client representative, including presenting components of the project to the public on behalf of the BLM.

Reliant Energy Southern Nevada Development Program Environmental Compliance & Permitting Services. Initial services include the performance of fatal flaw analyses for multiple siting options in Clark County, consultations with client representatives and land management agencies; preparation of site-specific cost projections for NEPA, ESA, and NHPA compliance programs, as well as State and local permits and entitlements. Continuing services include coordinating Nevada Power Company/Sierra Pacific Resources and Southwest Gas efforts, scheduling tasks and activities for permitting at different sites, and tracking consultant performance on behalf of the client.

Environmental Compliance Services to Del Webb Corporation. Manage and participate in the preparation of multiple NEPA, NHPA, and ESA compliance documents, consult with agencies, and direct the compliance efforts for a complex land exchange program involving properties throughout the State of Nevada. Provide a wide range of support services including biological and cultural resources assessments, preparation of use plans, and assessments of air quality impacts, municipal budgets, and economic effects.

Apex Heavy Use Industrial Park Environmental Compliance & Permitting Assistance. Consult with agencies and facilitate client interests on critical environmental issues including air quality impacts and water resources. Prepare NEPA compliance documents for a 11,200 acre land sale, and assist subsequent infrastructure development.

Hanford Nuclear Reservation Barrier Development Program Peer Review Panel. Reviewing research strategies, team organization, and prototype designs for protective barriers intended for use on high-level and mixed waste repository sites. Reviewing studies of past and potential future environmental change.

U. S. Nuclear Regulatory Commission, Advisory Committee on Nuclear Waste. Preparation of briefing documents, participation in panel meetings, and presentation of oral evaluations of governmental studies on the characterization, data acquisition, and model evaluation of climatic and hydrologic conditions at the proposed Yucca Mountain Nuclear Waste Repository.

Professional History

Environmental Compliance Manager & Paleontological Resources Specialist, CH2M HILL, Las Vegas, 2001 to present

Manager, Division of Planning & Compliance, URS Corporation, Las Vegas, 2000-2001

Manager, Environmental Services, Dames & Moore, Las Vegas, 1990-2000

Research Professor of Botany, Director of the Laboratory of Arid-lands Paleoecology, Quaternary Research Center, University of Washington, Seattle, 1983-1990

Adjunct Professor, Remote Sensing Laboratory, Department of Geosciences, University of Washington, Seattle, 1985-1990

Post-Doctoral Research Associate, College of Forest Resources, University of Washington, Seattle, 1979-1983

Graduate Research Assistant, Laboratory of Paleoenvironmental Studies, Department of Geosciences, University of Arizona, Tucson, 1974-1978

Countries Worked In

United States, Mexico, Australia

Professional Affiliations

American Association for the Advancement of Science

Selected Publications

2008 - A Late Holocene Record of Vegetation and Climate from a Small Wetland In Shasta County, California. (with R. S. Anderson, S. J. Smith, and R. B. Jass. *Madroño*, Vol. 55, No. 1, pp. 15–25.

2004 - Development of Vegetation in the Central Mojave Desert of California during the Late Quaternary. (with P. A. Koehler and R. S. Anderson). *Palaeogeography, Palaeoclimatology, Palaeoecology* 215:297-311.

2001 – Ploidy Race Distributions since the Last Glacial Maximum in the North American Desert Shrub, *Larrea tridentata* (with K.L. Hunter, J.L. Betancourt, B.R. Riddle, T.R. Van Devender, and K.L. Cole). *Global Ecology & Biogeography* 10: 521-533.

W. Geoffrey Spaulding

2000 – A Molecular Analysis of Ground Sloth Diet through the Last Glaciation (with M. Hofreiter, H. N. Poinar, K. Bauer, P.S. Martin, G. Possnert, and S. Paabo). *Molecular Ecology* 9: 1975-1984.

1999 - Middle to Late Quaternary Climatic Changes in Death Valley and Vicinity. In *Proceedings of Conference on Status of Geologic Research and Mapping in Death Valley National Park*. U.S. Geological Survey Open-File Report 99-153, pp. 121-124.

1999 - Environmental Imperatives Reconsidered: Demographic Crises in Western North America During The Medieval Climatic Anomaly (with T. L. Jones, G. M. Brown, L. M. Raab, J. L. McVickar, D. J. Kennett, A. L. York, and P. L. Walker). *Current Anthropology* 40(2): 137-170.

1998 - Molecular coproscopy: dung and diet of the extinct Shasta ground sloth *Nothrotheriops shastensis* (with H. Poinar, M. Hoffreiter, P. S. Martin, and S. Paabo). *Science* 281: 402-406.

1996 - Paleobiotic and isotopic analysis of mollusks, fish, and plants from Core OL-92: Indicators for an open or closed lake system (with J. R. Firby, S. E. Sharpe, J. F. Whelan, and G. R. Smith). In *An 800,000-year paleoclimatic record from Owens Lake, California*, edited by G. I. Smith and J. L. Bischoff, pp. 143-160. Geological Society of America Special Paper 317.

1995 - Environmental change, ecosystem responses, and the Late Quaternary development of the Mojave Desert. In *Quaternary Environments and Deep Time: Papers in Honor of Paul S. Martin* (D. S. Steadman and J. I. Mead, eds.), pp 225-256. Fenske Printing, Inc., Rapid City, South Dakota.

1995 - Pika (*Ochotona*) and the Late Quaternary paleoecology of the Great Basin (with J. I. Mead). In *Quaternary Environments and Deep Time: Papers in Honor of Paul S. Martin* (D. S. Steadman and J. I. Mead, eds.), pp 257-283. Fenske Printing, Inc., Rapid City, South Dakota.

1993 - Climatic changes in the western United States since 18,000 yr. B.P. (with R. S. Thompson, C. Whitlock, P. J. Bartlein, and S. P. Harrison) In *Global climates since the last glacial maximum*, edited by H. E. Wright, Jr., J. E. Kutzbach, T. Webb, III, W. F. Ruddiman, F. A. Street-Perott, and P. J. Bartlein, pp. 468-513. University of Minnesota Press, Minneapolis.

1992 - An alternative perspective on Mojave Desert prehistory (with J. H. Cleland). *Society for California Archaeology Newsletter* 26: 1-6.

1992 - *Ground water at Yucca Mountain: How high can it rise?* (with members of the NAS, NRC Panel on Coupled Hydrologic/Tectonic/Hydrothermal Processes at Yucca Mountain). National Academy Press, Washington, D.C.

1992 - Ecological characterization of fossil plants (with S. J. Mazer, T. L. Phillips, R. E. Taggert, and B. H. Tiffney). In *Terrestrial ecosystems through time: Evolutionary paleoecology of terrestrial plants and animals*, edited by A.K. Behrensmeyer *et al.*, pp. 139-180. University of Chicago Press.

1992 - Late Cenozoic terrestrial ecosystems (with R. E. Taggart, J. A. Harris, B. Van Valkenberg, L. D. Martin, J. D. Damuth, and R. Foley). In *Terrestrial ecosystems through time: Evolutionary*

paleoecology of terrestrial plants and animals, edited by A. K. Behrensmeyer *et al.*, pp. 419-541. University of Chicago Press.

1992 - Glacial/Interglacial 13C/12C ratios of atmospheric CO2 inferred from carbon in C4 plant cellulose (with B. D. Marino, M. B. McElroy, and R. J. Salawitch). *Nature* 357: 461-466.

1991 - A middle Holocene vegetation record from the Mojave Desert and its paleoclimatic significance. *Quaternary Research* 35: 427-437.

1991 - Pluvial climatic episodes in North America and North Africa: Types and correlation with global climate. *Palaeogeography, Palaeoclimatology, Palaeoecology* 84: 217-227.

1991 - Comparison of pollen and macrofossil based reconstructions of Late Quaternary vegetation in western North America. In *Proceedings of the 7th International Palynological Congress, Brisbane, Australia*, edited by E. M. Truswell and J. A. K. Owen, pp. 359-366. Elsevier, Amsterdam.

1990 - Packrat middens: Their composition and methods of analysis (with K. L. Cole, J. L. Betancourt and L. K. Croft. In *Packrat middens: The last 40,000 years of biotic change*, edited by J. L. Betancourt, P. S. Martin, and T. R. Van Devender, pp. 59-84. University of Arizona Press, Tucson.

1990 - Environments of the last 50,000 years in the vicinity of Yucca Mountain, central-southern Nevada. *High Level Radioactive Waste Management* 2: 1251-1258.

1990 - Vegetation dynamics during the last deglaciation, southeastern Great Basin, U.S.A. *Quaternary Research* 33: 188-203 (1990).

1990 - Vegetational and climatic development of the Mojave Desert: The last glacial maximum to the present. In *Packrat middens: The last 40,000 years of biotic change*, edited by J. L. Betancourt, P. S. Martin, and T. R. Van Devender, pp. 166-199. University of Arizona Press, Tucson.

1988 - Climatic changes of the last 18,000 years: Observations and model simulations (with COHMAP Project Members). *Science* 241: 1043-1052.

1986 - The last pluvial climatic episodes in the deserts of southwestern North America (with L. J. Graumlich). *Nature* 320:441-444.

1985 - Vegetation and Climates of the last 45,000 years in the vicinity of the Nevada Test Site, south-central Nevada. U. S. Geological Survey Professional Paper No. 1329.

1983 - Late Wisconsin paleoecology of the American southwest (with E. B. Leopold and T. R. Van Devender). In *The late Pleistocene of the United States*, edited by S.C. Porter, pp. 259-293. University of Minnesota Press, Minneapolis.

1983 - Late Wisconsin macrofossil records of desert vegetation in the American southwest. *Quaternary Research* 19: 256-264.

1979 - Development of vegetation and climate in the western United States (with T. R. Van Devender). *Science* 204: 701-710.

Traffic and Transportation (42–46)

Fry Road Mitigation Measures

42. *Please discuss the mitigation measures planned to minimize the impact to drivers on Fry Road during pipeline construction activities.*

Response: A Transportation Management Plan (TMP) will be prepared by the Applicant and submitted to the appropriate agencies (Solano County, City of Vacaville, Caltrans) for their review. The purpose of the TMP is to identify potential hazards associated with project-related traffic. The plan would incorporate measures such as information signs, flagmen when equipment may result in blockages of throughways, and traffic control to implement any necessary temporary changes in lane configuration. Specific provisions will include measures at least as stringent as the following:

- Parking for workers, construction vehicles, and trucks
- Construction along affected roadways at night where permitted
- Traffic diversion plans (in coordination with the City and County) to ensure access during temporary lane/road closures
- Traffic control devices, signing, and lighting to mitigate the impacts associated with street or lane closures during the construction of the transmission line
- Advance notification to residents, emergency providers, and hospitals that would be affected when roads may be partially or completely closed
- Lane closure as needed for transmission line and pipeline construction with optimal timing to prevent having long stretches of roadway closed without any construction in progress

Additional provisions may be identified by the appropriate regulatory agencies.

The TMP will also mitigation potential impacts related to pipeline construction on auto traffic near Fry Road. These TMP measures will be developed further and incorporated into the TMP. Please note, in addition, that the pipeline will be constructed, owned, and operated by Pacific Gas and Electric Company.

Traffic Control Programs

43. *Please indicate the types of traffic control programs that will be used to ensure safe roadway conditions, (such as lane marking, construction notices, roadway signage, detours, flagperson, etc.).*

Response: The TMP will incorporate measures to ensure safe roadway conditions at least as stringent as those listed above in the response to Data Request #42. The TMP measures may include lane marking, construction notices, and roadway signage. Detours may be imposed only when a roadway is blocked for more than a few minutes.

Parking Policies

44. Please indicate what policies will be in place to ensure pipeline construction workers will park in designated areas.

Response: The TMP will incorporate parking policies at least as stringent as those listed above in the response to Data Request #42. The contractor will be provided with a map of the designated parking areas. Should the contractor's workforce park in non-designated areas, the linear contractor will be held responsible for any resulting land damage; the penalty could be a risk of being towed at owner's expense, cost to restore any land damage that may have been incurred, etc.

Central Parking Transportation

45. Please indicate if transportation will be available from a central parking area to and from the work site for the linears.

Response: Ideally, the immediate workforce would park along the portion of the pipeline or transmission line being constructed. However, should the landowner not authorize this, the workforce will be required to park at the designated power plant parking area and then be bussed all together to the work area. The TMP will include measures to avoid or reduce any potential impacts from parking either near the pipeline construction worksite or at a central location.

Delivery Route of Hazardous Materials

46. Please review the ease-west bound route for the delivery of hazardous material and provide a modified truck route of roadways that may be used for the delivery of hazardous material.

Response: Lewis Road is a north-south roadway along most of its length (Lewis Road is about 7 miles long, and 0.3 mile is in the east-west direction near the intersection with Chevron Way). Trucks coming from west of the project site (north-west or south-west) using Interstate 80 (I-80) can exit I-80 at Midway Road, turn onto Lewis Road, and travel south to enter the project site. This solution was offered to avoid the residential areas in Vacaville and minimize the potential safety hazards to the public.

Trucks coming from east of the project site (north-east or south-east) using State Route 113 (SR 113) can exit SR 113 at Fry Road and turn onto Lewis Road to enter the project site.

These proposed routes are subject to Caltrans approval.

46a. Identify any traffic safety points such as railroad crossings or sharp curves; and any sensitive receptors such as school routes or bus stops along these routes.

Response: The routes proposed for hazardous material deliveries avoid densely populated areas; no transit route would use the same routes in the project's vicinity. The Vacaville Transportation Department indicated that a school bus stop was located at the corner of Lewis Road and Holdner Road; however, its policy does not allow disclosure of the exact route. The department also indicated that the routes changed often. Although there are schools in Dixon along SR 113, Dixon Unified School District does not offer school bus service. There are no hospitals or schools along this route.

The at-grade railroad crossing on Lewis Road near the intersection of Lewis Road and Hawkins Road is a potential safety hazard. The crossing is protected by two drop guards and flashing cross-buck signs. The transporter will not only be required to obtain a Hazardous Material Transportation License in accordance with California Vehicle Code Section 32105 but will also be required to follow appropriate safety procedures at railroad crossings to ensure safe delivery/removal of hazardous materials.

The only sharp turn that could be identified is located at the north end of Lewis Road. The software Autoturn v5 was used to determine if a turn could be made within the paved area of the road. It was determined that the biggest truck that could achieve the turn within the paved area is a WB-40 truck as defined in AASHTO 2001 (45.5-foot-long semi-trailer) could achieve the turn within the paved area of the road.

Transmission System Engineering (47)

System Impact Study

47. Please provide a supplemental System Impact Study and submittal date, noted in the discussion with staff and Navigant Consulting, Inc. on February 24, 2009.

Response: The Applicant has requested additional time to complete the supplemental System Impact Study (request docketed March 25, 2009, Docket Log # 50668).

Visual Resources (48–50)

Redwood Tree Height

48. Please provide the assumed height of the redwood tree depicted in the simulation.

Response: Per AFC section 5.13.2.3.4, the trees in the photographic simulation of Figure 5.13-6 are shown at maturity, at estimated heights of approximately 125 feet.

The trees in the row behind are expected to be coast redwoods (se*quoia sempervirens*) or similar trees, which would be planted as 36-inch box specimens that will be approximately 12 feet tall at planting, 27 feet tall at 5 years, and 125 feet or taller at maturity. Figure 5.13-5 depicts the appearance of this landscaping at 5 years after planting, and Figure 5.13-6 depict its appearance at maturity.

As described in the AFC, this landscape planting will be done by the City of Vacaville as part of a broader program to provide landscape screening for the Easterly Wastewater Treatment Plant. Under current plans, the City will complete the landscaping before CPVVS begins construction.

Interconnection Substation Layout Plan

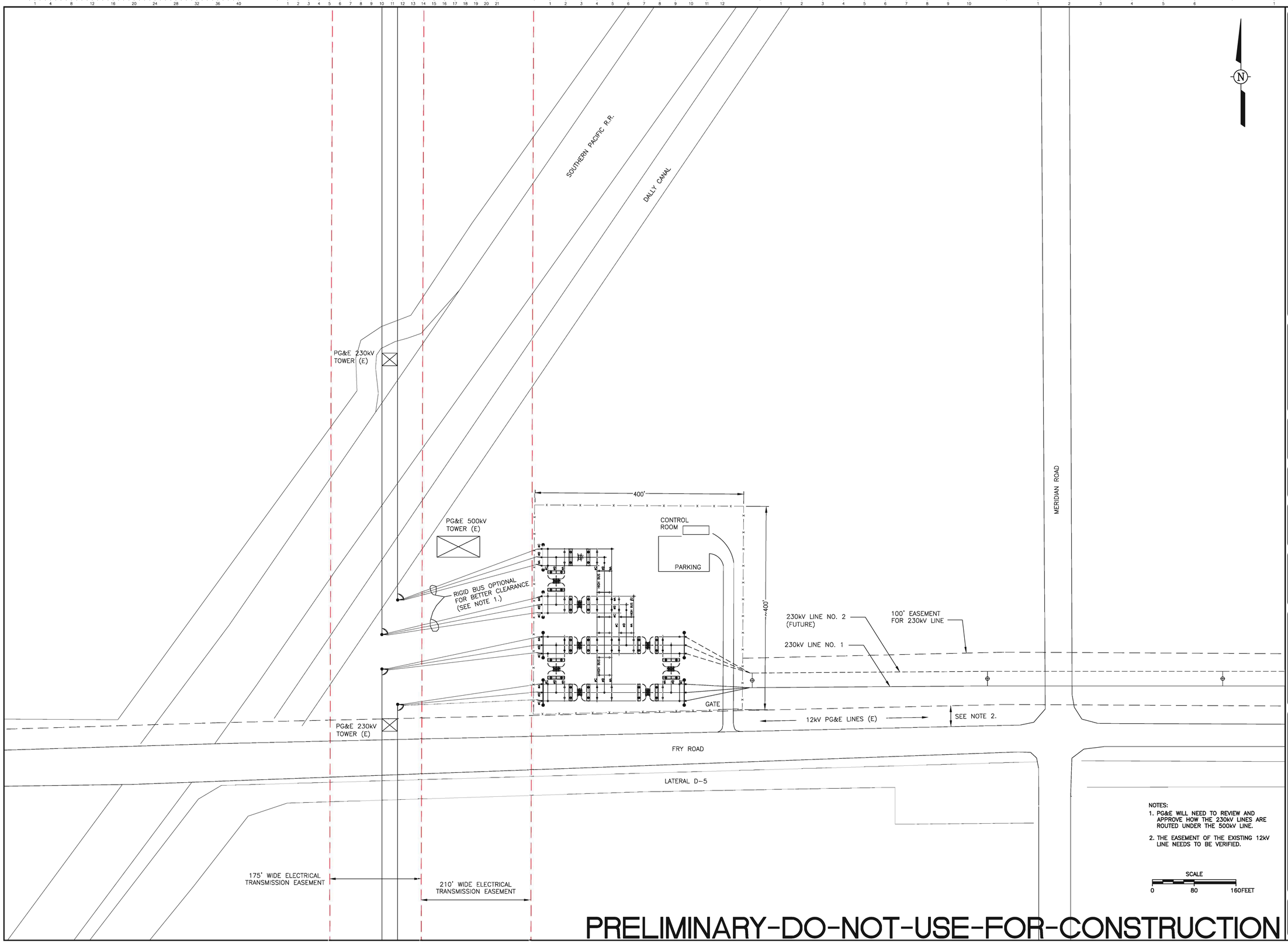
49. Please provide a scaled layout plan of the interconnection substation showing major components and site boundaries, in relation to Fry Road; and scaled elevation views of the proposed interconnection substation.

Response: Figure DR49-1 is a scaled layout plan of the substation showing major components and site boundaries in relation to Fry Road. The visual simulation (see response to Data Request #50) provides an elevation view based on typical structure heights for this equipment.

Interconnection Substation Visual Simulation

50. Please provide an additional visual simulation depicting the proposed interconnection substation and 230-kV transmission line as seen from Fry Road. A suggested viewpoint would be the vicinity of Meridian Road looking west, framed to capture both the transmission towers and substation.

Response: Figure DR50-1 is a photographic simulation of the proposed interconnection substation and 230 kV transmission line seen from Fry Road immediately west of its intersection with Meridian Road, view west.



NOTES:
1. PG&E WILL NEED TO REVIEW AND APPROVE HOW THE 230kV LINES ARE ROUTED UNDER THE 500kV LINE.
2. THE EASEMENT OF THE EXISTING 12kV LINE NEEDS TO BE VERIFIED.

SCALE
0 80 160FEET

PRELIMINARY-DO-NOT-USE-FOR-CONSTRUCTION

ISSUED/REVISED FOR:

LEVEL	APPR. BY	DATE	DESCRIPTION

PROJECT MANAGER:	PROJECT-MGR
ENGINEER:	ENGINEER-NAME
DESIGNER:	DESIGNED-BY
DRAFTER:	DRAWN-BY
DATE:	DATE
SCALE:	SCALE
CHECKED BY:	CHECKED-BY
ELEC. APPROVAL:	ELEC-APPROVED
CIVIL APPROVAL:	CIVIL-APPROVED

PROJECT DESIGNED FOR:

PROJECT:

TITLE:
CPV VACAVILLE PROJECT
230kV SWITCHING
STATION LAYOUT

Shaw Energy Delivery Services, Inc.
4005 Port Chicago Highway
Concord, CA 94520-1120

NOTICE:
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CONTRACTOR SHALL VERIFY ALL CONDITIONS ON JOB SITE & NOTIFY PROJECT MANAGER OF ANY VARIATIONS FROM DIMENSIONS SHOWN ON THESE DRAWINGS BEFORE PROCEEDING WITH ANY CONSTRUCTION.

SEAL

SEAL

PROJECT NUMBER
3301115085

DRAWING No.	SEQ No.	REV.
330115085-D2		

A. Appearance of the substation site before construction. View west along Fry Road from the intersection with Meridian Road.

B. Appearance of site after construction.

FIGURE DR50-1
PHOTOGRAPHIC SIMULATION, INTERCONNECTION SUBSTATION
CPV VACA STATION
VACAVILLE, CA

CH2MHILL

EY052008001SAC Figure_DR_50-1.ai 03/31/09 tdaus

Waste Management (51–53)

Field Sampling and Analysis

51. *a. Please provide results of field sampling and analysis which adequately characterize the presence or absence of harmful chemicals or conditions and whether there will be any risk to construction or plant personnel due to the presence of these chemicals.*

    b. Please determine if there is any analytical characterization data for the agriculture chemicals and biosolids that were applied to the land.

Response: A Phase II Environmental Site Assessment for the project site is included as Attachment DR51-1. This assessment provides the results of field sampling and analysis, and includes discussions of the potential risks from agricultural chemicals and biosolids.

Construction and Demolition Waste Diversion Program

52. *Please identify whether the City of Vacaville or Solano County operates a Construction and Demolition Waste Diversion Program, and cite the jurisdiction to which the CPVVS project would be accountable.*

Response: Because the CPVVS is within the Vacaville city limits, the City has jurisdiction. The City of Vacaville has no ordinance requiring a Construction and Demolition Waste Diversion Program.

Project Operations

53. *Please describe how project operations will meet each of the requirements of the program cited in the previous data request.*

Response: See response to Data Request #52.

ATTACHMENT DR51-1

Phase II Environmental Site Assessment

Final

Preliminary Phase II Environmental Site Assessment for the Competitive Power Ventures Vaca Station

Solano County, California

Prepared for

CPV Vacaville, LLC.

March 26, 2009

CH2MHILL
2485 Natomas Park Drive
Suite 600
Sacramento, California 95833

Final

Preliminary Phase II Environmental Site Assessment for the Competitive Power Ventures Vaca Station

Solano County, California

Submitted to

CPV Vacaville, LLC.

March 26, 2009

Steve Long
Environmental Scientist

Anthony Chakurian, CA P.G. No 7667
Professional Geologist

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CH2MHILL

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SECTION 1

Introduction

Competitive Power Ventures (CPV) Vacaville, LLC. is proposing to lease the 25–acre property (north and west of the intersection of Fry and Lewis Roads, as shown in Figure 1) in Vacaville, California. The subject property is being considered for future uses associated with the development of a gas-fired electrical generating station identified as the CPV Vaca Station (CPVVS) project. A Phase I environmental site assessment (ESA) for the proposed CPVVS property was prepared by CH2M HILL (May, 2008).

Based on a review of historic aerial photographs, it was determined that the property has been used historically as an agricultural field from prior to 1937 up to the early 2000s. The property was purchased in 1999 by the City of Vacaville as part of a 143.5-acre parcel. It was used for 4 or 5 years for the application of biosolids; municipal wastewater treatment sludge (CH2M HILL, 2008). Historical groundwater impacts at the site have been attributed to agricultural practices rather than the program of biosolids application (Luhdorff and Scalmanini, 2005, included in Appendix B).

Because of the long-term use of the subject property for agricultural production (row crops), it was recommended in the Phase I report that a limited program of soil sampling and laboratory analysis be completed to determine if metals or organochlorine pesticide residues remained that could pose a potential future health risk to construction workers or other workers on the property. While the proposed CPVVS would not use groundwater or create discharges that would affect groundwater resources, it was also recommended that baseline groundwater conditions be assessed prior to CPVVS construction or operation as a due diligence measure to protect CPVVS against future environmental liability.

The signed proposal with Scope of Work (Appendix A) was received from CPV on June 25, 2008. This report has been prepared for the proposed CPVVS project to satisfy the requirements of that proposal.

It should be noted that this report is intended to provide the basis for an initial screening of environmental site conditions at the proposed CPVVS site, as they pertain to CPV's decision to acquire and operate a facility on the property. This assessment focuses on soils and groundwater and does not address the conditions of other site environmental media (such as surface water or sediment) and does not establish the lateral or vertical limit of detected contamination. For these reasons, this report does not constitute a full-scale Phase II ESA, as described in the *Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process* (Designation E 1903-97) published by the American Society for Testing and Materials (ASTM, February 1998).

SECTION 2

Site Description

The 25-acre subject property is a portion of a 143.5-acre parcel identified as APN 142-200-040. The subject property is located on the northwest corner of the intersection of Fry and Lewis Roads, in Vacaville, Solano County, California. The site topography is relatively flat with a slight gradient toward the east and southeast. Rainfall is expected to infiltrate or flow overland to a roadside ditch located along the east side of the property. The nearest surface water bodies are unlined canals, operated by Solano Irrigation District, located south of Fry Road. The nearest natural water body is Alamo Creek, approximately 0.4 mile north of the subject property (Figure 1). The subject property is located in an area used primarily for agricultural production of corn and other row crops. The site has been fallow for a few years but had been mowed and disked during the September 2008 field investigation. Other property owned by the City of Vacaville to the west and north of the proposed CPVVS site was also fallow during site visits in 2008.

No structures are located on the proposed CPVVS site except for a utility pole with a transformer and a utility box located near the southeast corner. A groundwater monitoring well (MW-5) is also located near the southeast corner of the site (Figure 2). This monitoring well was part of a shallow groundwater study conducted for the City of Vacaville Easterly Wastewater Treatment Plant (WWTP) (Luhdorff and Scalmanini, 2005) that is included in Appendix B. This study showed that the flow direction of the unconfined shallow groundwater is toward the southeast.

The WWTP is located approximately 500 feet northwest of the proposed CPVVS site (Figure 1). A gravel access road for the WWTP (the sludge haul road) is located along the west side of the subject property and was elevated approximately 2 to 4 feet in the northwest corner of the site.

Soils at the subject site are mapped almost entirely as a Capay silty clay loam (**Ca**) map unit, with a very limited portion in the north central margin of the subject site mapped as a San Ysidro sandy loam, 0 to 2 percent slopes (**SeA**). Both of these moderately well-drained, deep soils are formed on basin rims in alluvium derived from sedimentary rocks. The Capay silty clay loam soils are described as nearly level to level with a silty clay loam texture throughout the profile. The San Ysidro sandy loam has a sandy loam surface layer with a clay loam subsurface (NRCS, 1977).

SECTION 3

Methodology

All Phase II ESA site activities were conducted by CH2M HILL staff as follows.
On September 2, 2008, prior to the sample collection, the sample locations were staked in the field by Steve Long and Wilfred Akah. On August 8, 2008, Ed Haas and Wilfred Akah conducted the surface soil sampling effort at the proposed CPVVS site. Sample locations were collected at this time using a hand-held, resource-grade Trimble GeoXT global positioning system (GPS) unit. On September 19 and 20, 2008, Ed Haas and Steve Long, respectively, returned to the site with subcontractor, Gregg Drilling and Testing, Inc. (Gregg) to complete subsurface soil and groundwater sampling.

3.1 Sampling Approach

Guidance on the number of samples required to characterize the property was obtained from the DTSC (2002) *Interim Guidance for Sampling Agricultural Fields for School Sites*. This guidance recommends a minimum of 15 samples for areas that are 21 to 60 acres. Discrete samples are recommended on centers of approximately 1 acre. As shown in Figure 2, the current assessment of the 25-acre parcel used an even distribution of 20 sample locations with five rows (A to E, north to south) and four columns (1 to 4, west to east). A minimum of four offsite background samples are also recommended for assessing ambient levels for heavy metals. As shown in Figure 2, five background sample locations were sampled (two in the northwest portion, one along the south margin, and two along the eastern margin). Background sample locations were chosen in areas that were not likely to have received a biosolids (for example, elevated northwestern portion [BG-1 and BG-2], beneath roadway fill [BG-3], and far side of drainage ditch [BG-4 and BG-5]). No background samples were collected along the northern margin because that area was contiguous with the site, previously farmed, and probably also received biosolids.

Guidance on the sampling depths required to characterize the property was also obtained from the DTSC (2002) document that recommends discrete samples at each location in the 0-to-6-inch-below-ground-surface (bgs) depth interval (surface samples) and in the 2-to-3-foot-bgs interval (subsurface). This was the soil sampling approach adopted for the 20 locations within the parcel and the background sample locations (except for BG-3, which did not get a surface sample because it was adjacent to Fry Road). Based on previous experience with DTSC, some deeper soil data around the 5-foot-bgs depth is generally required, especially when potential onsite excavations during construction could extend to this depth. For this reason (as shown in Figure 2), samples around the 5-foot depth were also collected at select site locations (A1, B3, C4, D2, and E1) and at the five background soil locations.

Groundwater grab samples were collected at three sample locations (A1, B3, and D2) in order to achieve a reasonable spread across the site when supplemented with the groundwater sample from MW-5 in the southeastern corner of the site. The groundwater grab samples were collected from the first encountered shallow groundwater in the boring.

3.2 Sample Collection and Analysis Methodology

Surface soil samples were collected from the 20 site locations using individually wrapped, dedicated plastic scoops and were placed directly in pre-cleaned laboratory sample containers. The containers were immediately labeled with the sample designation, date, time, the name of person collecting the sample, and the requested laboratory analyses. The fully labeled sample containers were placed into bubble wrap and into a sealable plastic bag and then placed immediately onto ice in a cooler where they were kept until received at the analytical laboratory. All samples were shipped via priority overnight delivery in a sealed cooler under normal chain of custody procedures to Applied Sciences Laboratory (ASL) in Corvallis, Oregon.

Deeper soil samples (that is, those beneath fill or in the 3- to 5-foot depth range) were collected using a Geoprobe™ direct push technology (DPT) drill rig under subcontract with Gregg Drilling and Testing, Inc. The samples were collected using dedicated polyethylene sleeves within a 2-inch drive tube. Downhole portions of the drive tube sampler were decontaminated in the field prior to each boring. Standard decontamination procedures (Alconox-water scrub, tap water rinse, and distilled water rinse) were used to prevent cross-contamination of the samples. After retrieval of the sampler from the ground, the polyethylene sleeve was cut open and the desired depth interval was removed and placed into pre-cleaned laboratory sample containers. Samples were chilled and prepared for shipment as previously discussed. Soil samples were described with respect to soil field texture (Unified Soil Classification System) and color (Munsell Soil Color chart).

Field duplicates were collected to provide a way to assess sampling precision. Field duplicate samples were collected from within the same depth interval as the original (native) sample. The field duplicates were sampled and preserved in the same way as the native sample and were labeled in a manner that was “blind” to the laboratory (that is, did not reveal the associated, native sample). Field duplicate soil samples were collected for five of 59 native samples, as follows: A1-05SB, A3-03SB, B3-03SB, C4-05SB, and E1-05SB.

Groundwater grab samples were collected using the Geoprobe™ rig Hydropunch® sampler at three locations (A1, B3, and D2). Another groundwater sample was also collected from monitoring well MW-5 in the southeastern portion of the site. Groundwater samples were collected from MW-5 after purging the well until field monitoring parameters (pH, conductivity, temperature, turbidity, and redox) were stable. The soil boring logs for locations A1, B3, and D2, as well as the groundwater sampling field data sheet for MW-5 are provided in Appendix C. The groundwater samples analyzed for metals were filtered to reflect dissolved metal concentrations. Samples for organochlorine pesticide analyses were not filtered.

All soil and groundwater samples were analyzed for CAM 17 metals and for organochlorine pesticides. Chemical analyses for the CAM 17 metals were performed by Method SW6010B (except mercury was analyzed by Method SW7471A [for soils] or Method SW7470A [for groundwater]). Method SW8081 was used for organochlorine pesticides for both soils and groundwater.

Soil and groundwater sample analytical results (detected chemicals only) were screened against the U.S. Environmental Protection Agency (Region 9) Preliminary Remediation Goals (PRGs) for an industrial scenario. The detected values for soils were also compared to the California Human Health Screening Levels (CHHSLs) for an industrial/commercial, new construction scenario. In addition, results were compared to California hazardous waste total threshold limit concentration (TTLC) criteria (total concentration in milligrams per kilogram [mg/kg] on a wet weight basis for soil) or to the toxicity criteria in micrograms per liter (µg/L) for water.

The soil analytical data were used to develop summary statistics tables for the different inorganic analytes. The Shapiro-Wilk W test was used to test whether or not the distribution of the analytes was normally distributed. If a normal distribution was indicated, then an arithmetic mean is presented in the summary statistics; otherwise, a geometric mean is presented. The soil analytical data for inorganic constituents were also used to compare means of different groups and test the statistical significance for the following questions.

- Are metals concentrations different between surface soils in the in-field (native) samples and the background samples?
- Are metals concentrations different between the surface and subsurface soils in the in-field samples?

A non-paired t-test was used to compare group means. This parametric test provides a robust way to assess whether or not the means values of two groups of different sizes are significantly different from one another for the different inorganic analytes. Because there were a number of non-detect values in the data set, a less robust, non-parametric test was also used to compare the group means, the Mann-Whitney U test.

SECTION 4

Results

As shown in Figure 2, surface (0- to 6-inch-bgs) and near surface (3-foot-bgs) soil samples were collected at 20 locations evenly arranged over the approximately 25-acre proposed CPVVS site. Of these 20 locations, five locations (A1, B3, C4, D2, and E1) received additional samples at the 5-foot-bgs depth). Surface and subsurface soils were also sampled at five locations (BG-1 through BG-5) in areas that did not receive biosolids to provide a way to assess ambient (background) metals concentrations. A total of 59 soil samples were collected, with five additional samples collected as field duplicates.

Groundwater grab samples were collected from three of the 20 locations (A1, B3, and D2) to supplement the groundwater sample from MW-5 in the southeastern corner of the site. The intent of the groundwater sampling program was to document baseline shallow groundwater conditions prior to CPVVS construction or operations. Table 1 provides a summary of the preliminary Phase II ESA sampling at the proposed CPVVS site.

Because the metals were most widely detected in the different samples, summary statistics are provided in Table 2. Table 2 shows that in the surface soils, antimony, cadmium, molybdenum, and thallium were either not detected at all or in relatively few samples. In the subsurface soils, antimony and thallium were again detected in only one or two samples while cadmium and molybdenum were detected in 92 percent and 76 percent of subsurface soils, respectively. Most of the CAM-17 metals sought were detected in nearly all surface and subsurface samples, including arsenic, barium, beryllium, chromium, cobalt, copper, lead, mercury, nickel, silver, vanadium, and zinc.

Among the 13 metals detected in the surface soils, seven were normally distributed (arsenic, beryllium, chromium, lead, nickel, vanadium, and zinc) so their central tendency was estimated by the arithmetic mean. Among the 15 metals detected in the subsurface soils, the same metals were also normally distributed. Additionally, cadmium, copper, mercury, and molybdenum were also normally distributed. The central tendency for metals that did not have a normal distribution was estimated by the geometric mean.

Table 3 provides the mean concentrations of metals for surface and subsurface samples in both the in-field and the background samples. Table 3 shows that mean metals concentrations are higher within the in-field surface soil samples compared to background surface soils for beryllium, chromium, copper, lead, mercury, selenium, silver, vanadium, and zinc. However, only three of these constituents, copper, silver, and zinc, were significant higher at the $p \leq 0.05$ level. It is possible that the metals are found at higher concentrations within the field due to agricultural practices that included the applications of biosolids. However, it was also noted that mean concentrations of certain metals are higher in the background surface samples than in the in-field samples. These metals included arsenic, barium, cobalt, and nickel. Among these metals, the only statistically significant difference was for nickel.

Table 3 also shows that mean metals concentrations are higher within the in-field surface soil samples compared to subsurface soils for chromium, copper, lead, mercury, silver, vanadium, and zinc. All of these findings are statistically significant except those for chromium and vanadium. These elevated metals in the surface soils could be explained by agricultural practices and the application of biosolids. However, it should also be noted that mean concentrations of arsenic, barium, beryllium, cobalt, nickel, and selenium are higher in the subsurface soils than in the surface soils. Of these, all were statistically significant except for selenium.

Certain plants have the ability to accumulate metals, which could account for lower concentrations of certain metals in the surface layer. Brown et al. (1983) noted that the following metals could be accumulated and removed from surface soils in harvested plants: copper and cobalt by plants in the Mint (Lamiaceae), Legume (Fabaceae), and Figwort (Scrophulariaceae) families; nickel by plants in the Mustard (Brassicaceae) family; selenium in plants from the Legume and Aster (Asteraceae) families; and zinc by plants in the Birch (Betulaceae), Aster, Legume, and Violet (Violaceae) families. Accumulation in plants and removal by harvesting is a possible mechanism that could explain how the concentrations of certain metals (that is, copper, cobalt, nickel, selenium, and zinc) could be lower in the in-field surface soils when compared to surface background or in-field subsurface soils.

Table D-1 (Appendix D) provides a summary of all soil analytical results for metals and organochlorine pesticide constituents and compares the detected values to regulatory agency thresholds, including preliminary cleanup thresholds, hazardous waste thresholds, and human health screening levels. Table D-1 also shows that arsenic and chromium values were found in excess of the screening values for all the samples. In the case of arsenic, the health risk-based values are very low (1.6 and 0.24 mg/kg dry weight [dw] basis). In Table 3, it was noted that arsenic in surface soils was higher in the background samples than in the field (8.80 vs. 8.145 mg/kg). It was also noted that arsenic was higher in the subsurface soils than in the surface soils. The calculated 95 percent upper confidence limit (UCL) for the in-field surface and subsurface samples is 8.99 and 11.37 mg/kg dw, respectively. When all of the background surface and subsurface samples are taken together, the mean concentration is 10.1 with a standard deviation of 1.702, which gives a 95 percent UCL of 10.95 mg/kg dw. This indicates that, while arsenic is present at levels in excess of the low risk-based screening values, the arsenic levels detected in the soils at the proposed CPVVS site are not dramatically different than local background levels. Additionally, the concentrations of arsenic observed at the subject site are generally consistent with background levels for arsenic within California (Kearney Foundation, 1996). While this report did not provide total background arsenic values for the two soil series mapped at the CPVVS site (Capay silty clay loam or San Ysidro sandy loam), there were reported values for two fine-textured soil series in Solano county (Hugo clay loam and Yolo clay loam series) at 9.6 and 4.5 mg/kg, respectively. The highest documented total background arsenic value was 11 mg/kg for an Altamont clay loam in San Diego County.

For chromium, the CHSSL criterion based on chromium VI (37 mg/kg dw) was exceeded for all the in-field samples. However, the CHSSL criterion based on chromium III (10,000 mg/kg dw) was not exceeded by any of the samples, which ranged between 25.5 and 48.0 mg/kg dw. While chromium speciation was not done to characterize the percent distribution between chromium VI and III, it is not expected that a significant

amount (if any) of the total chromium results are composed of chromium VI. This is because chromium VI is much more likely to be present under reduced or saturated conditions, which were not present in soil samples at the proposed CPVVS site.

The organochlorine pesticide results (Table D-1) indicate that these constituents were detected almost exclusively in the surface soil samples. All subsurface samples were non-detect for organochlorine pesticides except for a single estimated (J-flagged) result for Endosulfan II that was detected in the field duplicate of the 3-foot sample at location B-3. With only two exceptions (alpha-chlordane and 4,4-DDE), organochlorine pesticides in the surface soil samples were estimated at levels that were between the method detection limit and the report limit (that is, J-flagged). Alpha-chlordane was detected above the reporting limit in three surface samples (A4, E3, and BG-2) at concentrations ranging from 0.5 to 0.87 mg/kg dw. 4,4-DDE was detected above the reporting limit in the surface soil samples in all but one of the in-field samples (ranging from 0.5 to 1.6 mg/kg dw) and in three of four of the background samples (ranging from 0.48 to 1.3 mg/kg dw).

Other organochlorine pesticides that were detected at levels below the reporting limit in surface samples include gamma-BHC (Lindane), beta-BHC, delta-BHC, alpha-chlordane, 4-4′-DDE, 4,4′-DDT, dieldrin, Endosulfan I, Endosulfan II, Endosulfan sulfate, Heptachlor and Heptachlor epoxide. Summary statistics and statistical comparisons were not prepared, due to the limited occurrence of organochlorine pesticide compounds in the surface soils and the relatively low number of detected results.

Table D-1 also shows the comparison of analytical soil results against the hazardous waste criteria as defined by the California Code of Regulations Title 22, Division 4.5, Chapter 11, Section 66261.24. The blue-shaded values in Table D-1 show that five of the in-field surface samples and one of the background surface soil samples had 4,4′-DDE detections that were above the total threshold limit concentration (TTLC) hazardous waste criterion of 1.0 mg/kg (on a wet weight [ww] basis). The 4,4′-DDE was only detected in the surface soil samples but was found in both the in-field and the background samples. The calculated 95 percent UCL for the in-field surface soil samples is 1.031 mg/kg on a dw basis. Using the average moisture content of the surface samples (3.25 percent), the 95 percent UCL would be 0.997 mg/kg on a ww basis, which is roughly equivalent to (but just below) the TTLC criteria of 1.0 mg/kg (ww basis). The 95 percent UCL for the background surface soils samples was 1.200 mg/kg (dw basis) or roughly 1.161 mg/kg (ww basis).

Table D-2 (Appendix D) summarizes the analytical results for the groundwater samples collected at the proposed CPVVS site on September 19, 2008. The analytical data indicated some relatively minor detections of metals and organochlorine pesticide in the shallow groundwater beneath the proposed CPVVS site. However, the analytical data did not indicate any exceedances of health risk-based criteria (tap water PRGs) for metals, although it should be noted that the method detection limits were too high to assess the relatively low risk criteria for tap water for arsenic (0.045 µg/L) and thallium (2.4 µg/L). There was a single exceedance (in sample A1-12GW) of the health risk-based criteria for the organchlorine pesticide, Heptachlor epoxide. This compound was detected at 0.026 µg/L, which exceeded the tap water PRG (based on Heptachlor) of 0.015 µg/L. Because groundwater will not be used for potable water at the proposed CPVVS project, it is not anticipated that these results pose a significant threat to human health during construction or operation of the CPVVS. These data provide a baseline of shallow groundwater

conditions during the late dry season (September) prior to CPVVS construction or operation.

For the proposed CPVVS site, the soil contaminant levels observed in this limited sampling program are such that, without mitigation, construction worker risks would be expected to be higher than an industrial/commercial scenario, given the potential for increased direct exposure via dermal contact, ingestion, and inhalation. This elevated risk to workers is primarily due to exposure to arsenic and, to a lesser degree, organochlorine pesticides (especially 4,4'-DDE) which were detected near the hazardous waste TTLC. Exposure mitigation for construction workers should therefore include soil handling best management practices (BMPs) aimed at minimizing soil contact and fugitive dust generation during construction.

SECTION 5

Conclusions and Recommendations

A preliminary Phase II ESA, composed of soil and groundwater sampling and chemical laboratory analysis, was conducted for the proposed CPVVS site near Vacaville, California. The results of the assessment, as documented in this report, indicate that inorganic and organochlorine constituents exist in surface and subsurface soils at levels that warrant consideration in the plans to develop the proposed CPVVS.

The data collected for this report indicate arsenic concentrations exist at levels above the comparative health risk-based values (PRGs and CHHSLs) in surface and subsurface soils at the site. Chromium was also detected above the risk-based values for chromium VI; however, it is expected that the total chromium levels detected in surface and subsurface soils are associated with the less toxic form (chromium III) due to the unsaturated (oxidizing) conditions in surface soils at the site. Based on these conditions, we conclude that the actual chromium levelsare below the risk-based values (ie., those for chromium III).

In surface soils only, a residual organochlorine pesticides (4,4'-DDE) was noted at levels near the hazardous waste TTLC criterion; however, these were below health risk-based screening levels (PRGs and CHHSLs). With only a few minor exceptions, organochlorine pesticides were not detected in subsurface soils.

Arsenic levels in the field were detected at concentrations that were consistent with the background soils collected from around the site. They were also comparable with arsenic levels documented in a state-wide assessment of background concentrations of metals (Kearney Foundation, 1996). While arsenic is a known carcinogen and represents a potential risk for human health under an industrial/commercial worker exposure scenario to surface soils, it is expected that the implementation of normal dust-control and erosion mitigation measures (as part of the construction BMPs) would go a long way toward avoiding potential health risks for construction workers and offsite receptors during the CPVVS construction activities.

A baseline assessment of dry season groundwater conditions beneath the CPVVS property was also completed. The analytical data indicated some relatively minor detections of metals and organochlorine pesticide in the shallow groundwater beneath the proposed CPVVS site. While the analytical data did not indicate any exceedances of health risk-based criteria (tap water PRGs) for metals, it should be noted that the method detection limits were too high to assess the relatively low risk criteria for tap water for arsenic and thallium. There was a single exceedance (in sample A1-12GW) of the health risk-based criteria for the organchlorine pesticide, Heptachlor epoxide. Because groundwater will not be used for potable water at the proposed CPVVS project, it is not anticipated that these results pose a significant threat to human health during construction or operation of the CPVVS. CH2M HILL recommends that following.

- CPV should notify the current landowner (City of Vacaville) of these initial results. According to information obtained during the Phase I ESA, the proposed CPVVS

property is not currently under regulatory agency mandate to address surface soil contamination. Given the historic nature of activities that resulted in the current site conditions, there is no apparent regulatory requirement for notification other than that required under the California Energy Commission (CEC) review process. Based on the findings in this technical memorandum, it is not expected that the levels of contaminants detected at the site would trigger a regulatory-mandated cleanup action. However, CPV should review the findings of this report with their legal staff to make final decisions on regulatory liability and notification.

- Prior to initiating construction activities, a Construction Health and Safety Plan (and/or Soil Management Plan) should be prepared that addresses the issues of construction worker exposure to soil and the potential off-site impacts by wind and/or water erosion. The Plans should be protective of site workers and potential off-site receptors and prepared in general conformance with regulatory requirements. The Plans can then be used by stakeholders (CPV and construction contractors) for determining any incremental construction costs that could be associated with potentially harmful soil constituents during the bidding process. These Plans should describe specific actions to control construction worker exposures to onsite soil constituents (such as personal protective equipment, safe work practices, and engineered controls) and to limit offsite impacts (such as erosion and sedimentation controls).

The preliminary Phase II ESA activities described in this report were completed in accordance with the Attached Scope of Work (Appendix A), which was signed and received by CH2M HILL from CPV on June 25, 2008. The approaches described in the Scope of Work are consistent with generally accepted standards of practice for environmental investigations. These types of investigations are based on the analytical testing for a limited number of analytes on a limited number of discrete soil samples.

The sample locations were chosen to be representative of site conditions and the analytical testing designed to detect expected contaminants. However, these investigations do not provide a warranty that other contaminants of a similar nature do not exist on other areas of the property that were not sampled. Increased certainty about overall environmental site conditions can be achieved with an increased amount of sampling and analyses, but the need for further site investigations should be based upon CPV's requirements for risk management relative to their real estate portfolio.

SECTION 6

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Tables

TABLE 1
Sample Summary
Draft Phase II Environmental Site Assessment

Location	Latitude	Longitude	Easting	Northing	Samples[a]
A1	38.339344	-121.901009	6159836.503	2313168.198	Soil: 0-6 in, 3 ft, 5 ft GW: grab at 12 ft
A2	38.339381	-121.899909	6160152.262	2313176.617	Soil: 0–6 in and 3 ft
A3	38.339415	-121.898815	6160466.025	2313184.493	Soil: 0–6 in and 3 ft
A4	38.339432	-121.897711	6160782.760	2313185.938	Soil: 0–6 in and 3 ft
B1	38.338945	-121.901004	6159835.800	2313022.832	Soil: 0–6 in and 3 ft
B2	38.338958	-121.899903	6160151.616	2313022.715	Soil: 0–6 in and 3 ft
B3	38.338988	-121.89881	6160465.337	2313029.030	Soil: 0–6 in, 3 ft, 5 ft GW: grab at 12 ft
B4	38.338996	-121.897713	6160779.991	2313027.064	Soil: 0–6 in and 3 ft
C1	38.338541	-121.901013	6159831.110	2312875.712	Soil: 0–6 in and 3 ft
C2	38.338541	-121.899916	6160145.769	2312870.901	Soil: 0–6 in and 3 ft
C3	38.338541	-121.898824	6160458.820	2312866.416	Soil: 0–6 in and 3 ft
C4	38.338546	-121.897726	6160773.667	2312863.352	Soil: 0–6 in, 3 ft, 5 ft
D1	38.338134	-121.901022	6159826.310	2312727.430	Soil: 0–6 in and 3 ft
D2	38.338128	-121.899917	6160143.083	2312720.587	Soil: 0–6 in, 3 ft, 5 ft GW: grab at 12 ft
D3	38.338121	-121.898824	6160456.610	2312713.152	Soil: 0–6 in and 3 ft
D4	38.338106	-121.897726	6160771.475	2312703.212	Soil: 0–6 in and 3 ft
E1	38.337725	-121.901033	6159820.806	2312578.729	Soil: 0–6 in, 3 ft, 5 ft
E2	38.337701	-121.899935	6160135.672	2312565.091	Soil: 0–6 in and 3 ft
E3	38.337705	-121.898835	6160451.201	2312562.012	Soil: 0–6 in and 3 ft
E4	38.337707	-121.897735	6160766.720	2312557.770	Soil: 0–6 in and 3 ft
BG1	38.339716	-121.901436	6159716.220	2313305.210	Soil: 0–6 in, 3 ft, 5 ft
BG2	38.339132	-121.901441	6159711.472	2313092.604	Soil: 0–6 in, 3 ft, 5 ft
BG3	38.337255	-121.899419	6160281.035	2312400.687	Soil: 3 ft and 5ft
BG4	38.338098	-121.897107	6160948.800	2312697.724	Soil: 0–6 in, 3 ft, 5 ft
BG5	38.339000	-121.897100	6160955.842	2313026.014	Soil: 0–6 in, 3 ft, 5 ft
MW-5	—	—	—	—	GW: est. 30–35 ft screen interval[b]

Note: Sample locations collected on August 8, 2008, using a hand-held Trimble GeoXT GPS device.

[a] Samples are noted in depth below ground surface. For background samples (BG1, BG2, and BG3) the depth below ground surface is interpolated below fill to correspond to ground surface within the site.

[b] A GPS location was not collected for MW-5. The screened interval for this well is estimated from Luhdorff and Scalmanini (2005).

ft = feet
GW = groundwater
in = inches

TABLE 2
Summary Statistics for Metals in Surface and Subsurface Soils Within the Site
Draft Phase II Environmental Site Assessment

Parameter	Number of Detects	Detection Frequency	Normal Distribution?	Mean	Standard Deviation	Minimum	Maximum
Surface Soils (n = 20)							
Antimony	0	0%	—	—	—	—	—
Arsenic	20	100%	Yes	8.14	1.292	6.2	11.1
Barium	20	100%	No	167.6*	36.64	135	307
Beryllium	20	100%	Yes	0.73	0.073	0.57	0.83
Cadmium	0	0%	—	—	—	—	—
Chromium	20	100%	Yes	40.09	4.356	30.8	45.9
Cobalt	20	100%	No	11.63*	6.455	9.1	39.5
Copper	20	100%	No	43.50*	5.072	37	59.8
Lead	20	100%	Yes	12.64	1.194	10.4	15.9
Mercury	20	100%	No	0.09*	0.034	0.58	0.22
Molybdenum	0	0%	—	—	—	—	—
Nickel	20	100%	Yes	28.24	3.155	22.9	33.2
Selenium	3	15%	No	1.61*	0.748	1.35	3.7
Silver	20	100%	No	1.43*	0.221	1.1	2.1
Thallium	0	0%	—	—	—	—	—
Vanadium	20	100%	Yes	72.68	9.707	54.6	85.9
Zinc	20	100%	Yes	78.67	5.658	66.1	89.4
Subsurface Soils (n = 25)							
Antimony	1	4%	—	—	—	—	—
Arsenic	25	100%	Yes	10.72	1.646	6.74	14.1
Barium	25	100%	No	277.9*	244.4	79.8	1360
Beryllium	25	100%	Yes	0.81	0.055	0.70	0.96
Cadmium	23	92%	Yes	0.13	4.668	0.03	0.32
Chromium	25	100%	Yes	37.86	4.855	25.5	48.0
Cobalt	25	100%	No	14.86*	8.839	7.49	50.8
Copper	25	100%	Yes	33.93	4.428	26.8	47.6
Lead	25	100%	Yes	10.83	1.412	8.72	14.0
Mercury	25	100%	Yes	0.046	0.017	0.015	0.088
Molybdenum	19	76%	Yes	0.34	4.175	0.20	0.68
Nickel	25	100%	Yes	33.70	4.652	26.8	42.5
Selenium	18	72%	No	1.81*	1.490	0.58	4.67
Silver	17	68%	No	0.11*	0.212	0.022	0.80
Thallium	2	8%	—	—	—	—	—
Vanadium	25	100%	Yes	69.63	7.123	54.3	86.5
Zinc	25	100%	Yes	66.50	7.160	52.1	83.2

Notes:

Summary statistics are based on native samples only and do not include background or field duplicate values.
The reported values are in mg/kg on a dry weight basis.

The test for normal distribution of data was significant at the $\alpha \geq 0.05$ level.

Reported means are arithmetic except where noted by (*) where the geometric mean was reported instead.

For the calculation of means, estimated (J-flagged) values were used while non-detected (U-flagged) values were estimated as one-half of the reported method detection limit.

Summary statistics were not calculated when the number of detected values was below 3.

TABLE 3
Mean Metal Concentrations (mg/kg on dry weight basis) and Comparisons Between Surface and Subsurface Soils
Draft Phase II Environmental Site Assessment

	Mean Concentrations in Surface Samples		**Significant Difference?**	
Parameter	**Native Samples (n = 20)**	**Background Samples (n = 4)**	**Unpaired t-test**	**Mann-Whitney U**
Antimony	Not calculated	Not calculated	—	—
Arsenic	8.145	**8.80**	No (p = 0.3517)	No (p = 0.2012)
Barium	170.5	**182.5**	No (p = 0.5485)	No (p = 0.2299)
Beryllium	**0.728**	0.698	No (p = 0.4253)	No (p = 0.2012)
Cadmium	Not calculated	Not calculated	—	—
Chromium	**40.09**	36.98	No (p = 0.1793)	No (p = 0.0958)
Cobalt	12.37	**14.3**	No (p = 0.5907)	No (p = 0.5355)
Copper	**43.76**	33.40	**Yes** (p = 0.0006)	**Yes** (p = 0.0019)
Lead	**12.64**	11.25	No (p = 0.0754)	No (p = 0.1411)
Mercury	**0.094**	0.064	No (p = 0.1151)	No (p = 0.1411)
Molybdenum	Not calculated	Not calculated	—	—
Nickel	28.24	**32.150**	**Yes** (p = 0.0371)	No (p = 0.1038)
Selenium	**1.718**	1.438	No (p = 0.4700)	No (p = 0.9383)
Silver	**1.44**	1.095	**Yes** (p = 0.0067)	**Yes** (p = 0.0067)
Thallium	Not calculated	Not calculated	—	—
Vanadium	**72.68**	66.63	No (p = 0.2385)	No (p = 0.1519)
Zinc	**78.67**	65.95	**Yes** (p = 0.0003)	**Yes** (p = 0.0053)

	Mean Concentrations in Native Samples		**Significant Difference?**	
Parameter	**Surface Samples (n = 20)**	**Subsurface Samples (n = 25)**	**Unpaired t-test**	**Mann-Whitney U**
Antimony	Not calculated	Not calculated	—	—
Arsenic	8.145	**10.72**	**Yes** (p < 0.0001)	**Yes** (p < 0.0001)
Barium	170.5	**329.2**	**Yes** (p < 0.0063)	**Yes** (p = 0.0006)
Beryllium	0.728	**0.808**	**Yes** (p = 0.0001)	**Yes** (p = 0.0004)
Cadmium	Not calculated	Not calculated	—	—
Chromium	**40.09**	37.86	No (p = 0.1180)	No (p = 0.0910)
Cobalt	12.37	**16.36**	No (p = 0.0985)	**Yes** (p = 0.0073)
Copper	**43.76**	33.93	**Yes** (p < 0.0001)	**Yes** (p < 0.0001)
Lead	**12.64**	10.38	**Yes** (p < 0.0001)	**Yes** (p = 0.0001)
Mercury	**0.094**	0.046	**Yes** (p < 0.0001)	**Yes** (p < 0.0001)
Molybdenum	Not calculated	Not calculated	—	—
Nickel	28.24	**33.70**	**Yes** (p < 0.0001)	**Yes** (p = 0.0001)
Selenium	1.178	**2.321**	No (p = 0.1062)	No (p = 0.2009)
Silver	**1.44**	0.213	**Yes** (p < 0.0001)	**Yes** (p < 0.0001)
Thallium	Not calculated	Not calculated	—	—
Vanadium	**72.68**	69.63	No (p = 0.2312)	No (p = 0.1534)
Zinc	**78.67**	66.50	**Yes** (p < 0.0001)	**Yes** (p < 0.0001)

Notes:

Summary statistics are based on native samples only and do not include field duplicate values.

For the calculation of means, estimated (J-flagged) values were used while non-detected (U-flagged) values were estimated as one-half of the reported method detection limit.

Means were not calculated when the number of detected values was below 3 and significance testing was only done when adequate number of detections was available in both the surface and subsurface soils.

Boldface means are the higher value in the groups compared and are shaded when the difference was statistically significant at the p ≤ 0.05 level.

Figures

LEGEND

- ◑ Monitering Well
- ◪ Transformer and Utility Box
- Project Site

N

0 375 750
Feet

VICINITY MAP

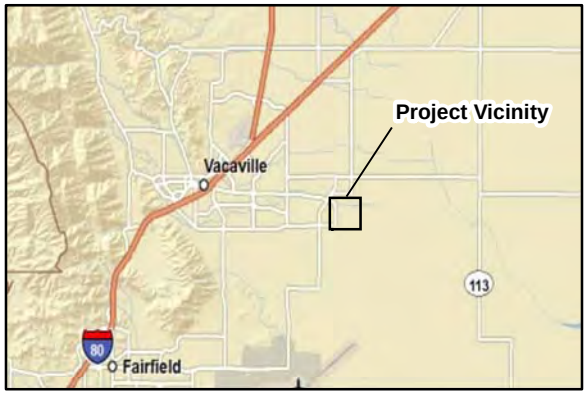
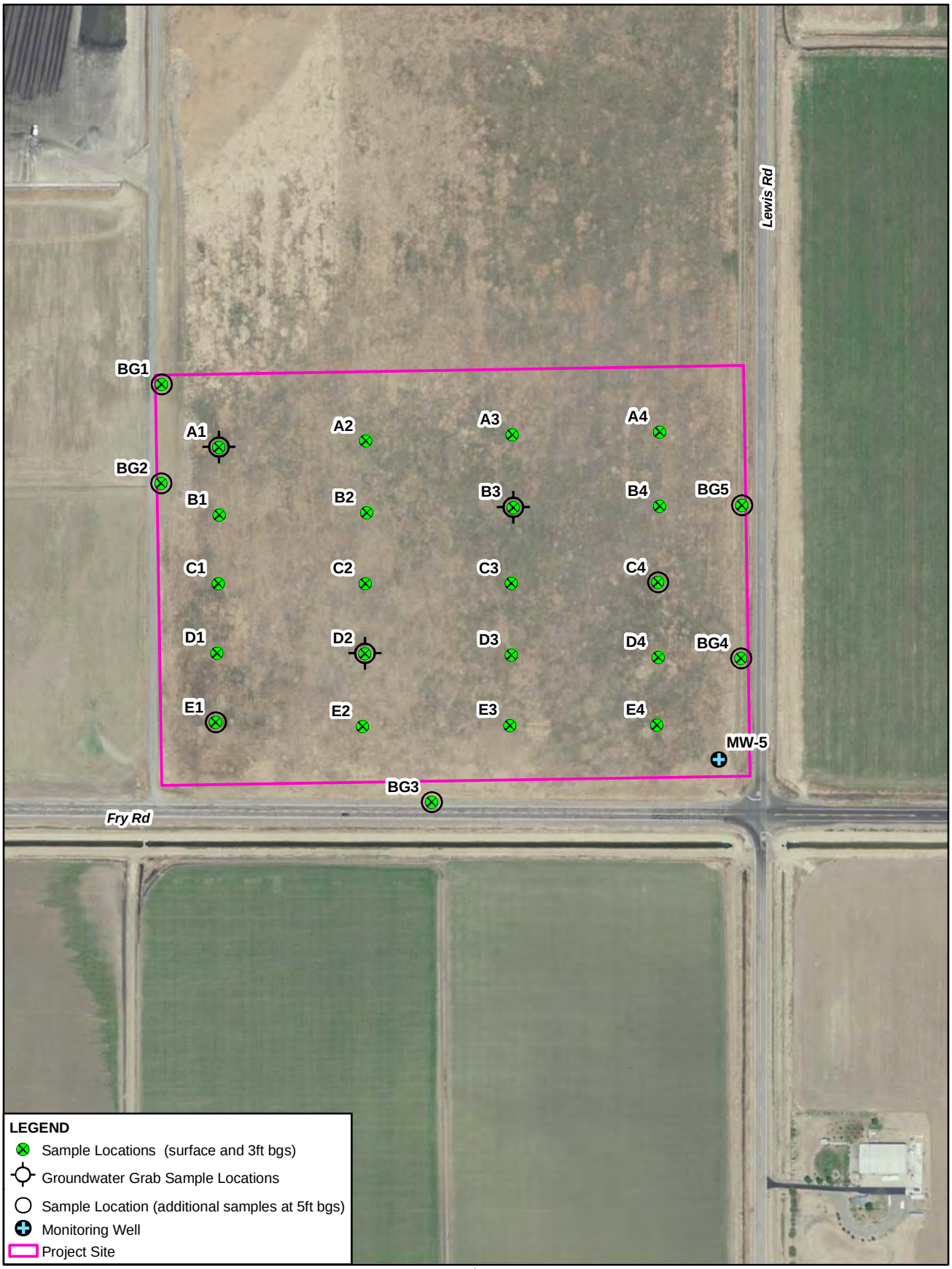


FIGURE 1
SITE MAP
PHASE II ENVIRONMENTAL SITE ASSESSMENT
VACAVILLE ENERGY CENTER, VACAVILLE, CA

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.



Source: Sample locations collected on 08/05/08 using a Trimble GeoXT GPS unit.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 150 300

Feet

FIGURE 2
SAMPLE LOCATIONS MAP

PHASE II ENVIRONMENTAL SITE ASSESSMENT

VACAVILLE ENERGY CENTER, VACAVILLE, CA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\VACAVILLE_AFC_370668\MAPFILES\PHASEII\PHASEII_SAMPLES.MXD MHASKELL 11/3/2008 09:51:22

Appendix A
Signed Phase II Proposal

CH2M HILL
2485 Natomas Park Drive
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Sacramento, CA 95833
Tel 916-920-0300
Fax 916-920-8483

June 5, 2008

Mr. Andrew C. Welch
Vice President
Competive Power Ventures, Inc.
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Suject: Preliminary Phase II Environmental Site Assessment
Vacaville Energy Center, Vacaville, California

Dear Mr. Welch:

CH2M HILL is pleased to submit this proposal to CPV Vacaville, LLC (CPV Vacaville) to perform soil sampling and analysis activities for CPV Vacaville's new power plant site, located in Vacaville, Solano County, California. The proposed activities are intended to address the recommendations that were included in the *Phase I Environmental Site Assessment* (ESA) by CH2M HILL, dated May 12, 2008. These recommendations were that the soil be analyzed for residues of agricultural chemicals and municipal waste water sludge (i.e., biosolids) and that the baseline groundwater conditions be assessed. This proposed work will support the due diligence for CPV Vacaville in association with the proposed construction and operation of a power plant on the subject property. It is also intended to address potential California Energy Commission (CEC) concerns for future worker health and safety.

The project site is a 25-acre (±) parcel located south of the City of Vacaville's Easterly Wastewater Treatment Plant within the Vacaville City limit. The Phase I ESA noted that subject property was part of a larger 143.5-acre parcel. This agricultural property was acquired by the City of Vacaville in the late 1990's and was held by private individuals prior to that time. The subject property has been used for corn production and, for approximately 4 to 5 years, it had received biosolids (i.e., wastewater treatment facility sludge) under a permit from the Central Valley Regional Water Quality Control Board (CVRWQCB). During that period, the rate of biosolids application was dictated by the crop uptake capacity. Reportedly, the biosolids applications were halted and the field has been fallow for approximately 6 years.

Because the subject property has agricultural site use history and because it was known to receive biosolids from a municipal wastewater treatment facility, there is a potential for the on-site soils to contain residues of persistent agricultural chemicals or biosolid constituents, such as heavy metals, at levels that could be potentially harmful to human health. The

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proposed soil sampling and analysis activities are intended to characterize the residues of agricultural chemicals and biosolids that could remain on the property.

Scope of Work

The scope of work for this project includes the following tasks:

- Task 1 – Sampling and Analysis
  - Obtain and review copies of the analytical data for the biosolids that have been applied to the field
  - Arrange for laboratory analyses of the soil and groundwater samples
  - Lay out sampling grid and record locations with global positioning system (GPS) unit
  - Complete underground utility locating and obtain Solano County drill permits
  - Conduct field sampling program using direct push technology (DPT) drill rig and collect soil and groundwater samples
  - Ship samples to the analytical laboratory under chain-of-custody
- Task 2 – Reporting
  - Produce soil logs and sample data sheets
  - Summarize and review soil and groundwater sample analytical results
  - Compare soil analytical results to appropriate risk-based and hazardous waste criteria
  - Interpret the implications of the findings for the proposed project.
- Task 3 - Project Management

Task 1 – Sampling and Analysis

CH2M HILL will obtain copies of analytical data reports for the biosolids that were applied to the subject property. It is assumed that these analytical data are readily available from the City of Vacaville under their permit to apply the biosolids from the CVRWQCB. The shallow groundwater study will also be reviewed to determine what parameters have been recently sampled. These data will be used to determine what analyses may be required for the new samples.

All the soil samples will be analyzed for persistent organochlorine pesticides using USEPA Method 8080A. For the purpose of costing, it is assumed that all soil samples will also be analyzed for CAM 17 metals (USEPA Series 6000 and 7000 and 7471 for mercury), although the final suite of analyses will be determined after analytical reports for the biosolids have been reviewed.

Soil sampling for the agricultural field will be done in general accordance with the California EPA Department of Toxic Substances Control (DTSC) *Interim Guidance for Sampling Agricultural Fields for School Sites (Second Revision,* August 26, 2002). While it is recognized that the proposed use of the Vacaville property is not for a school, this document provides conservative guidelines for characterizing soil conditions in agricultural fields.

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Based on the DTSC guidance and size of the subject parcel, it is recommended that discrete samples be collected at 20 locations uniformly distributed throughout the property. A resource-grade GPS unit (Trimble GeoXT) will be used to locate samples within the field. At all locations, samples will be collected using a direct push technology (DPT) drill rig at two depths, near surface (0 to 6 inches) and subsurface (2 to 3 feet below ground surface [bgs]). At five of the sample locations, deeper samples will be collected near 5 feet bgs. Five additional soil samples will be collected as field duplicates of existing samples to assess sampling and laboratory quality assurance/quality control (QA/QC). Ten more samples will be collected at five locations in adjacent areas to use as background samples for metals. Based on this approach, the total estimated number of soil samples to be collected is 60.

In addition, groundwater samples will be collected for the subject property. First, the existing groundwater monitoring well in the southeast portion of the field will be sampled. At three additional locations throughout the field, the DPT drill rig will be used to collect a groundwater grab sample. Based on this approach and one additional QAQC sample, the total number of groundwater samples estimated for this effort is 5. All groundwater samples will be field filtered before shipping to the laboratory. As previously explained, the analytical suite will include organochlorine pesticides and metals with the final choice of analytes determined by the review of existing analytical data for the site.

It is expected that surface soil samples will be collected with dedicated, disposable scoops. Subsurface soil and groundwater grab samples will be collected using the DPT drive sampler that has been decontaminated prior to each use to prevent cross-contamination of samples. Soil samples will be collected directly into laboratory-provided sample containers and chilled as soon as practical in an ice chest. The samples will be kept chilled until they are received at the analytical laboratory under chain-of-custody procedures.

Task 2 – Reporting

Descriptive logs for the soil borings will be included in the report as an attachment.

Upon receipt of the analytical data from the laboratory, the results will be tabulated for the memorandum. Comparative screening-level criteria (where available for each analyte) will be taken from sources such as the USEPA Preliminary Remediation Goals (PRGs) and California Human Health Screening Levels (CHHSLs). The applicable Title 22 Hazardous Waste Criteria, where available, will also be determined. These comparative values will be shown along with the analytical results in the summary table in order to document the comparison to the screening criteria.

The findings and conclusions will be included in a technical memorandum entitled Preliminary Phase II Environmental Site Assessment. This report will document the justification for the soil sampling, field activities, and the findings as they pertain to the proposed project. If further activities are warranted, those recommendations and their basis will also be provided in the technical memorandum.

Task 3 – Project Management

Project management for this project will include staff management and scheduling; supervision of the entire work scope, contract management, financial management, and client communication. Douglas M. Davy will serve as the Project Manager for this task. Dr.

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Davy has 22 years of experience managing environmental permitting projects for infrastructure development. Mr. Steve Long will serve as Senior Technical Lead and has 19 years of experience conducting Phase I and Phase II Environmental Site Assessments.

The Preliminary Phase II Environmental Site Assessment memorandum will be conveyed electronically to allow review and client input prior to final production of the memorandum. For this reason, it is assumed that no meetings will be required to discuss the findings of this due diligience investigation.

Budget

We propose to conduct this work on a time and materials basis with a budget not to exceed without prior approval by CPV Vacaville. Attachment B is an itemized listing of costs by task.

Schedule

The duration of this scope of work is approximately 10 weeks from receipt of the notice to proceed. This duration includes time to plan for, schedule, and conduct the sampling, to complete the laboratory analyses, and to draft the technical memorandum. It should be noted that it may take as long as 5 weeks to schedule the drilling contractor and obtain the required permits. CH2M HILL will work with CPV Vacaville to adjust the schedule for specific tasks performed under this scope of work. It is anticipated that all work will be completed by December 31, 2008.

Deliverables

The draft Preliminary Phase II ESA will be provided electronically to CPV Vacaville for review and comment. Within 1 week of receipt of comments, 5 copies will be submitted to CPV Vacaville.

Assumptions

It is assumed that the client will arrange for access to the subject property for CH2M HILL and their subcontractors to conduct the field investigations. It is also assumed that the City of Vacaville will provide copies of relevant information concerning the analytical data for the biosolids that were applied to the property. This information will need to be obtained prior to the field sampling event so that it can be reviewed and incorporated into the sample analytical program. For the purpose of this cost estimate for the 65 samples, the individual sample analytical cost is assumed to be $500 per sample. It the actual sample costs determined after the data review will exceed this amount, it will be necessary to increase the budget accordingly.

The technical memorandum will address the data collected under the proposed scope of work. The approach described in this scope of work are consistent with generally accepted standards of practice for environmental investigations. These type of investigations will be

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based on the analytical testing for a limited number of analytes on a limited number of discrete soil and groundwater samples.

The sample locations will be chosen to provide an adequate coverage of the subject property and are expected to be representative of site conditions. However, these investigations do not provide a warranty that other site contaminants of a similar nature do not exist on other areas of the property that were not samped. Increased certainty about overall environmental site conditions can be achieved with increased amount of sampling and analyses. The need for further site investigations should be based upon CPV Vacaville's requirements for risk management relative to the proposed power plant project.

It has been assumed that this project will be completed in the year 2008.

Contract Terms

This work will be accomplished on a time and materials basis and in accordance with the Terms and Conditions of the February 19, 2008 Agreement for Consulting Services between CPV Vacaville, LLC and CH2M HILL, as amended by CH2M HILL's specific additional provisions (see Attachment A) for conducting a Phase 2 ESA.

If you have any questions or require additional information, please contact Doug Davy, Senior Project Manager in our Sacramento office (916-286-0278).

Sincerely,

CH2M HILL

Karen L. Parker
Operations Leader

Accepted by CPV Vacaville, LLC

Name: Peter Podurgiel

Signature: Peter Podurgiel

Date: June 25, 2008

c: D. Davy
S. Long

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ATTACHMENT A - OTHER PROVISIONS

For Phase 2 Site Assessment Services ("Phase 2 Services") under the Agreement for Consulting Services between CH2M HILL and CPV Vacaville, LLC (CPV Vacaville) date February 19, 2008 (AGREEMENT), the following provisions shall apply:

1. Limitation of Liability

To the maximum extent permitted by law, CH2M HILL's liability for CPV Vacaville's damages for any cause or combinations of causes for Phase 2 Services will, in the aggregate, not exceed $100,000. CPV Vacaville agrees to indemnify CH2M HILL for any damages that exceed this liability. CPV Vacaville waives all claims against CH2M HILL, including those of latent defects, that are not brought within two years of completion of the Phase 2 Services or final payment, whichever is later. This provision takes precedence over any conflicting provision of the AGREEMENT or any document incorporated into them or referenced by them.

2. No Third Party Beneficiaries

All work products will be prepared for the exclusive use of CPV Vacaville, for specific application to the property described in the SCOPE OF SERVICES. No warranty, expressed or implied, is made. There are no beneficiaries of the work products other than CPV Vacaville, and no other person or entity is entitled to rely upon the work products without the written consent of CH2M HILL.

Should CPV and CH2M HILL agree that the work product will be released to a financial institution or others for review, CPV Vacaville will obtain an executed reliance letter from the financial institution which states that CH2M HILL's liability for any reliance on the work product will be subject to the same limitations as agreed between CPV Vacaville and CH2M HILL in this AGREEMENT.

3. Additional Terms

a. It is beyond CH2M HILL's scope of work to review or examine: (1) materials containing asbestos; (2) the presence of radon; (3) the presence of lead-based paint; (4) lead in drinking water; (5) identification or delineation of jurisdictional wetlands; (6) issues associated with worker health and safety; (7) issues pertaining to compliance with environmental regulations; (8) issues pertaining to cultural/historic resources, (9) issues pertaining to endangered species and ecological resources, (10) indoor air quality, (11) issues pertaining to biological agents or mold or (12) liabilities associated with the offsite management of solid or hazardous wastes.

b. Unless specifically identified in the Scope of Work, cost estimates for cleanup and identification of parties potentially responsible for the cleanup of hazardous substance releases are not included.

c. At CPV's direction, CH2M HILL has not performed any surface or subsurface sampling and cannot therefore give any assurance as to the absence or presence of surface or subsurface contamination.

d. Any report prepared under the SCOPE OF SERVICES is based, in part, on unverified preliminary information supplied to CH2M HILL from several sources during the project; therefore, CH2M HILL cannot guarantee its completeness or accuracy.

e. CH2M HILL makes no representation regarding whether this investigation constitutes "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice" as defined under Section 101(35)(B) of CERCLA.

f. The CH2M HILL's staff who performed the site assessment are not attorneys; therefore any report prepared under the SCOPE OF SERVICES is not a legal representation or interpretation of environmental laws, rules, regulations, or policies of local, state, or federal governmental agencies.

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g. Any opinions or recommendations presented apply to site conditions existing when services were performed. CH2M HILL cannot report on, or accurately predict events that may change the site conditions after the described services are performed, whether occurring naturally or caused by external forces.

h. CH2M HILL assumes no responsibility for conditions we are not authorized to investigate, or which are not in our specific SCOPE OF SERVICES.

i. CH2M HILL's services shall not include directly or indirectly storing, arranging for or actually transporting, disposing, treating or monitoring hazardous substances, hazardous materials, hazardous wastes or hazardous oils

j. CH2M HILL's services shall not include an independent verification of the quality of work conducted and information provided by independent laboratories or other independent contractors retained by CH2M HILL in connection with CH2M HILL's services provided to CPV Vacaville.

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Vacaville Energy Center Preliminary Phase II ESA

Price by Element

Lowest Tasks, All Budgets, without Budget Subtotals, without Period Subtotals, without Estimating Frequency Subtotals

Task	Hours	Labor	Labor Subtotal	Expense	Subs	Travel	Subtotal
Top Task 01							
01.01 - Soil and GW sampling							
01.02 - Sample analyses							
Subtotal for 01							
Top Task 02							
02.01 - Data analyses and reporting							
Subtotal for 02							
Top Task 03							
03.01 - Administrative tasks							
Subtotal for 03							
Grand Total							

Appendix B
Shallow Groundwater Study

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

GROUND-WATER RESOURCES
HYDROLOGY • DEVELOPMENT • MANAGEMENT

August 23, 2005
File No. 05-4-051

Ms. Jacqueline McCall
Water Quality Manager, Department of Public Works
City of Vacaville
6040 Vaca Station Road
Elmira, CA 95625

SUBJECT: SHALLOW GROUNDWATER QUALITY IN THE VICINITY OF THE EASTERLY WASTEWATER TREATMENT PLANT, SOLANO COUNTY, CA

Dear Ms. McCall:

Per your request, Luhdorff and Scalmanini, Consulting Engineers (LSCE) has prepared this letter report investigating shallow groundwater quality in the vicinity of the City of Vacaville's Easterly Wastewater Treatment Plant (EWWTP) located at 6040 Vaca Station Road, Elmira, CA 95625 (**Figure 1**).

This investigation is in response to Order WQO 2002-0015 issued by the California State Water Resources Control Board (State Board) remanding Waste Discharge Requirements (WDRs) Order No. 5-01-044 to the Central Valley Regional Water Quality Control Board (RWQCB) for appropriate modifications.

Specifically, the State Board objects to the RWQCB's lenient language regarding potential impacts to groundwater quality as in *Finding 32* of the RWQCB's Order No. 5-01-044: *"Current monitoring data has not identified significant changes of groundwater quality as a result of the operation of the wastewater treatment facility."* The State Board contends that based on the historical variability of electrical conductivity (EC) values, total dissolved solids (TDS) and nitrate-N (nitrate as nitrogen) concentrations, and pH in samples retrieved from the five monitoring wells, the water quality record does not appear to support the RWQCB's findings. The State Board also criticizes the lack of information on monitoring well locations. Specifically, the State Board concludes (page 62, State Board Order WQO 2002-0015):

> "Without more information on well location and some explanation of the changes in nitrate-N, TDS and pH concentrations, the Board is unable to draw any meaningful conclusions from the monitoring data. The Board will remand this issue to the Central Valley Regional Board for clarification. If the treatment plant's operation has caused groundwater quality changes, Vacaville should be given the opportunity to submit

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information demonstrating that the changes meet the criteria in Resolution No. 68-16. If increases in nitrate-N concentrations over the MCL in groundwater are, in fact, due to the Easterly treatment plant operation, these changes would not meet the Resolution No. 68-16 criteria."

SCOPE

The purpose of this letter report is to determine whether or not the historical operation of the EWWTP has caused groundwater quality changes in its vicinity and, if applicable, delineate the sources of such changes.

EWWTP OPERATION

The plant was initially constructed in 1959 and has been expanded several times since then. The plant provides secondary treatment, employing activated sludge reactors and secondary clarifiers with nitrification. The treatment plant capacity was designed for 10 million gallons per day (mgd) average dry weather flow (ADWF); it averaged 6.9 mgd ADWF in 1997. Construction work to expand the plant commenced in late 2000 and continues through the present. At the end of the Phase I construction in 2006, the facility will have a design flow capacity of 15 mgd (ADWF). The expanded facility layout is shown on **Figure 2**.

MONITORING NETWORK

The City maintains a network of five shallow monitoring wells, MW #1 through MW #5, in the vicinity of the plant (**Figure 1**). These wells were constructed between 1990 and 1994 to a depth of 30 to 35 feet below ground surface (bgs) (**Table 1**). MW #1 is located in very close proximity to the northwest corner of the decommissioned West Pond and Old Alamo Creek. MW #2 and MW #3 are located about 550 and 850 feet east of the West Pond, respectively. MW #4 and MW #5 are located about 2,500 to 3,000 feet southeast of the southeast corner of the West Pond on historically farmed agricultural land.

POTENTIAL SOURCES FOR GROUNDWATER CONTAMINATION

Old Alamo Creek and SID Canal

Treated effluent wastewater is discharged to Old Alamo Creek and flows eastward along the northern facility boundary. The creek was identified as a major source of groundwater recharge and contributor to near-surface groundwater levels in the area (*Investigation of Shallow Groundwater, Elmira Project Final Report, August 1988* [LSCE, 1988]). The EWWTP's wastewater effluent discharge constitutes the greatest flow component of the creek; other flows include a small amount of natural flow (in the winter months, if any), agricultural tailwater, and urban stormwater runoff from the City of Vacaville (prior to 1988).

Irrigation water infiltration along the unlined portion of the Solano Irrigation District's (SID) canal north of the EWWTP (paralleling the creek) was also found to contribute to groundwater recharge during the irrigation season (LSCE, 1988).

West Pond and East Pond

The unlined West Pond and East Pond were used for temporary storage of effluent prior to its discharge to the creek (**Figure 3**). Thus, losses of effluent from these ponds to deep percolation would affect the quality of underlying groundwater similarly to recharge from the creek. The West Pond typically contained effluent between October and May/June until it was decommissioned in 2003 to allow plant expansion and modernization. The East Pond has not been operated or received effluent since 1990. Also, the East Pond was largely removed when the most recent plant expansion occurred. Its former location is now occupied by new facilities such as paved parking lots, the administrative building, and primary and secondary treatment facilities (**Figure 2**).

Effluent quality data from 1994 and 1995 (as monitored at the outfall to Old Alamo Creek) show an EC ranging from 800 to 1,182 µS/cm with an average of 969 µS/cm (41 samples); a pH (standard pH units) ranging from 6.8 to 7.7 (monthly average of daily measurements) with an average of 7.2 (730 samples); and TDS concentrations ranging from 471 to 670 mg/L with an average of 584 mg/L (44 samples). Nitrate-N concentrations ranged from 8 to 21.3 mg/L (1996-1997) and from 4.8 to 16.4 mg/L (1998-1999; 20 monthly samples) averaging 10.2 mg/L in 1998 and 13.1 mg/L in 1999.

Lagoons

Two sloped tile-lined sludge holding lagoons, located in the eastern portion of the plant, received sludge from a secondary anaerobic digester at about 2% solids through 2004 (**Figure 3**). Drained water was collected and returned to the plant's headworks. During the wet weather months, solids cake (8 – 12% solids) was hauled to the Biosolids Storage Lagoon #3. Each year, starting in late spring, the stored cake was excavated and hauled to the Interim Biosolids drying area and ultimately hauled to B&J Landfill. Biosolids samples retrieved in April and October 2004 contained 40 and <7 mg/kg nitrate-N on a dry weight basis, respectively. The Biosolids Storage Lagoon #3 was not lined, but it was equipped with a French Drain system to remove leachate. The Interim Biosolids drying area had a compacted soil base and a drain system. Drained fluids from the Interim Biosolids drying area and the storage lagoon were returned to the plant's headworks.

The potential for groundwater contamination posed by the lagoons and biosolids drying facilities is considered low as tiled floors and drain systems were installed to prevent deep percolation of leachate. The old lagoons have been decommissioned since 2001 and replaced with new state-of-the-art facilities during the plant expansion. The new facilities eliminate the potential for movement of waste products into the subsurface.

Soil Fields

Soil Fields #1 and #2 located south of the plant (**Figure 1**) received biosolids applications in 1989, 1990, 1992, and 1993. Soil Field #3 received biosolids applications only in 1990, 1992, and 1993. Since then, these fields have not received any biosolids from the plant. In 1995 and 1997, soil samples were retrieved from depths of 7 and 15 inches. Nitrate concentrations in the samples retrieved from the 7-inch depth samples ranged from 10 to 47 mg/kg (dry weight). Nitrate concentrations in the samples retrieved from the 15-inch depth samples ranged from 5.4 to 31 mg/kg (dry weight). Field #4, used as a control field, never received biosolids applications. Nitrate concentrations in the control field ranged from 7.6 to 13 mg/kg (dry weight) at depths of 15 and 7 inches, respectively.

Local Agricultural Land Use

Fields #1 through #4 and north to Holdener Road (**Figure 1**) have been farmed historically as irrigated croplands. Irrigation water is provided via the SID canal, although the land has periodically been dry farmed as well. All fields have received fertilizers in the course of being farmed.

GROUNDWATER LEVELS

Groundwater elevations in the three on-site monitoring wells (MW #1, MW #2, and MW #3) ranged from about 59 to 66 feet, mean sea level (msl) prior to Fall 2000, with the highest and lowest water levels typically observed in MW #1 and MW #3, respectively (**Figure 4**). Seasonal water level fluctuations were on the order of three to five feet, and the gradient beneath the plant was typically between 0.0004 to 0.0015.

Contours of equal groundwater elevation are provided for January 2005 (**Figure 5**), a period of high water levels, and April 2002 (**Figure 6**), a period of low water levels. During both of these periods, groundwater flow was roughly to the southeast, with gradients between MW #1 and MW #5 of 0.0016 and 0.0018, respectively.

In Winter 2000/01, water levels in MW #2 and MW #3 did not recover, but rather levels continued to decline to 56.44 and 54.74 feet (msl), respectively, by mid-2001. Water levels stayed notably depressed until 2004, when sustained recovery was observed. Generally, similar water level trends were also observed in MW #1 during this period.

The lowest water levels during the monitoring period (with the exception of 2001) were consistently observed in MW #4 and MW #5. Water levels in these two off-site wells have been stable and range between 53 and 60 feet (msl).

Groundwater beneath the EWWTP occurs within a few feet of the ground surface. The shallowest depths to groundwater occur at MW #1 (about 4 to 12 feet, below ground surface). The pond floor near MW #1 is at an elevation of about 65 feet (msl), which indicates that groundwater has periodically intersected the pond floor. At MW #2 and MW #3, the depth to

groundwater has ranged from about 7 to 18 feet (bgs). The water level records for MW #4 and MW #5 show that groundwater levels southeast of the plant site are commonly even shallower than under the facility. Specifically, groundwater levels are usually less than 4 feet, bgs (MW #4) and less than 6 feet, bgs (MW #5). Occasionally, groundwater is at the land surface at these locations.

The near-surface water table was also reported in *Investigation of Shallow Groundwater, Elmira Project Final Report* (LSCE, 1988). In 1987, 48 temporary monitoring wells were installed at selected sites on 200-foot centers to depths of 4 to 6 feet to investigate shallow groundwater movement in the plant's vicinity (**Figure 7**). Bi-weekly to monthly water level measurements were obtained from October 1987 to July 1988 (**Attachment**). During this time, the direction of flow south of Old Alamo Creek was predominantly to the east and southeast. North of the creek, the direction of flow was predominantly to the east and northeast. The creek acted as a source of recharge to groundwater during much of the monitoring period. The SID canal north of the plant also contributed to high groundwater levels during the irrigation season.

The lowered water levels observed in late 2000 and early 2001 are associated with excavation activities (starting in late 2000) and the associated dewatering of construction pits (starting in early 2001) during the expansion of the EWWTP. Although there are no records of the exact timing and magnitude of the dewatering activities, dewatering is known to have continued through early 2005 (the last pump was removed in January/February 2005). Water extracted from the pits was added to the plant's inflow for treatment and ultimately discharged to the creek.

Wells most affected by the dewatering were MW #2 and MW #3, as most construction related excavation occurred in close proximity to these wells (in the area of the former East Pond and east of it). The upgradient well, MW #1, was less affected by pit dewatering most likely due to its relative remoteness, and its closer proximity to the creek and local recharge from creek bed infiltration.

High summer water levels have been observed in MW #4 and MW #5 (since the monitoring frequency has been increased from a semi-annual to a quarterly schedule) indicating that deep percolation of irrigation water is also a source of groundwater recharge. High summer water levels were also observed in the network of 48 temporary monitoring wells in 1988.

WATER QUALITY

Electrical Conductivity

Samples retrieved from MW #1 had electrical conductivity (EC) values ranging from 760 to 940 µS/cm in 1994; EC increased to about 1,300 µS/cm in 1995, and continued to fluctuate between 1,000 and 1,200 µS/cm through 1999 (**Figure 8**). From mid-1999 to mid-2001, the EC decreased at this location to about 700 µS/cm; it then briefly increased in the latter half of 2001 and has since been stable around 700 µS/cm.

The EC values observed in MW #2 have decreased from the beginning of the water quality record for this well. Particularly, EC values declined from 2,040 µS/cm in January 1994 to less than 1,000 µS/cm since the beginning of 2003. This represents an average decline of 100 µS/cm per year between January 1994 and January 2005. Most notably, the EC dropped by 350 µS/cm in 2001, the year when excavation dewatering commenced.

The EC of samples retrieved from MW #3 increased steadily from about 2,000 µS/cm in 1994 to about 2,500 µS/cm in mid-1999, and then decreased to 1,970 µS/cm by March 2001. A significant decline (350 µS/cm) occurred between November 2000 and March 2001; this decline coincided with the commencement of excavation dewatering. Since 2001, the EC continued to decline another 400 µS/cm to less than 1,600 µS/cm in 2005.

The EC results for samples retrieved from MW #4 show little variability over the historical record; EC values ranged from 840 to 1,050 µS/cm. A slight increase of about 100 µS/cm occurred during 2001. Similar to MW #4, the EC in MW #5 has been stable throughout the monitoring period with values in 2005 similar to those in 1994 (between 1,500 and 1,600 µS/cm). EC values observed in MW #5 have been consistently about 500 µS/cm higher than in MW #4, although it is farther removed from the EWWTP than MW #4.

In April and May 1988, groundwater quality samples were retrieved from ten temporary shallow monitoring wells in the vicinity of the EWWTP (**Figure 9**). At the same time, surface water samples were retrieved from Old Alamo Creek upstream from the plant at CR1, just downstream of the effluent outfall at CR2, and from the SID canal at the sampling location identified as "S/D" on **Figure 9**. The EC values of upstream and downstream creek water samples were 334 and 773 µS/cm, respectively. The SID canal had an EC of 287 µS/cm. Groundwater from wells north of the creek had EC's ranging from 820 µS/cm at C-3 (closest to the creek) to 3,640 µS/cm at B-1 (furthest removed from the EWWTP). Wells located immediately downgradient from the plant had EC values ranging from 993 µS/cm at G-5 to 1,600 µS/cm at H-3, and as high as 5,120 µS/cm at F-4. Further downgradient at I-1, the EC was 1,210 µS/cm, and cross-gradient well H-8 had an EC of 1,150 µS/cm.

pH

The three on-site monitoring wells (MW #1, #2, and #3) have similar pH values. MW #1 exhibits slightly higher concentrations than MW #2, and MW #3 exhibits slightly lower concentrations than MW #2 (**Figure 10**). Minor apparent fluctuations are closely correlated between these wells. The median pH concentrations for samples from these wells during 1994 to 2005 are 7.12, 7.01, and 6.96, respectively. Notably, the pH concentrations decrease with increasing distance from the creek. The data record for MW #1 shows somewhat higher variability than the other on-site wells, particularly in 1995.

The pH values for MW #4 and MW #5 are slightly higher than in the on-site wells, with median values of 7.43 and 7.36, respectively; the variability is also somewhat greater. Over the period of record, the pH has been generally stable.

Nitrate-N

Nitrate-N concentrations in samples from MW #1 spiked from nondetect (<0.1 mg/L) in early 1994 to 30.1 mg/L in early 1995, then subsequently dropped to about 10 mg/L by the end of 1995, and continued to gradually decline to near zero concentrations in 2001 (**Figure 11**). Since then, nitrate-N concentrations have remained below 0.5 mg/L and have been generally non-detectable at a detection limit of 0.1 mg/L.

In contrast to the wide variability observed at MW #1, nitrate-N concentrations in MW #2 have always been very low and did not exceed 0.7 mg/L until early 2001 when dewatering commenced. In mid-2001, nitrate-N concentrations were up to 2.3 mg/L and then slowly declined to 0.7 mg/L in 2005.

Nitrate-N concentrations in samples retrieved from MW #3 slowly declined from about 5 mg/L in 1994 to 0.2 mg/L in early 1999. Nitrate concentrations increased again in late 1999 and continued this trend at an accelerated rate from early 2001 (shortly after excavation dewatering commenced) until April 2004. A slight decrease in nitrate has been noted since then.

The historical record shows stable nitrate-N concentrations at MW #4, ranging from 1.0 to 5.3 mg/L. MW #5, though, has experienced a steady increase in nitrate-N concentrations from less than 6 mg/L in 1994 to about 12 mg/L in 2005. There are two notable concentration fluctuations that occurred in wells MW #4 and MW #5 (in 1995 and in 2004). In 1995, nitrate-N concentrations spiked to 5.3 mg/L and 15 mg/L in MW #4 and MW #5, respectively. These spikes coincided with the aforementioned nitrate-N spike in MW #1.

The water quality results for the April/May 1988 sampling event showed nitrate-N concentrations for upstream and downstream creek water samples of <1 and 8.1 mg/L, respectively. Similar to the upstream creek location, nitrate-N was not detected in the SID canal. Groundwater from wells north of the creek had nitrate-N concentrations ranging from <1 mg/L (A-4) to 5.6 mg/L (B-1). Wells located immediately downgradient from the plant had concentrations ranging from <1 mg/L (G-4, G-5, and H-3) to 15 mg/L at E-4. Further downgradient at I-1, the concentration was 2.1 mg/L, and cross-gradient well H-8 had a concentration of 1.4 mg/L.

Other Water Quality Data

The proportional abundance of major cation and anion concentrations, as exhibited in the samples from the 1988 sampling event, was plotted on trilinear diagrams (**Figures 12** and **13**). The close clustering of data points on these diagrams reflect the similar water type in most wells, including creek water quality near the effluent outfall (CR2), with sodium (40 to 60%) being the major cation at most locations (**Figure 12**). Creek water from the upstream location CR1 and the irrigation canal were distinctly different with higher proportional representation of magnesium. Downgradient wells H-3 and I-1 had distinctly greater sodium concentrations. The anion clustering was not quite as dense; however, CR1 and the canal exhibit a relatively

higher abundance of bicarbonate (**Figure 13**). Well B-1 stands out due to its high sulfate concentration.

The creek water at CR1, the canal water, and groundwater at C-3 were classified as magnesium-bicarbonate type. Groundwater from most of the temporary shallow wells was classified as sodium-bicarbonate type. Exceptions were B-1 and H-3, both of which had proportionately higher sulfate concentrations.

DISCUSSION AND CONCLUSIONS

Ongoing groundwater quality monitoring occurred in the vicinity of the EWWTP for the period from 1994 to the present. Data also exist from an isolated sampling event in Spring 1988. Since the EWWTP has been in operation since its construction in 1959, a comparison of pre-project conditions to project conditions is not possible.

Groundwater level data from MW #1 through MW #5 show that shallow groundwater predominantly flows in easterly to southeasterly directions south of Old Alamo Creek. Groundwater level data from 48 temporary shallow wells (October 1987 to July 1989) identified the creek as a major source of groundwater recharge. This is also supported by the distribution of major cations and anions in both wastewater effluent and groundwater. Creek water just downstream of the effluent outfall was characterized as sodium-bicarbonate type, and groundwater of a similar type was observed in all temporary shallow wells downgradient of the plant. In contrast, SID water, creek water upstream of the plant, and groundwater in C-3 north of the creek were classified as magnesium-bicarbonate type.

There are only small differences in pH concentrations among the three on-site monitoring wells; however, these differences appear significant. The correlation between the subtle fluctuations in pH values observed at wells MW #1, MW #2, and MW #3 indicates a common source.

High summer water levels observed in MW #4 and MW #5, and the Summer 1988 data from the temporary monitoring wells, indicate that deep percolation of irrigation water is also a source of groundwater recharge. This is supported by pH values that are somewhat elevated compared to those observed in on-site wells MW #1 through MW #3. The SID water has a significantly higher pH (8.1 in 1988) than the effluent (averaging 7.2 in 730 daily samples retrieved in 1994 to 1995), and the fields adjacent to the plant are irrigated with SID water.

Deep percolation of irrigation water also appears to have mobilized nitrate residue, however, the historical water quality data record is insufficient to definitively determine to what degree the slightly elevated nitrate-N concentrations observed in MW #5 (about 12 mg/L) is attributable to historical and ongoing agricultural land uses or the limited period of application of biosolids on Fields #1 through #3. However, even though wells MW #4 and MW #5 are located on the eastern boundary of Field #3, MW #5 has exhibited greater increase in nitrate-N concentrations (an increase of about 7 mg/L) over its period of record than exhibited at MW #4 (an increase of about 1.5 to 2 mg/L). As noted above, EC values at MW #5 (which is further downgradient of the EWWTP than MW #4) have been consistently about 500 μS/cm

greater than at MW #4. These factors suggest that the contributing source of the nitrate-N increase is more likely due to historical agricultural land use than the limited period of biosolids applications.

Above, a correlation is noted between a spike in nitrate concentrations in 1995 at wells MW #1, MW #4, and MW #5. These spikes are possibly explained by high groundwater levels that occurred in early 1995 causing increased mobilization of nitrate in the soil profile. Groundwater intersected the bottom of the West Pond in early 1995, and a local groundwater mound and reversal of the groundwater gradient toward MW #1 may have occurred.

Infiltration from the West and East Ponds is not directly evident on groundwater contour maps but seems likely based on the shallow depths to groundwater.

Evidence for groundwater recharge via infiltration from the early sludge lagoons is not apparent from groundwater contour maps, and the water quality records from MW #2 and MW #3 suggest that the impacts of the sludge lagoons prior to the recent plant modifications were minimal due to mitigation measures such as the tile liners and the various drain systems. More recently, during expansion construction activities, it appears that excavation work near MW #3 resulted in the mobilization of nitrate, as nitrate concentrations exhibited a notable increase between early 2001 and mid-2004 coincident with construction activities implemented at the plant. The elevated nitrate concentrations observed in well MW #3 are expected to continue to decline since potential sources for nitrate loading have been removed and the newly installed lagoons are fully lined; however, it is recommended that groundwater quality sampling be continued.

The steady decline in EC in the three on-site monitoring wells (MW #1 through MW #3) and essentially stable conditions observed in the downgradient off-site wells MW #4 and MW #5 over the entire monitoring history are indicative of successful operational changes at the EWWTP such as the decommissioning of the East Pond in 1990 and West Pond in 2003; and cessation of biosolids applications in 1993. Also, the excavation of potentially impacted soils during expansion construction activities and the replacement of old sludge lagoons with new facilities have further mitigated potential sources of groundwater contamination. Since 2001, the EC values in all wells but MW #3 have been significantly lower than in MW #5; and, after five years of steady decline, the EC at MW #3 reached a historical low in 2005 (with the exception of an isolated measurement in 1995) and is now similar to the EC observed in MW #5 for more than 11 years.

SUMMARY OF KEY FINDINGS

- Creek bed infiltration along the effluent-dominated Old Alamo Creek provides a major source for groundwater recharge in the vicinity of the EWWTP. This recharge contributes to shallow groundwater levels and affects the local shallow groundwater quality.

- Irrigation water infiltration along the unlined portion of the SID canal paralleling Old Alamo Creek contributes to groundwater recharge during the irrigation season.
- Deep percolation of irrigation water south of the plant contributes to groundwater recharge during the irrigation season and has the potential to mobilize soil nitrate and other constituents.
- Infiltration from the West and East Ponds is not directly evident on groundwater contour maps but seems likely based on the shallow depths to groundwater. Such infiltration would affect the quality of underlying groundwater similarly to recharge from the creek.
- Evidence for groundwater recharge via infiltration from the early sludge lagoons is not apparent from groundwater contour maps, and the water quality record suggests that the impacts of the sludge lagoons prior to the recent plant modifications were minimal.
- The EC at MW #4 and MW #5 has been generally stable throughout the more than 11-year period of monitoring (1994-2005). Notably, EC values have been about 500 µS/cm greater at MW #5 than at MW #4. Additionally, MW #5 is located further downgradient from the plant site than MW #4. The higher EC values suggest historical agricultural practices are a contributory factor to the water quality observed at MW #5.
- The historical water quality data record is not sufficient to definitively delineate to what degree the slightly elevated nitrate-N concentration observed in MW #5 (about 12 mg/L) is attributable to historical and ongoing agricultural land uses or the application of biosolids. However, the higher EC at this location, and difference in the nitrate-N trend occurring over the historical record, suggest that agricultural land use is the greater contributing factor.
- The EC in the on-site monitoring wells has significantly decreased for the past six or more years, and is presently still declining (MW #2 and #3) or stable (MW #1). Particularly, EC values in MW #1 and MW #2 have declined to concentrations similar to those displayed in off-site well MW #4. Further, the EC values in well MW #3 have recently declined to levels consistent with those observed for more than eleven years in off-site well MW #5. Nitrate concentrations are very low and stable at locations MW #1 and MW #2. These trends are indicative of the operational changes at the EWWTP such as the decommissioning of the East Pond in 1990 and West Pond in 2003; and cessation of biosolids applications in 1993. Also, the excavation of potentially impacted soils during expansion construction activities and the replacement of old sludge lagoons with new facilities have further mitigated potential sources of groundwater contamination.
- It appears that excavation work near MW #3 resulted in the temporary mobilization of soil nitrate, as reflected by increasing nitrate concentrations in MW #3 between 2001 and 2004. During the last three quarters, nitrate concentrations have steadily decreased again, and it is anticipated that this trend will continue in the long-term.

Please call if you have any questions.

Sincerely,

LUHDORFF AND SCALMANINI
CONSULTING ENGINEERS

Vicki Kretsinger
Principal Hydrologist

Till Angermann, P.G.
Staff Hydrogeologist

PROFESSIONAL GEOLOGIST
TILL ERIC ANGERMANN
No. 7789
8/23/2005
STATE OF CALIFORNIA

TEA/vk

Cc: Mr. Dave Tompkins, City of Vacaville

Enclosures:

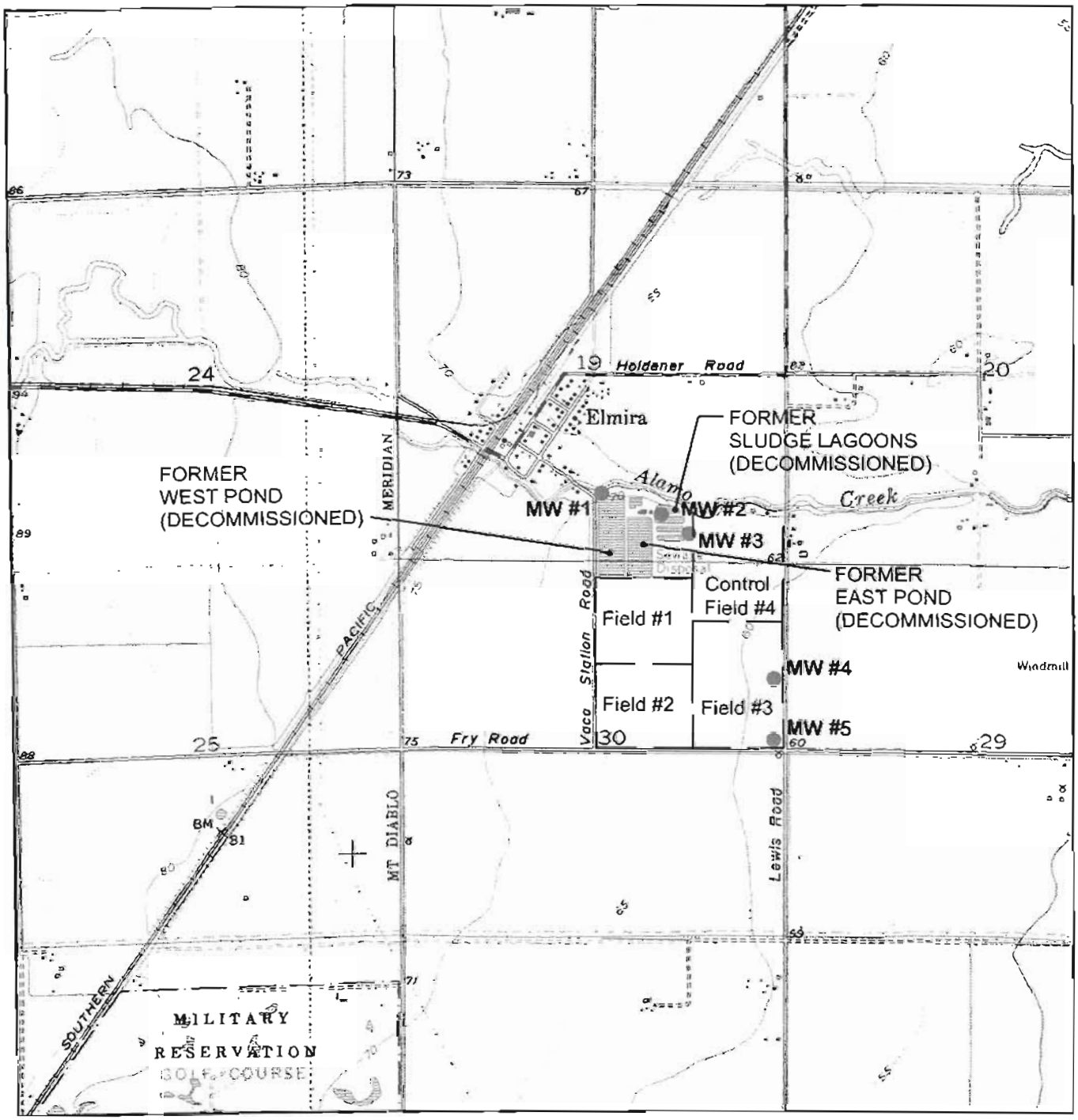
Table 1	Well Construction Details
Figure 1	Site Location Map, Easterly Wastewater Treatment Plant, Vacaville, CA
Figure 2	Site Plan, EWWTP – Vacaville, CA
Figure 3	Interim Biosolids Drying and Storage Facilities, EWWTP – Vacaville, CA
Figure 4	Groundwater Hydrographs for Shallow Monitoring Wells, EWWTP – Vacaville, CA
Figure 5	Contours of Equal Groundwater Elevation, January 19, 2005, EWWTP – Vacaville, CA
Figure 6	Contours of Equal Groundwater Elevation, April 11, 2002, EWWTP – Vacaville, CA
Figure 7	Temporary Monitoring Facilities (1987/88), EWWTP – Vacaville, CA
Figure 8	Electrical Conductivities in Shallow Monitoring Wells, EWWTP – Vacaville, CA
Figure 9	Spring 1988 Monitoring Results, EWWTP – Vacaville, CA
Figure 10	pH in Shallow Monitoring Wells, EWWTP – Vacaville, CA
Figure 11	Nitrate Concentrations in Shallow Monitoring Wells, EWWTP – Vacaville, CA
Figure 12	Trilinear Plot of Relative Cation Concentrations, EWWTP – Vacaville, CA
Figure 13	Trilinear Plot of Relative Anion Concentrations, EWWTP – Vacaville, CA
Attachment	Historical Groundwater Level and Quality Data (1987-1988)

Table 1
Well Construction Details
Easterly Wastewater Treatment Plant, City of Vacaville

Well Name	Date Drilled	Depth of Borehole (feet)	Cement Seal (feet)	Bentonite Seal (feet)	Gravel Pack (feet)	Perforated Interval (feet)	Casing Material	Top of Casing[1] (feet, msl)	Top of Casing[1] (feet, msl)	Top of Housing[1] (feet, msl)	Ground Surface Elevation[1] (feet, msl)
MW1	10/18/1990	35	0 - 17	17 - 22	22 - 33	23 - 33	PVC	72.19	*73.86*	*74.11*	*72.0*
MW2	10/18/1990	35	0 - 20	20 - 25	25 - 35	25 - 35	PVC	74.63	74.63	*75.06*	*73.5*
MW3	10/19/1990	30	0 - 14	14 - 19	19 - 30	20 - 30	PVC	72.98	*73.55*	*73.63*	*72.1*
MW4	1993/94	35[2]					Sch. 40 PVC 2"[3]	61.38	61.38	61.58	59.2
MW5	1993/94	35[2]					Sch. 40 PVC 2"[3]	61.88	61.88	61.95	58.6

Notes:

1. Phillippi Engineering, Inc. (letters dated 11/19/1990 and 7/12/1994); all surveyed elevations are based on NGVD 1929. Using the top of PVC casing of MW #2 as the reference elevation, the relative elevation differences between wells MW #1, #2, and #3 were resurveyed August 2, 2005 by Luhdorff and Scalmanini, Consulting Engineers (*italic* font style)
2. Well permit application dated 7/30/1993.
3. Layne-Western bid schedule (letter dated 7/29/1993).



REFERENCE: USGS 7.5 Minute Quadrangle, Elmira, California.

Scale in Feet

0' 1000' 2000'

● **MW #4** SHALLOW MONITORING WELL

CAD FILE: G:/Projects/City of Vacaville/05-4-051/Location Map.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 08-22-05 11:19am

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Figure 1
Site Location Map
Easterly Wastewater Treatment Plant
Vacaville, California

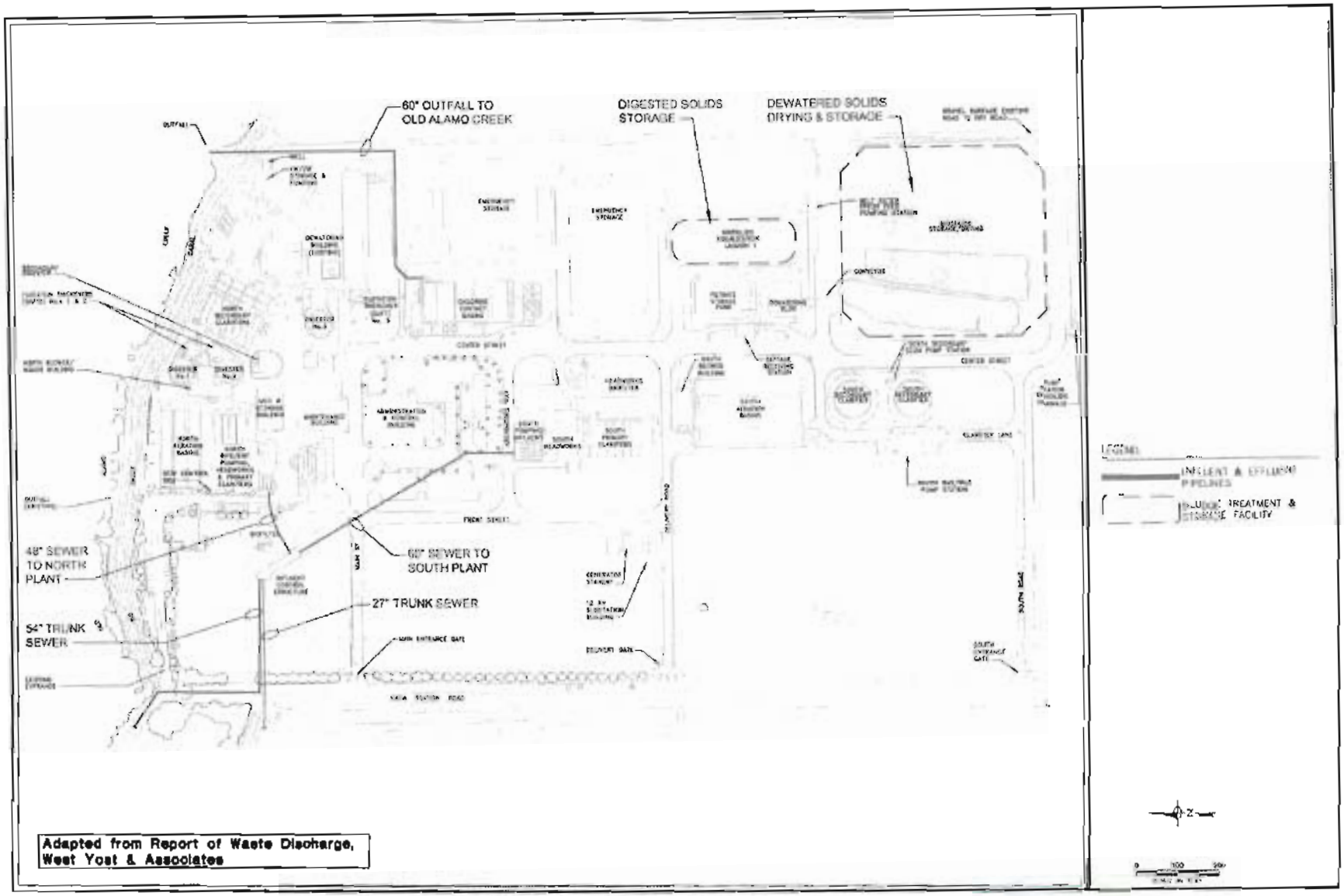

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Figure 2
Site Plan
EWWTP - Vacaville, California

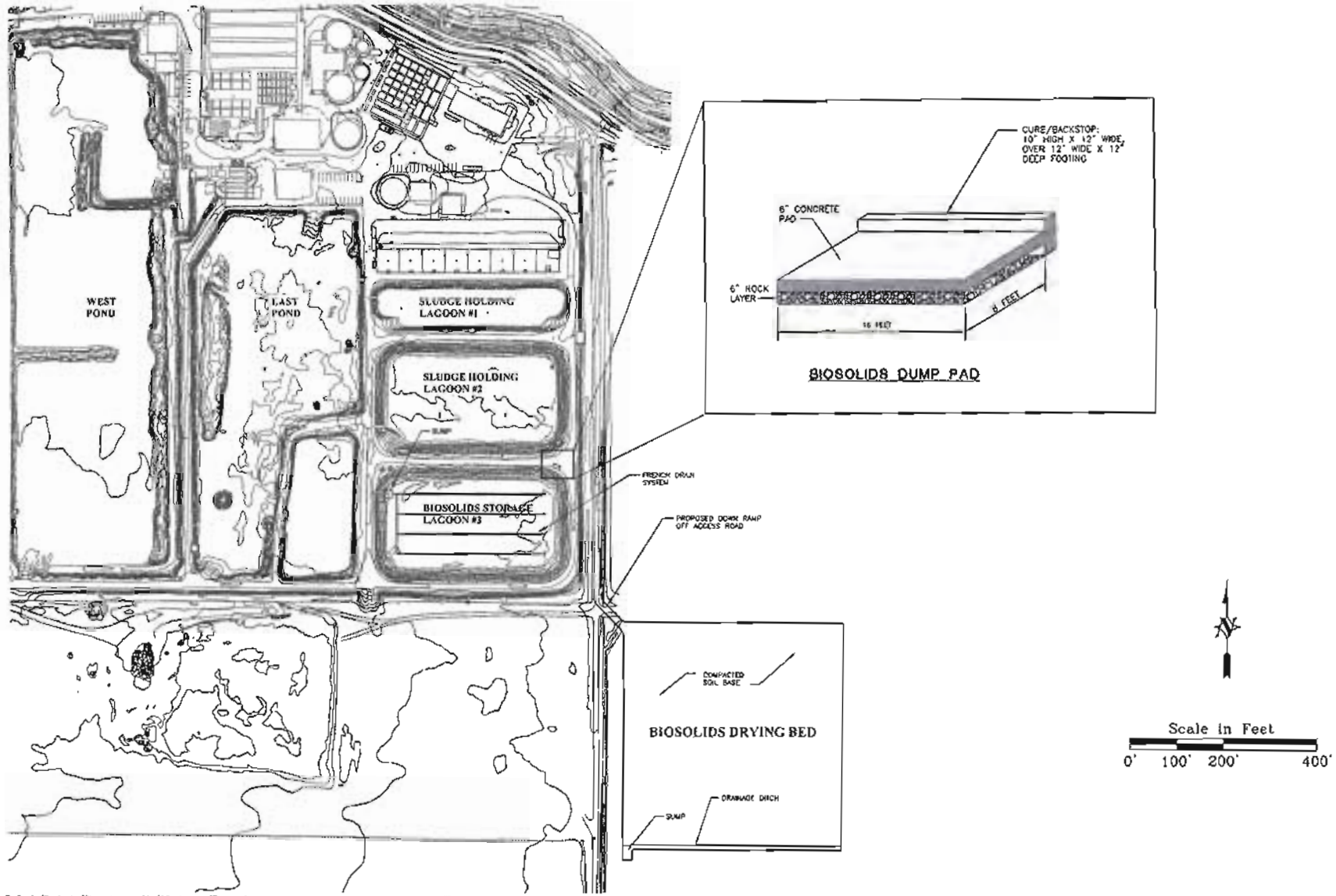

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Figure 3
Interim Biosolids Storage and Drying Facilities
EWWTP - Vacaville, California

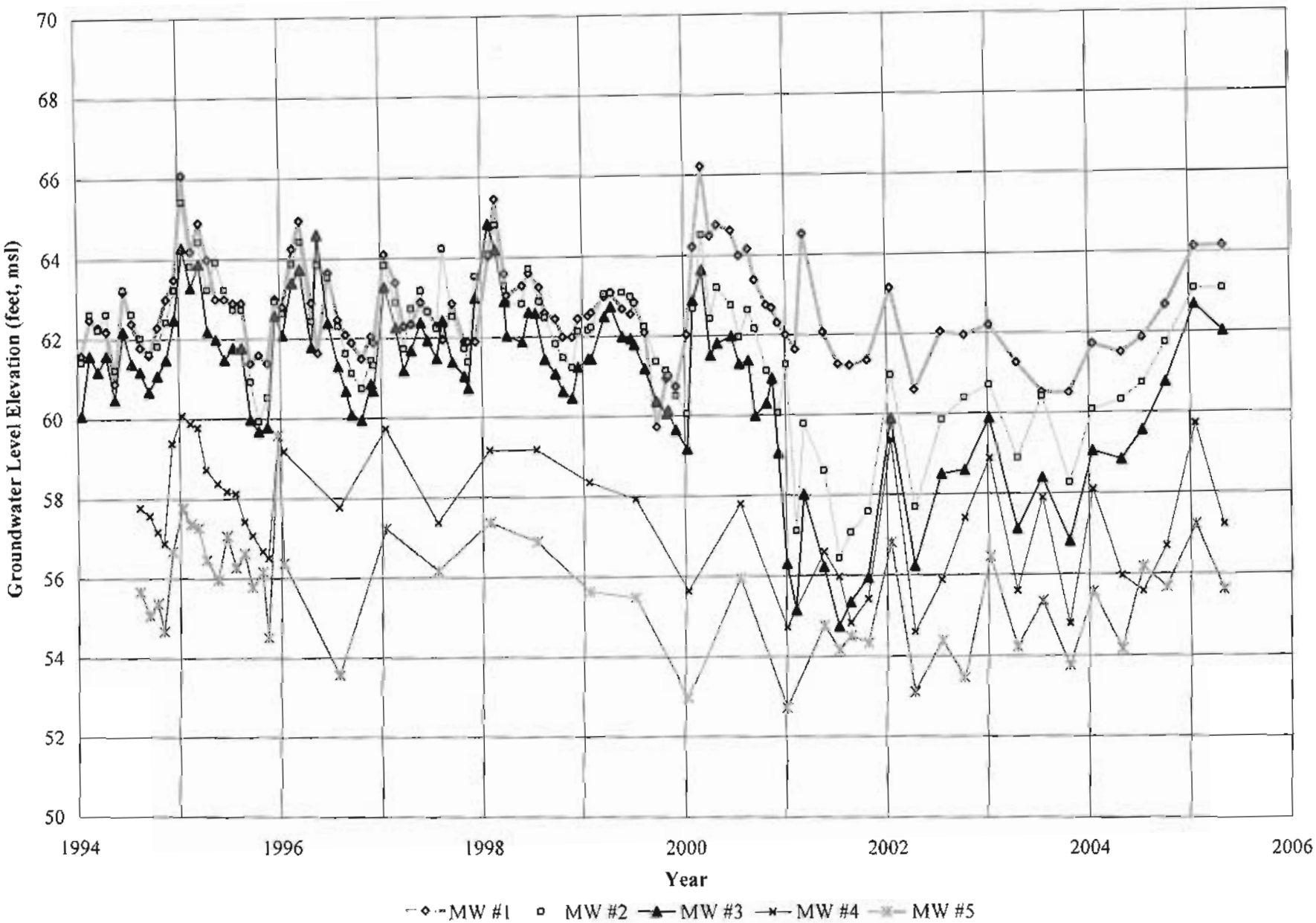

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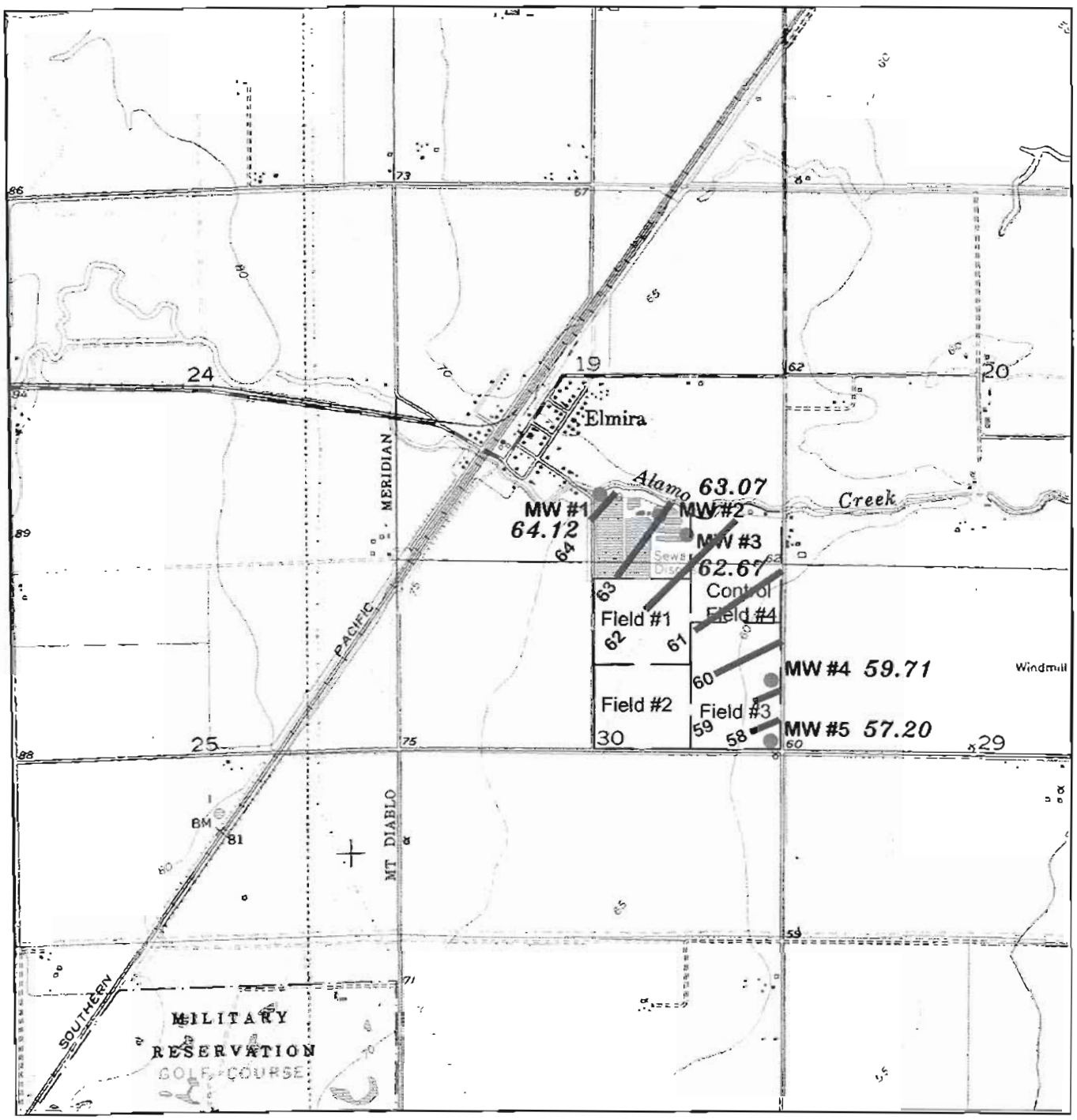
Figure 4
Groundwater Hydrographs for Shallow Monitoring Wells
EWWTP - Vacaville, California



REFERENCE: USGS 7.5 Minute Quadrangle, Elmira, California.

Scale in Feet

0' 1000' 2000'

MW #4 SHALLOW MONITORING WELL

59.71 WITH GROUNDWATER ELEVATION (feet, msl)

60 GROUNDWATER ELEVATION CONTOUR (feet, msl)

CAD FILE: G:/Projects/City of Vacaville/05-4-051/Figure 5.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 08-12-05 10:37am

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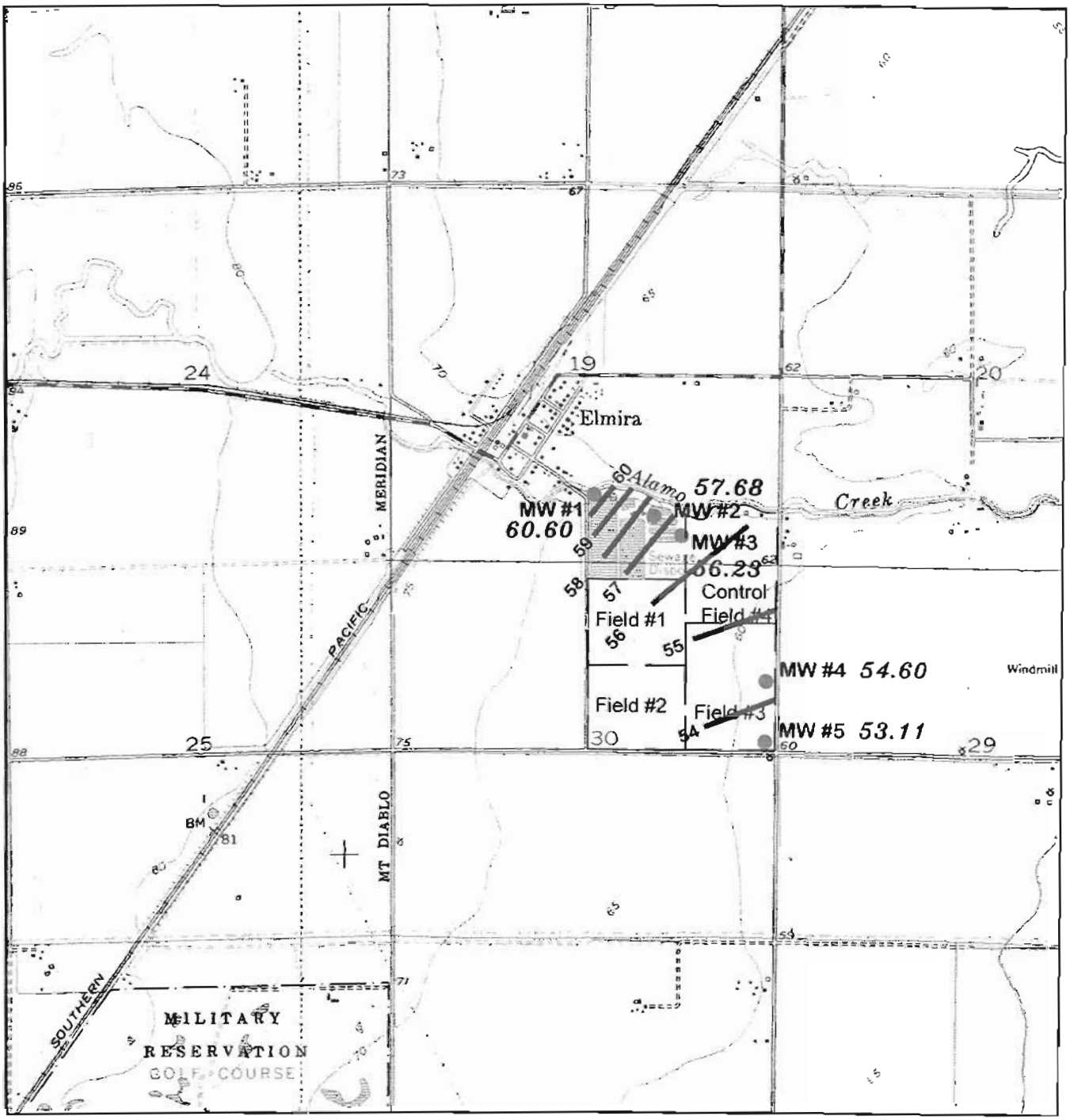
Figure 5
Contours of Equal Groundwater Elevation
January 19, 2005
EWWTP - Vacaville, California



REFERENCE: USGS 7.5 Minute Quadrangle, Elmira, California.

Scale in Feet

0' 1000' 2000'

● MW #4 SHALLOW MONITORING WELL
59.71 WITH GROUNDWATER ELEVATION (feet, msl)

60 ——— GROUNDWATER ELEVATION CONTOUR (feet, msl)

CAD FILE: G:/Projects/City of Vacaville/05-4-051/Figure 6.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 08-22-05 11:22am

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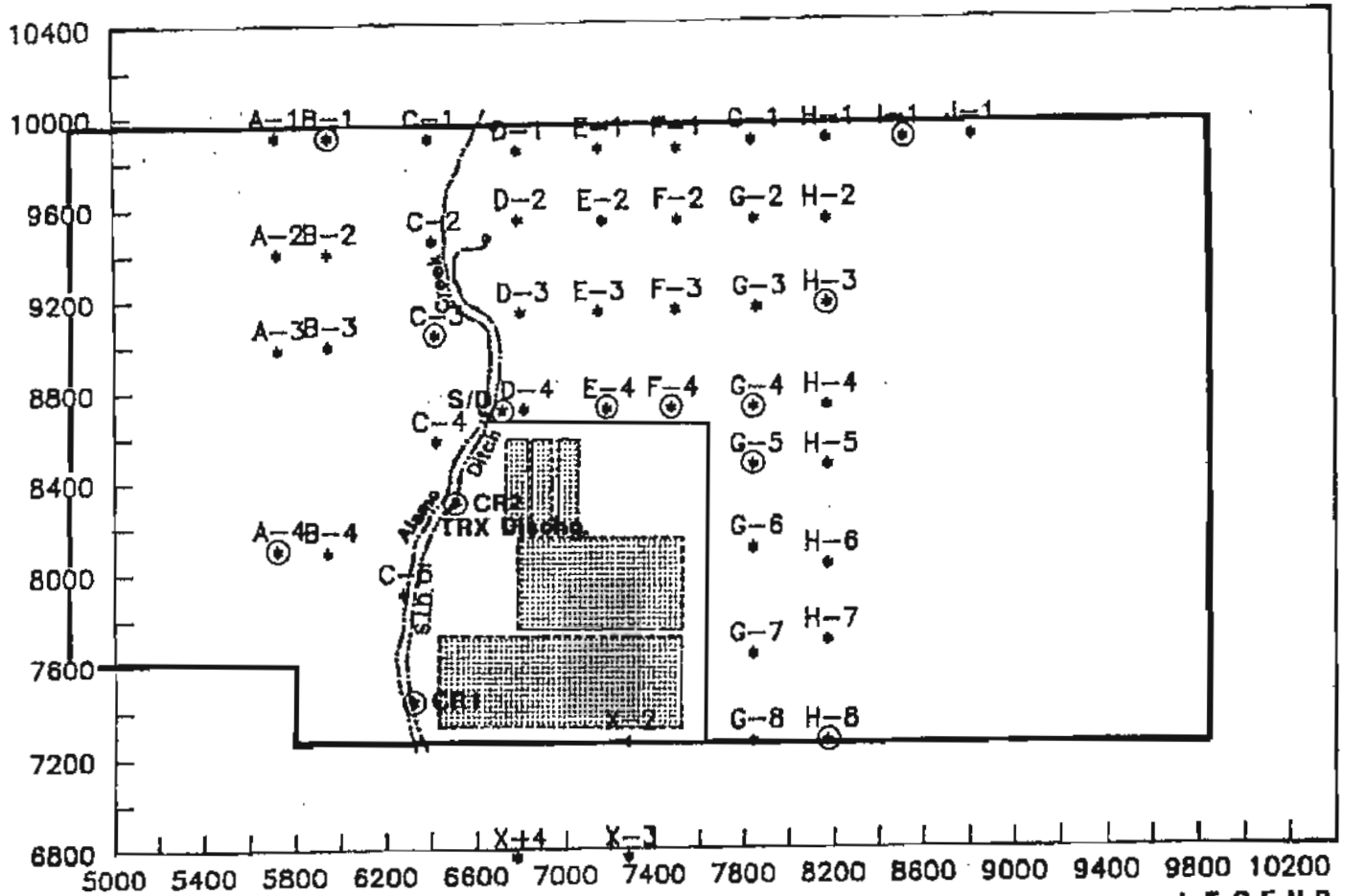
Figure 6
Contours of Equal Groundwater Elevation
April 11, 2002
EWWTP - Vacaville, California

R. LOZANO AND SONS – MONITORING SITES



Adapted from "Investigation of Shallow Ground Water, Elmira Project" (LSCE, 1988)

SCALE 1:771.4286

LEGEND

⊙ **Water Quality Sample Location**

CAD FILE: G:/Projects/City of Vacaville/05-4-051/Figure 7.dwg CFG FILE: LSCE2500.PCP_MRG · DATE: 08-22-05 1:40pm

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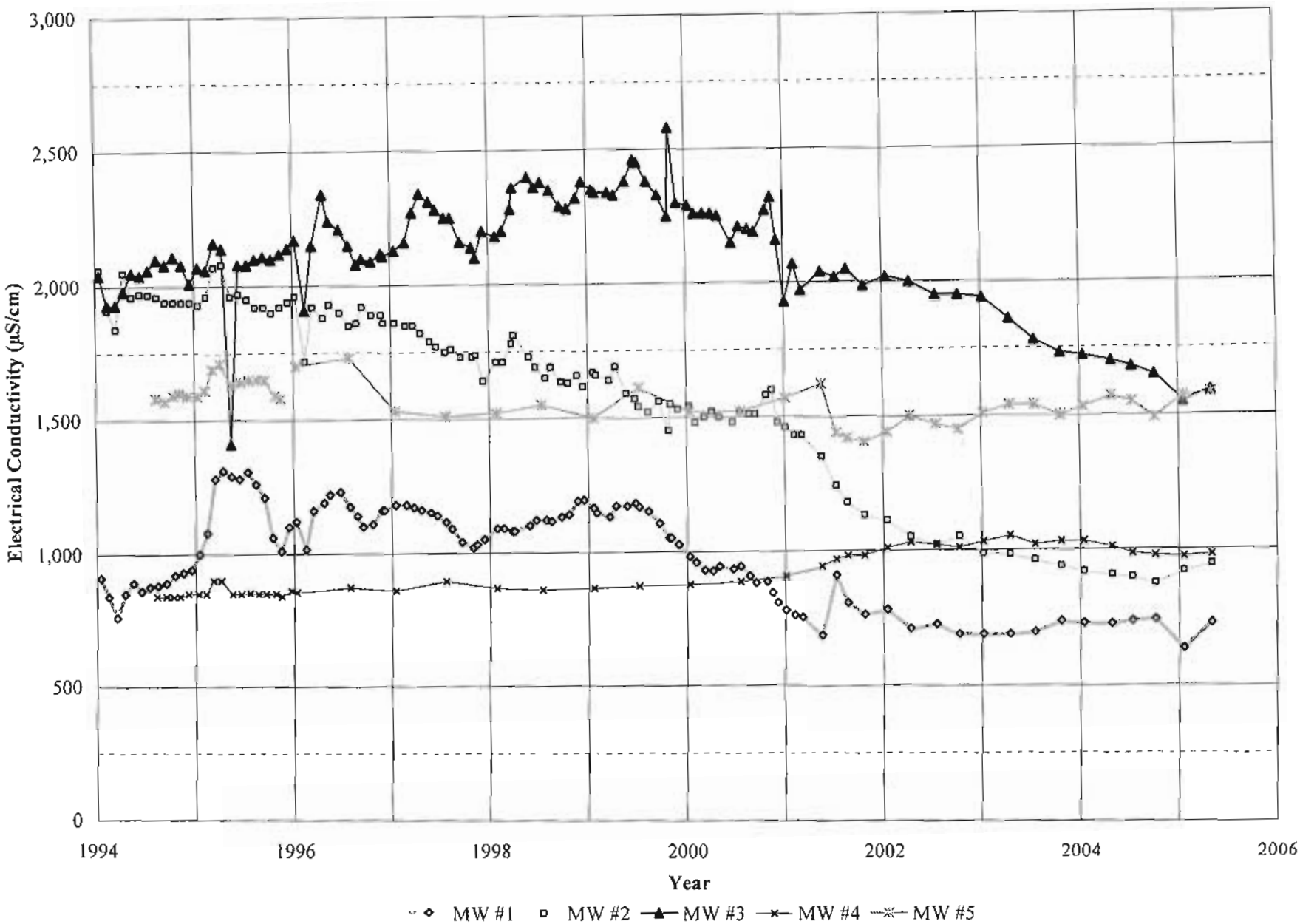
Figure 7
Temporary Monitoring Facilities (1987/88)
EWWTP - Vacaville, California



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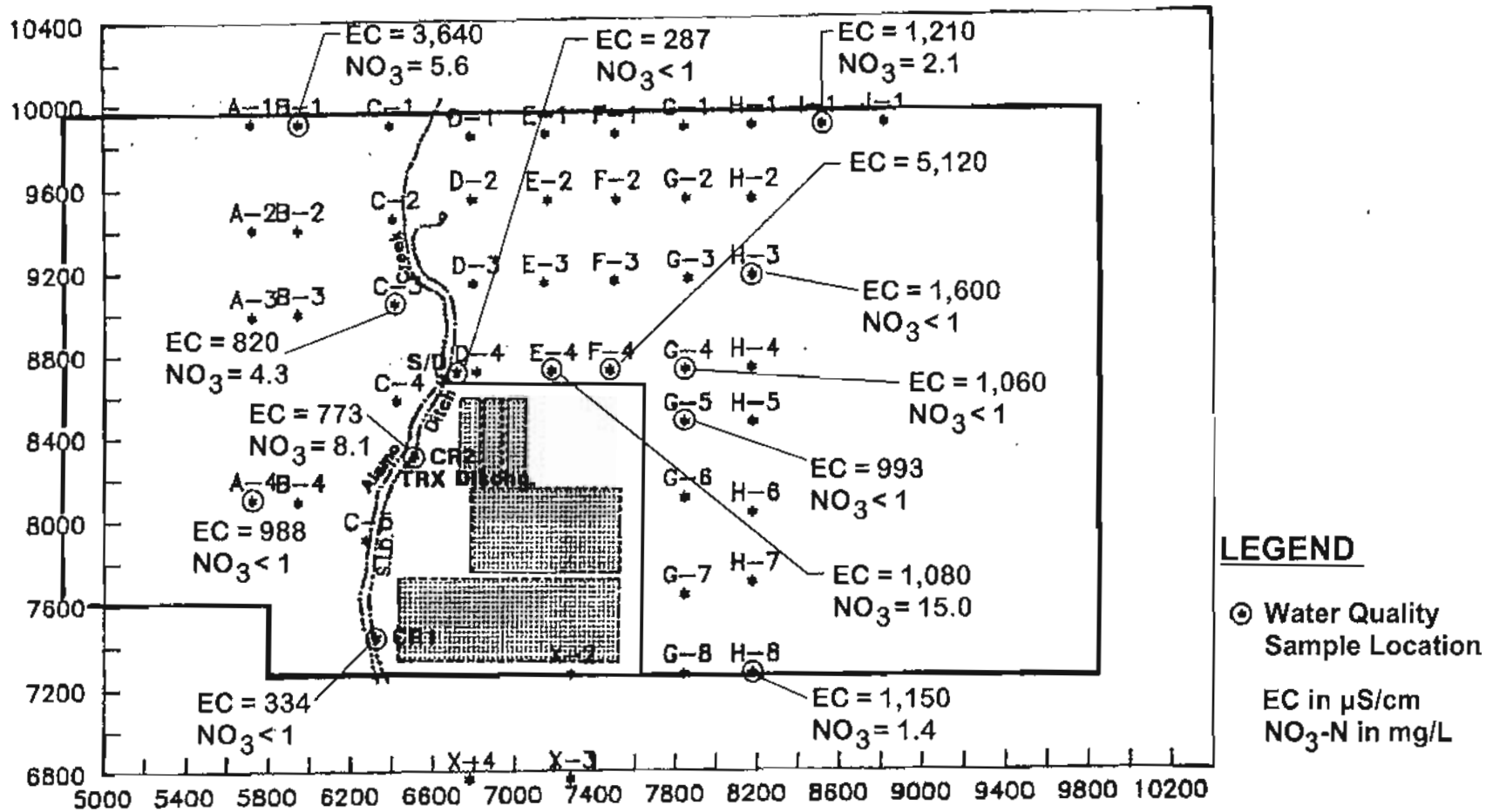
CONSULTING ENGINEERS

Figure 8
Electrical Conductivities in Shallow Monitoring Wells
EWWTP - Vacaville, California

R. LOZANO AND SONS – MONITORING SITES



Adapted from "Investigation of Shallow Ground Water, Elmira Project" (LSCE, 1988)

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LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 9
Spring 1988 Monitoring Results
EWWTP - Vacaville, California

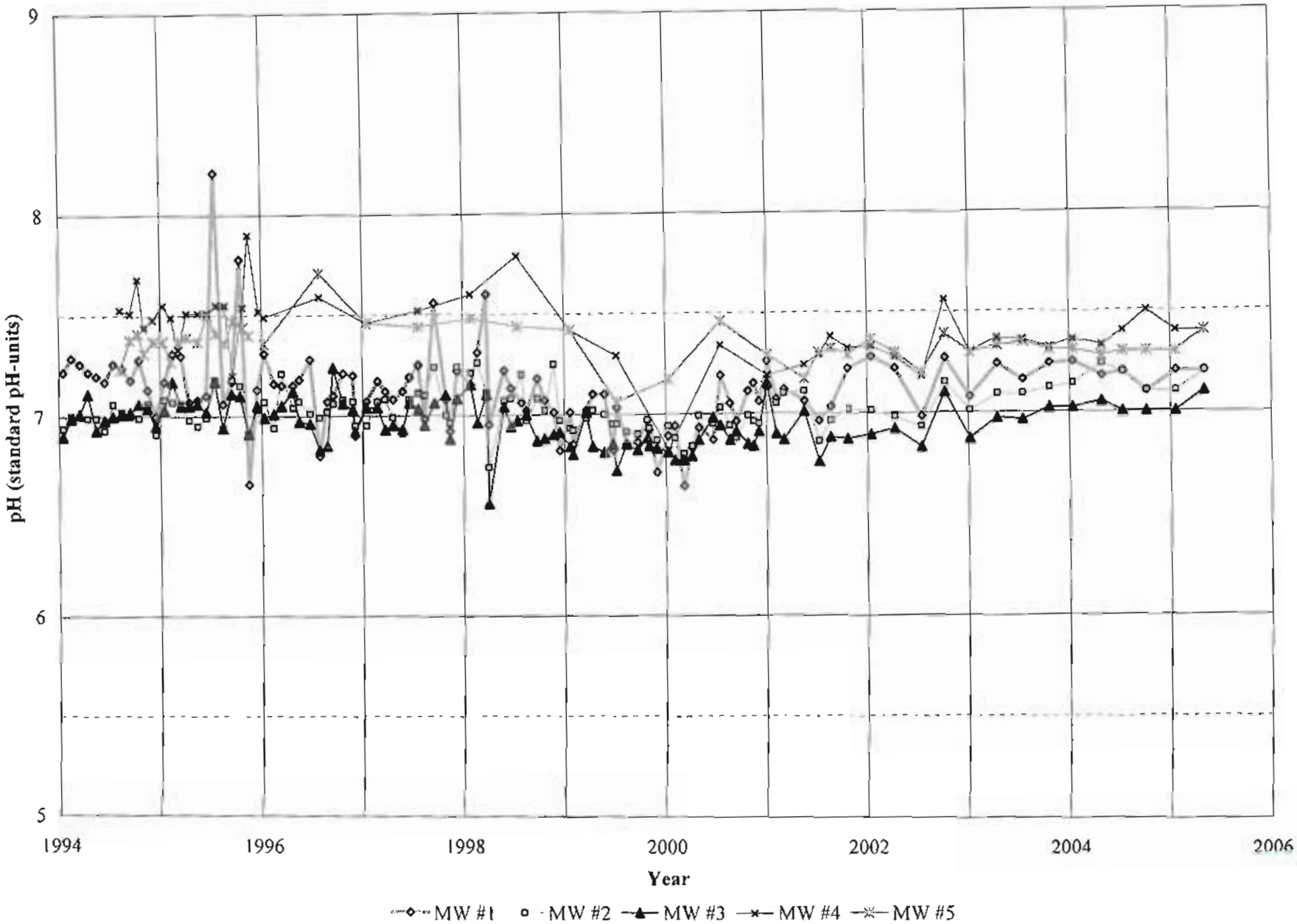

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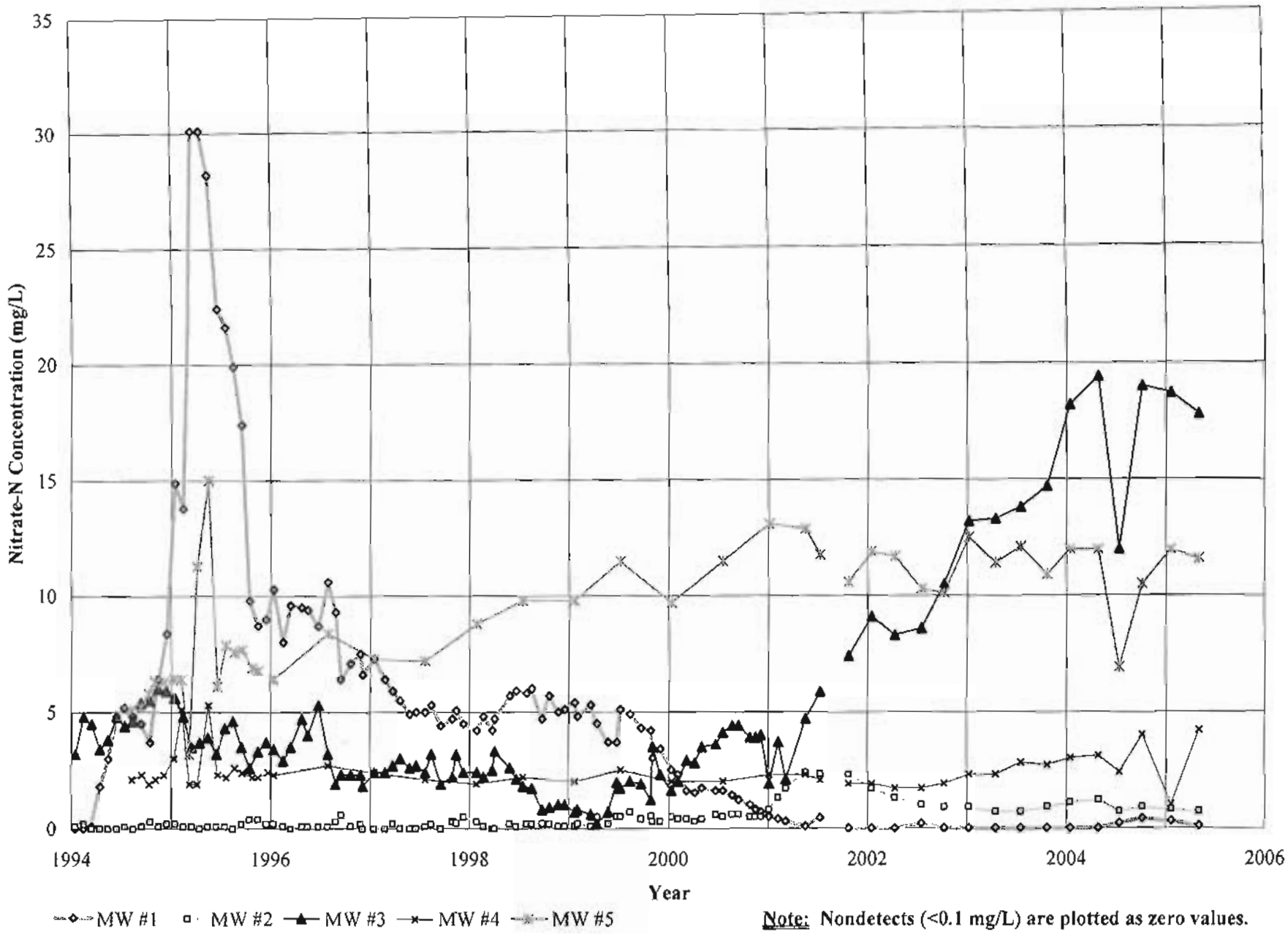
Figure 10
pH in Shallow Monitoring Wells
EWWTP - Vacaville, California



Note: Nondetects (<0.1 mg/L) are plotted as zero values.

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Figure 11
Nitrate Concentrations in Shallow Monitoring Wells
EWWTP - Vacaville, California

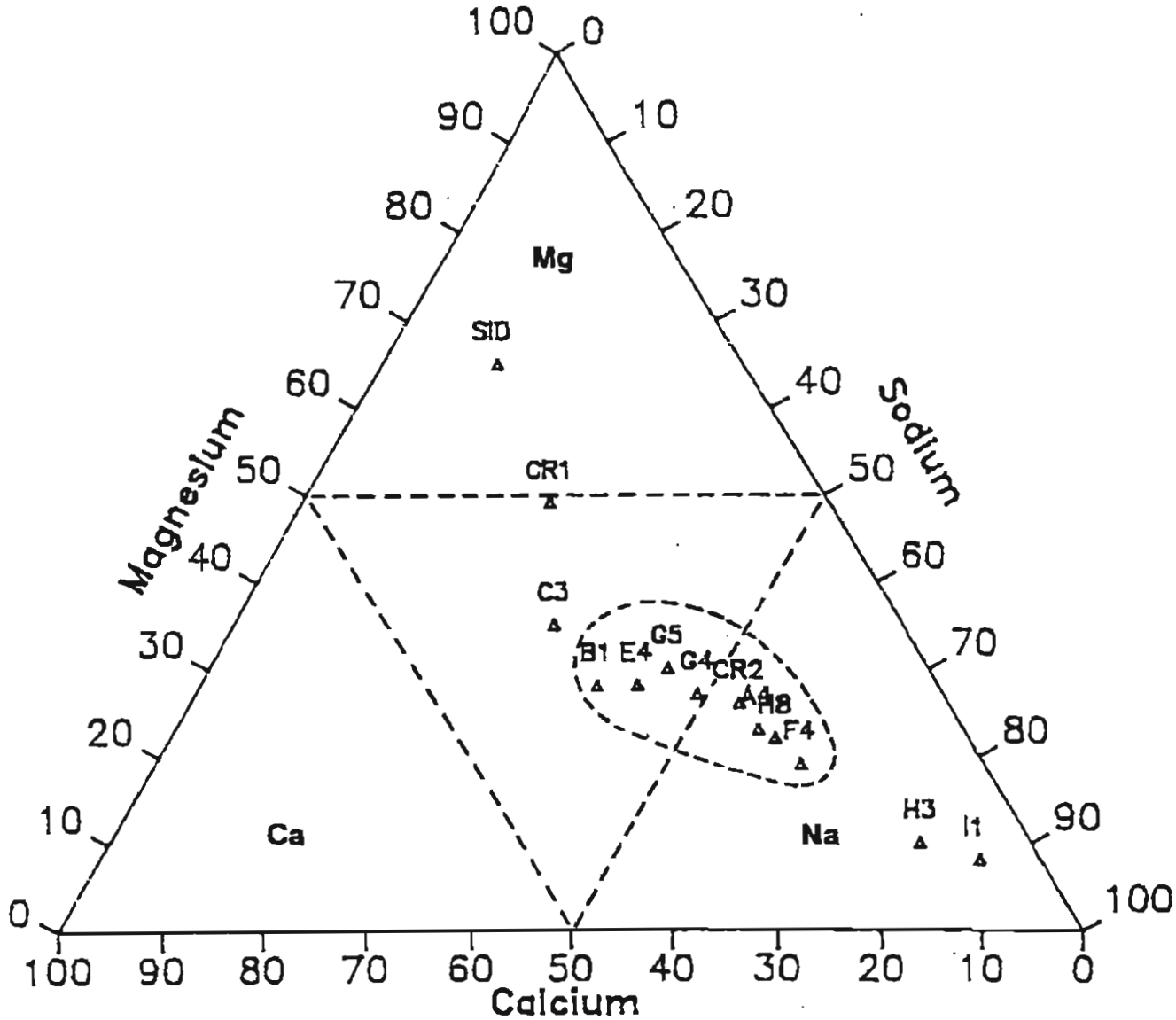

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Figure 12
Trilinear Plot of Relative Cation Concentrations
EWWTP - Vacaville, California

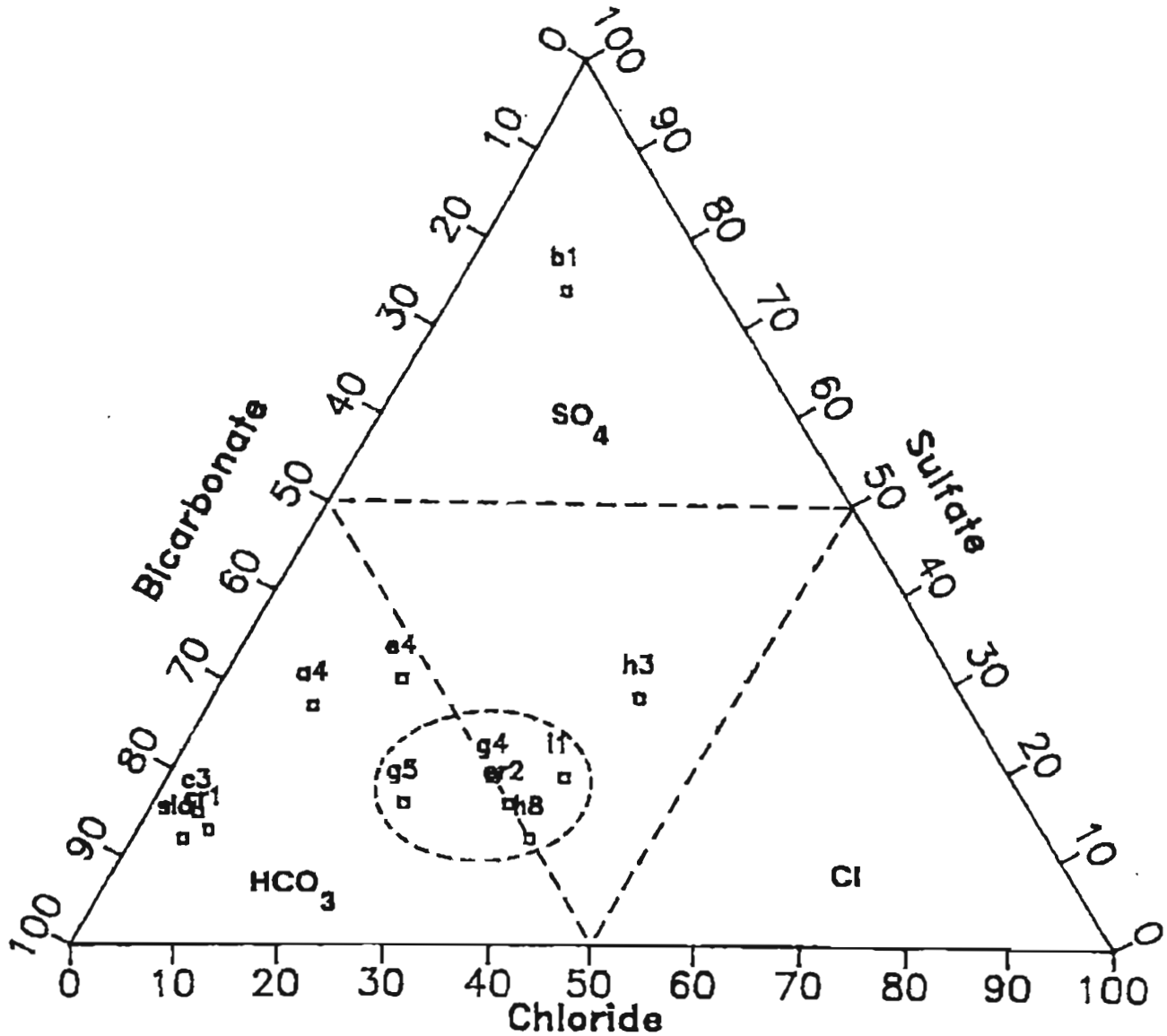

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Figure 13
Trilinear Plot of Relative Anion Concentrations
EWWTP - Vacaville, California

Attachment

MONITORING WELL AND SURFACE WATER ELEVATIONS

WELL	10/13/87 Elev	10/19/87 Elev	10/22/87 Elev	11/01/87 Elev	11/16/87 Elev	12/1/87 Elev	12/23/87 Elev	1/20/88 Elev	2/04/88 Elev
A-1	58.63	58.69	58.71	58.54	58.16	58.67	60.87	N/A	60.69
A-2	59.50	59.54	59.70	59.44	59.09	59.68	61.61	N/A	61.63
A-3	60.15	60.23	60.29	60.11	59.78	60.05	62.25	N/A	62.51
A-4	60.85	61.70	61.96	61.91	61.89	62.23	62.97	N/A	64.5
B-1	58.18	58.10	58.08	58.00	57.75	57.98	60.58	N/A	61.02
B-2	59.45	59.42	59.43	59.32	58.88	59.10	60.71	N/A	62.03
B-3	60.51	60.46	60.44	60.28	59.85	60.10	61.83	N/A	62.77
B-4	62.04	61.78	61.85	61.61	61.61	61.61	63.61	66.22	64.65
B-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C-1	58.85	58.84	58.81	58.81	58.45	59.31	60.42	62.08	60.65
C-2	59.92	59.97	59.96	59.76	59.51	59.91	61.29	63.29	61.63
C-3	60.81	60.77	60.73	60.46	60.19	60.31	61.88	64.23	62.52
C-4	61.78	61.65	61.39	N/A	N/A	N/A	62.45	64.89	63.31
C-5	62.86	N/A	62.86	N/A	N/A	N/A	64.56	67.03	65.32
D-1	59.74	59.18	59.18	N/A	N/A	N/A	60.48	62.2	60.92
D-2	60.57	59.95	59.78	59.39	N/A	59.33	60.97	62.89	61.53
D-3	61.07	60.60	60.40	60.40	60.40	60.40	61.47	63.48	62.16
D-4	61.96	61.62	61.37	60.85	60.63	60.80	63.80	64.88	63.44
E-1	59.03	58.90	58.84	58.73	58.33	58.51	60.41	N/A	60.9
E-2	59.68	59.49	59.50	59.25	59.00	59.05	60.98	N/A	61.47
E-3	58.43	59.06	59.29	59.70	59.65	60.53	62.80	N/A	62.59
E-4	61.07	60.89	60.79	60.52	60.29	60.71	63.36	63.98	63.26
F-1	58.21	58.15	58.10	57.96	57.72	58.02	60.15	N/A	60.59
F-2	58.57	58.45	58.44	58.40	58.37	58.57	61.28	N/A	61.62
F-3	59.70	59.70	59.73	59.70	59.65	59.99	62.16	N/A	61.99
F-4	60.60	60.50	60.50	60.16	59.83	60.38	59.90	63.41	63.16
G-1	57.49	57.45	57.40	57.33	57.02	57.54	59.47	N/A	59.34
G-2	58.53	58.44	58.43	58.34	57.98	58.76	60.12	N/A	60.11
G-3	59.43	59.29	59.29	59.14	58.76	59.61	61.21	N/A	61.06
G-4	60.40	60.31	60.31	60.06	59.69	60.20	62.52	63.03	62.6
G-5	60.82	60.71	60.70	60.49	60.16	60.14	62.15	64.07	63.46
G-6	61.49	61.40	61.46	61.19	60.81	60.79	62.73	65.53	65.11
G-7	62.17	62.31	62.32	62.20	61.74	61.71	65.20	66.54	66.1
G-8	N/A	N/A	N/A	N/A	61.58	62.38	64.01	67.57	67.22
H-1	57.14	57.07	57.07	57.04	56.78	57.72	59.32	N/A	59.27
H-2	58.06	58.01	58.03	57.92	57.61	58.26	59.92	N/A	59.93
H-3	58.92	58.85	58.83	58.74	58.36	58.61	60.92	N/A	60.84
H-4	59.34	59.25	59.29	59.09	58.74	58.87	61.57	62.03	61.64
H-5	60.42	60.34	60.34	60.16	59.76	59.77	62.45	N/A	63.05
H-6	61.30	61.31	61.20	61.09	60.64	60.93	64.64	N/A	65.07
H-7	61.87	61.90	61.91	61.75	61.25	61.26	63.07	N/A	65.17
H-8	N/A	N/A	N/A	N/A	61.73	61.95	64.21	66.9	66.39
I-1	56.95	56.90	56.90	56.82	56.59	56.76	58.85	N/A	59.05
J-1	56.53	56.49	56.51	56.40	56.02	56.18	58.52	N/A	58.9
X-1	N/A	N/A	N/A	65.46	N/A	N/A	N/A	N/A	N/A
X-2	64.00	63.84	63.82	63.56	62.97	63.20	68.34	68.65	68.53
X-3	N/A	N/A	N/A	N/A	N/A	63.40	69.22	70.349	69.91
X-4	N/A	N/A	N/A	N/A	63.26	63.45	65.25	N/A	68.86
BW11	60.37	60.49	60.59	60.16	60.19	60.24	60.24	N/A	60.26
BW8	61.42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61.31
BW5	63.47	N/A	N/A	N/A	N/A	N/A	N/A	N/A	63.4
BW12	63.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	63.71
SID-1	66.72	N/A	N/A	N/A	N/A	N/A	N/A	N/A	66.72
SID-2	66.71	65.22	65.17	N/A	N/A	N/A	N/A	N/A	66.71
SID-3	66.92	65.44	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SID-4	69.62	67.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SID-5	69.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WPEAST	68.98	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WPWEST	68.89	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

MONITORING WELL AND SURFACE WATER ELEVATIONS

WELL	3/05/88 Elev	3/26/88 Elev	4/8/88 Elev	4/13/88 Elev	5/9/88 Elev	5/17/88 Elev	7/05/88 Elev
A-1	59.03	58.34	58.34	59.54	59.38	59.18	58.56
A-2	60.07	59.39	59.59	60.46	60.45	60.34	59.71
A-3	60.93	60.67	61.41	62.01	61.75	N/A	N/A
A-4	62.94	61.8	64.04	63.16	62.99	62.79	62.13
B-1	59.59	58.67	58.35	58.7	59.66	59.51	59.43
B-2	60.65	59.84	59.43	59.77	60.82	60.73	60.37
B-3	61.28	60.46	60.77	61.07	61.62	61.43	61.2
B-4	62.92	62	62.77	62.7	62.88	62.57	62.46
B-5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C-1	59.37	N/A	N/A	N/A	N/A	N/A	N/A
C-2	60.46	59.92	60.28	60.5	61.13	60.96	60.48
C-3	61.2	60.6	60.98	61.22	61.92	61.66	61.5
C-4	61.98	N/A	N/A	61.66	62.21	61.93	61.94
C-5	63.65	62.8	62.8	62.93	63.18	N/A	N/A
D-1	59.49	59.51	59.9	60.23	60.97	60.92	N/A
D-2	60.04	N/A	N/A	N/A	N/A	N/A	N/A
D-3	60.66	60.45	60.9	61.15	61.63	61.41	60.9
D-4	61.57	61.67	61.94	62.02	62	61.81	61.68
E-1	59.2	58.78	59.01	59.17	60.18	60.13	59.63
E-2	60.17	60.15	60.13	60.14	60.48	60.42	60.23
E-3	60.91	59.81	59.65	59.67	60.14	60.19	59.98
E-4	61.41	60.96	60.93	61.06	61.37	61.23	61.48
F-1	58.79	58.15	58.22	58.31	59.46	59.53	N/A
F-2	59.83	59.06	59	59	59.23	59.29	59.9
F-3	60.09	N/A	N/A	N/A	N/A	N/A	N/A
F-4	61.44	60.22	60.11	60.01	60.08	60.21	60.96
G-1	58.05	57.54	57.38	57.57	58.26	58.41	58.03
G-2	59.08	58.34	58.14	58.21	59.1	59.09	58.91
G-3	59.9	59.31	59.31	59.31	59.46	59.48	N/A
G-4	60.82	63.04	59.97	59.99	60.21	60.15	60.52
G-5	61.28	N/A	60.33	60.4	60.51	60.38	61.06
G-6	61.99	N/A	61	61	61.03	60.91	61.69
G-7	63.4	N/A	61.89	61.93	61.85	61.73	62.62
G-8	64.14	N/A	62.85	62.08	62.51	62.4	63.37
H-1	58.02	57.14	56.95	57.08	58.06	58.2	57.85
H-2	58.61	57.92	57.62	57.76	58.43	58.45	58.54
H-3	60.06	61.12	58.36	58.55	58.83	58.84	59.13
H-4	59.75	62.29	58.83	58.93	59.07	59.01	59.5
H-5	60.86	N/A	59.91	59.92	59.98	59.91	60.64
H-6	62.41	N/A	61.31	60.81	60.69	60.54	61.56
H-7	62.44	N/A	61.38	61.46	61.32	61.23	62.23
H-8	63.41	N/A	62.26	62.3	62.11	62.02	63.09
I-1	57.45	56.75	56.4	56.57	57.3	57.61	57.42
J-1	57.04	56.42	56.02	56.23	56.75	57.81	56.82
X-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
X-2	64.79	64.77	64.77	N/A	64.77	N/A	N/A
X-3	66.85	66.85	66.85	N/A	66.85	N/A	N/A
X-4	66.62	65.96	65.96	N/A	65.96	N/A	N/A
BM11	60.35	60.36	60.19	60.41	60.34	60.65	60.34
BM8	61.51	61.4	61.4	61.5	61.33	61.5	61.35
BM5	63.02	62.37	62.77	62.89	62.53	62.9	62.32
BM12	63.5	N/A	64.65	65.05	64.11	65.1	63.55
SID-1	N/A	N/A	66.43	66.68	66.53	66.85	66.7
SID-2	N/A	N/A	66.47	66.73	66.54	66.86	66.67
SID-3	N/A	N/A	66.34	66.84	66.52	66.85	66.69
SID-4	N/A	N/A	69.39	68.85	68.17	68.44	68.42
SID-5	N/A	N/A	69.37	68.9	68.15	68.56	68.54
WPEAST	N/A	N/A	N/A	N/A	N/A	N/A	N/A
WPWEST	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 3

MONITORING WATER QUALITY RESULTS

LOZANO
PROJECT: 87-7-51

WELL IDENTIFICATION	DATE	EC umhos/cm	pH	Hardness as CaCO3	Ca	Mg	Na	SO4	Cl	HCO3 as CACO3	HCO3 as HCO3	NO3-N	NO3-NO3
LOZCR1	4/13/88	334	7.45	150	21.2	23.6	21.6	24.5	10.2	156	190	<1	<1
LOZCR2	4/13/88	773	7.10	181	31.6	24.7	95.6	66.8	104.0	186	227	8.1	35.9
LOZSID	4/13/88	287	8.10	155	16.8	27.5	9.0	20.8	5.7	144	176	<1	<1
LOZC3	4/9/88	820	7.62	446	63.9	39.9	69.3	69.6	16.2	362	442	4.3	19.0
LOZE4	4/9/88	1080	7.49	423	86.5	50.2	149.0	162.0	69.8	244	298	15.0	66.4
LOZG4	4/9/88	1060	7.35	619	50.9	35.0	122.0	101.0	122.0	280	342	<1	<1
LOZA4	5/9/88	988	6.87	235	44.3	30.1	143.0	134.0	38.2	320	390	<1	<1
LOZB1	5/9/88	3640	7.20	1380	297.0	155.0	397.0	1650.0	183.0	324	395	5.6	24.8
LOZF4	5/9/88	5120	7.30	992	190.0	126.0	771.0	IS	IS	286	349	IS	IS
LOZ65	5/9/88	993	6.85	300	54.7	39.7	109.0	79.6	86.6	312	381	<1	<1
LOZH3	5/9/88	1600	7.42	173	36.2	20.1	290.0	256.0	272.0	288	351	<1	<1
LOZH8	5/9/88	1150	7.05	240	44.8	31.2	161.0	67.9	163.0	296	361	1.4	6.2
LOZI1	5/9/88	1210	7.03	83	13.7	11.8	242.0	110.0	165.0	260	317	2.1	9.3

WELL IDENTIFICATION	F	TDS	Fe	Mn	Ca %	Mg %	Na %	SO4 %	Cl %	HCO3 %	NO3 %	WATER TYPE	SAR
LOZCR1	.2	187	.72	.045	27	49	24	13	7	80	0	MgHCO3	.8
LOZCR2	.8	468	.24	.026	20	26	54	16	34	43	7	NaHCO3Cl	3.1
LOZSID	.1	149	.13	.015	24	65	11	12	5	83	0	MgHCO3	.3
LOZC3	N/A	600	2.90	2.0	34	35	32	15	5	77	3	MgCaNaHCO3	1.7
LOZE4	N/A	860	3.00	1.4	29	28	43	30	17	43	10	NaHCO3SO4	3.2
LOZG4	N/A	631	17.70	9.1	24	27	49	19	31	50	0	NaHCO3Cl	3.2
LOZA4	N/A	976	.36	<.01	20	23	57	27	10	62	0	NaHCO3	4.1
LOZB1	N/A	2930	.27	.014	33	28	39	74	11	14	1	NaCaMgSO4	4.7
LOZF4	N/A	3840	.72	<.01	18	19	63	N/A	N/A	N/A	N/A		10.6
LOZ65	N/A	612	.40	.018	25	30	44	16	24	60	0	NaHCO3	2.7
LOZH3	N/A	1120	1.50	<.01	11	10	78	28	41	31	0	NaClHCO3SO4	9.6
LOZH8	N/A	863	10.30	.088	19	22	59	12	38	49	1	NAHCO3	4.5
LOZI1	N/A	83	.56	<.01	6	8	86	19	38	42	1	NAHCO3CL	11.6

Note: Concentrations mg/l unless otherwise noted

Appendix C
Boring Logs and Field Notes

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
378565.VE.01.01	Boring A-1	

SOIL BORING LOG

PROJECT NAME: Vacaville Energy Center Phase II	LOCATION: Vacaville, CA
TOP OF CASING ELEV. ____ CEMENT PAD RIM ____	DRILLING CONTRACTOR: Gregg Drilling
DRILLING METHOD AND EQUIPMENT: Geoprobe Direct Push Rig	

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE	DRILLING FINISH DATE	LOGGER:
	09/18/08	09/18/08	E. Haas

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: SYMBOLIC LOG	WELL: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1		8" of 48"			SILTY CLAY (CL), dark olive brown (2.5Y 3/3), dry, hard, non-plastic, no odor	CL	
2							
3							
4							
5		40" of 48"			SILT (ML), dark yellowish brown (10YR 4/6), damp, firm to hard, little clay, non-plastic, no odor.	ML	
6							
7							
8							
9					SILTY SAND (SM), dark yellowish brown (10YR 4/6), wet, loose, fine grained, poorly graded, no odor.	SP	
10							
11							
12							
13					End of boring at 12' bgs		
14							
15							
16			SYMBOLS GW GP GM GC SW SP SM SC ML CL OL MH CH OH Pt				
17							
18							
19							
20							
21							
22							
23				Pt			
24							
25							

CH2MHILL

PROJECT NUMBER: 378565.VE.01.01	BORING NUMBER: Boring B-3	SHEET 1 OF 1

SOIL BORING LOG

PROJECT NAME: Vacaville Energy Center Phase II	LOCATION: Vacaville, CA
TOP OF CASING ELEV. ____ CEMENT PAD RIM ____	DRILLING CONTRACTOR: Gregg Drilling
DRILLING METHOD AND EQUIPMENT: Geoprobe Direct Push Rig	

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE	DRILLING FINISH DATE	LOGGER:
	09/18/08	09/18/08	E. Haas

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: SYMBOLIC LOG	WELL: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1		36" of 48"			NO RECOVERY		
2					ORGANIC SILTY CLAY (OL), very dark grey (7.5YR 3/1), damp, firm to hard, low plasticity, trace organics (root material), no odor.	OL	
3							
4							
5		48" of 48"			SILTY SAND (SM), dark yellowish brown (10YR 4/6), wet, loose, fine grained, poorly graded, no odor.	SP	
6							
7							
8							
9		43" of 48"					
10							
11							
12							
13					End of boring at 12' bgs		
14							
15							
16			SYMBOLS				
17			GW				
			GP				
18			GM				
			GC				
19			SW				
			SP				
20			SM				
			SC				
21			ML				
			CL				
22			OL				
			MH				
23			CH				
			OH				
24			Pt	Pt			
25							

CH2MHILL

PROJECT NUMBER: 378565.VE.01.01	BORING NUMBER: Boring D-2	SHEET 1 OF 1

SOIL BORING LOG

PROJECT NAME: Vacaville Energy Center Phase II	LOCATION: Vacaville, CA
TOP OF CASING ELEV. ____ CEMENT PAD RIM ____	DRILLING CONTRACTOR: Gregg Drilling
DRILLING METHOD AND EQUIPMENT: Geoprobe Direct Push Rig	

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE	DRILLING FINISH DATE	LOGGER:
	09/18/08	09/18/08	E. Haas

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	WELL: SYMBOLIC LOG	WELL: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1		45" of 48"			SILT (ML), dark olive brown, (2.5Y 3/3), damp, hard, non-plastic, no odor	ML	
2							
3							
4							
5		46" of 48"					
6							
7							
8							
9		47" of 48"			SILTY SAND (SM), brown (7.5YR 4/4), moist, loose to medium dense, fine grained, no odor.	SM	
10							
11					SAND (SP), dark yellowisn brown (10YR 3/6), wet, loose, fine grained, no odor.	SP	saturated at 10.5' bgs
12							
13					End of boring at 12' bgs		
14							
15							
16			SYMBOLS				
17			GW				
			GP				
18			GM				
			GC				
19			SW				
			SP				
20			SM				
			SC				
21			ML				
			CL				
22			OL				
			MH				
23			CH				
			OH				
24			Pt	Pt			
25							

GROUNDWATER SAMPLING
FIELD DATA SHEET

SITE VEC WELL NUMBER MW-5

DATE 9/18/08 CLIENT

JOB NUMBER

FIELD CONDITIONS Sunny, ~60°F, Calm

INITIAL OVM: WELL CASING — BREATHING ZONE —

PURGE INFORMATION

START TIME 828 END TIME

INITIAL DEPTH TO WATER ~6.2 SCREEN INTERVAL TO

PURGE METHOD Geopump PUMP DEPTH (ft) PURGE RATE (gpm)

TOTAL VOLUME PURGED (gal)

TIME	VOLUME PURGED (gal)	pH	COND. (ms/cm)	TEMP. (C) 18.3	TURBIDITY (ntu)	DO (mg/l)	REDOX (mV)	WATER LEVEL (ft btoc)
829	0.1	6.53	1.35	~~4.60~~	0.0	4.60	181	
832	0.2	6.92	1.33	18.1	0.0	3.91	171	
835	0.4	7.10	1.32	18.1	0.0	3.64	156	
838	0.7	7.21	1.32	18.0	0.0	3.51	146	
841	0.9	7.24	1.32	18.0	0.2	3.45	139	
844	1.1	7.26	1.31	18.0	0.2	3.40	134	
847	1.4	7.29	1.31	18.0	0.5	3.32	132	
850	1.6	7.29	1.30	17.9	0.2	3.32	130	
853	1.9	7.30	1.30	17.9	0.3	3.31	129	
856	2.1	7.28	1.30	17.9	0.4	3.33	131	
858	SAMPLE							

ADDITIONAL FIELD COMMENTS

TIME	COMMENTS

FIELD TEAM (initials)

Appendix D
Summary of Results

Table D-1. Summary of Soil Sample Analytical Results, Phase II Environmental Site Assessment, CPV Vaca Station, Vacaville, California

Sample ID	PRGs[1] Industrial Soil (mg/kg)	CHHSL's[2] Industrial Soil (mg/kg)	TTLC[3] Wet wt basis (mg/kg)	A1-06SB	A1-03SB	A1-05SB	A1-10SB A1-05SB-FD	A2-06SB	A2-03SB	A3-06SB	A3-03SB	A3-10SB A3-03SB-FD	A4-06SB	A4-03SB	B1-06SB	B1-03SB	B2-06SB	B2-03SB	B3-06SB	B3-03SB	B2-10SB B3-03SB-FD	B3-05SB	B4-06SB	B4-03SB
% Moisture (SW3550)				4	17	17	16	3	18	3	11	14	5	16	3	17	4	12	4	17	13	17	5	11
Metals (SW6010B)																								
Antimony	410 n	380	500	1.0 U	**0.18 J**	0.19 U	0.22 U	0.94 U	0.21 U	0.97 U	0.18 U	0.21 U	0.97 U	0.19 U	0.96 U	0.20 U	0.92 U	0.20 U	0.90 U	0.20 U	0.16 U	0.19 U	0.96 U	0.20 U
Arsenic	1.6 c	0.24	500	**6.7**	**9.55**	**13.8**	**8.96**	**7.3**	**11.3**	**8.8**	**8.56**	**11.2**	**11.1**	**10.7**	**7.6**	**10.4**	**7.6**	**9.89**	**7.1**	**11.3**	**8.98**	**10.9**	**8.3**	**10.4**
Barium	190,000 nm	63,000	10,000	**179**	**301**	**115**	**266**	**162**	**423**	**168**	**162**	**182**	**307**	**372**	**165**	**337**	**168**	**211**	**169**	**292**	**437**	**135**	**211**	**226**
Beryllium	2,000 n	1,700	75	**0.83**	**0.83**	**0.76**	**0.61**	**0.71**	**0.78**	**0.74**	**0.78**	**0.82**	**0.77**	**0.86**	**0.79**	**0.79**	**0.76**	**0.85**	**0.69**	**0.77**	**0.78**	**0.70**	**0.81**	**0.84**
Cadmium	810 n	7.5	100	0.51 U	**0.31 J**	**0.18 J**	0.011 U	0.47 U	0.011 U	0.49 U	**0.14 J**	0.011 U	0.48 U	**0.11 J**	0.48 U	**0.12 J**	0.46 U	**0.13 J**	0.45 U	**0.064 J**	**0.13 J**	**0.081 J**	0.48 U	**0.15 J**
Chromium *(based on III)*	1,400 c	10,000	2,500	**45.9**	**41.5**	**35.4**	**35.8**	**39.2**	**33.4**	**40.4**	**36.7**	**39.4**	**39.7**	**37.1**	**44.5**	**38.8**	**41.5**	**39.7**	**38.4**	**35.4**	**35.6**	**25.5**	**44.2**	**41.2**
Chromium *(based on VI)*	200 c*	37	500	**45.9**	**41.5**	**35.4**	**35.8**	**39.2**	**33.4**	**40.4**	**36.7**	**39.4**	**39.7**	**37.1**	**44.5**	**38.8**	**41.5**	**39.7**	**38.4**	**35.4**	**35.6**	**25.5**	**44.2**	**41.2**
Cobalt	300 n	3,200	8,000	**11.4**	**9.28**	**14.8**	**5.68**	**9.4**	**13.2**	**10.9**	**10.3**	**12.5**	**39.5**	**50.8**	**10.7**	**11.6**	**10.9**	**22.0**	**9.7**	**14.9**	**8.36**	**13.5**	**12.9**	**11.8**
Copper	41,000 nc	38,000	2,500	**45.1**	**34.9**	**35.5**	**27.4**	**48.0**	**31.2**	**42.8**	**32.6**	**34.9**	**37.8**	**32.8**	**44.9**	**34.1**	**39.9**	**38.2**	**38.7**	**34.9**	**32.4**	**28.7**	**44.1**	**47.6**
Lead	800 n	3,500	1,000	**12.7**	**8.86**	**11.5**	**6.05**	**12.5**	**11.8**	**13.1**	**9.22**	**9.71**	**14.5**	**13.3**	**13.2**	**10.3**	**10.8**	**11.9**	**11.5**	**10.1**	**9.58**	**8.72**	**12.5**	**13.8**
Mercury (SW7471A)	28 ns	180	20	**0.11**	**0.053**	**0.071**	**0.039**	**0.11**	**0.054**	**0.086**	**0.034**	**0.039**	**0.10**	**0.046**	**0.076**	**0.048**	**0.071**	**0.057**	**0.071**	**0.018 J**	**0.046**	**0.015 J**	**0.080**	**0.037**
Molybdenum	5,100 n	4,800	3,500	2.6 U	0.17 U	0.18 U	**0.30 J**	2.4 U	**0.26 J**	2.4 U	**0.20 J**	**0.27 J**	2.4 U	**0.23 J**	2.4 U	**0.26 J**	2.3 U	**0.37 J**	2.3 U	**0.68 J**	0.16 U	**0.24 J**	2.4 U	**0.32 J**
Nickel *(assumed soluble salts)*	20,000 n	16,000	2,000	**32.2**	**37.0**	**33.1**	**25.1**	**26.5**	**31.6**	**28.0**	**30.0**	**33.7**	**33.2**	**42.2**	**30.5**	**29.6**	**31.2**	**36.6**	**26.2**	**40.9**	**26.2**	**30.0**	**31.9**	**31.3**
Selenium	5,100 n	4,800	100	3.10 U	**4.42**	**2.32 J**	1.32 U	2.8 U	**3.81**	2.9 U	**4.52**	1.31 U	2.9 U	**4.64**	2.9 U	**3.91**	2.8 U	1.24 U	2.7 U	1.24 U	**2.63**	1.16 U	2.9 U	**2.31 J**
Silver	5,100 n	4,800	500	**1.40**	0.046 U	0.050 U	0.39 U	**1.7**	**0.28 J**	**1.4**	**0.053 J**	**0.46 J**	**1.6**	**0.20 J**	**1.6**	0.053 U	**1.2**	**0.47**	**1.4**	**0.50 J**	0.043 U	**0.22 J**	**1.2**	**0.80 J**
Thallium	66 n	63	700	2.10 U	0.52 U	**0.66 J**	0.64 U	1.9 U	0.64 U	1.9 U	0.52 U	0.64 U	1.9 U	0.56 U	1.9 U	0.59 U	1.8 U	0.60 U	1.8 U	0.61 U	0.49 U	0.57 U	1.9 U	0.58 U
Vanadium	5,200 n	6,700	2,400	**85.9**	**70.0**	**71.0**	**53.7**	**69.7**	**63.1**	**74.3**	**67.1**	**73.5**	**78.9**	**67.5**	**81.8**	**67.2**	**76.8**	**72.3**	**69.6**	**68.1**	**61.9**	**54.3**	**81.7**	**71.6**
Zinc	31,000 nm	100,000	5,000	**84.2**	**70.4**	**68.6**	**57.8**	**80.0**	**62.8**	**80.9**	**64.3**	**67.3**	**75.4**	**62.5**	**80.2**	**65.9**	**73.8**	**70.4**	**74.8**	**71.1 J**	**60.0**	**57.7**	**82.9**	**83.2**
Pesticide Organics (SW8081A)																								
alpha-BHC (based on Lindane)	0.27 c	2.0	4.0	0.21 U	0.23 U	0.23 U	0.24 U	0.21 U	0.23 U	0.21 U	0.23 U	0.23 U	0.20 U	0.25 U	0.19 U	0.23 U	0.21 U	0.21 U	0.21 U	0.24 U	0.22 U	0.24 U	0.20 U	0.22 U
gamma-BHC (Lindane)	2.1 c	2.0	4.0	0.11 U	0.12 U	0.12 U	0.13 U	0.11 U	0.12 U	**0.12 J**	0.12 U	0.12 U	**0.34 J**	0.13 U	0.10 U	0.12 U	0.11 U	0.11 U	0.11 U	0.13 U	0.12 U	0.13 U	0.11 U	0.12 U
beta-BHC (based on Lindane)	0.96 c	2.0	4.0	0.095 U	0.10 U	0.11 U	0.11 U	0.094 U	0.10 U	0.095 U	0.10 U	0.11 U	0.092 U	0.11 U	0.086 U	0.11 U	0.093 U	0.097 U	0.093 U	0.11 U	0.098 U	0.11 U	0.091 U	0.099 U
delta-BHC (based on Lindane)	0.96 c	2.0	4.0	0.27 U	0.29 U	0.30 U	0.31 U	**0.31 J**	0.29 U	**0.28 J**	0.29 U	0.30 U	**0.40 J**	0.31 U	0.24 U	0.29 U	0.26 U	0.27 U	**0.34 J**	0.30 U	0.28 U	0.30 U	**0.45 J**	0.28 U
Heptachlor	0.38 c	0.52	4.7	**0.092 J**	0.093 U	0.095 U	0.098 U	0.084 U	0.094 U	**0.096 J**	0.093 U	0.095 U	0.082 U	0.10 U	0.077 U	0.094 U	0.083 U	0.087 U	0.084 U	0.097 U	0.088 U	0.096 U	0.082 U	0.089 U
Aldrin^	0.13^	0.13^	1.4	0.13 U	0.14 U	0.14 U	0.15 U	0.12 U	0.14 U	0.13 U	0.14 U	0.14 U	0.12 U	0.15 U	0.11 U	0.14 U	0.12 U	0.13 U	0.12 U	0.14 U	0.13 U	0.14 U	0.12 U	0.13 U
Heptachlor epoxide	0.19 c*	0.52	4.7	**0.27 J**	0.26 U	0.26 U	0.27 U	0.23 U	0.26 U	0.24 U	0.26 U	0.26 U	0.23 U	0.28 U	0.21 U	0.26 U	0.23 U	0.24 U	0.23 U	0.27 U	0.24 U	0.27 U	0.23 U	0.25 U
gamma-Chlordane	6.5 c*	1.7	2.5	0.28 U	0.31 U	0.32 U	0.33 U	0.28 U	0.32 U	0.28 U	0.31 U	0.32 U	0.28 U	0.34 U	0.26 U	0.32 U	0.28 U	0.29 U	0.28 U	0.33 U	0.30 U	0.32 U	0.27 U	0.30 U
alpha-Chlordane	6.5 c*	1.7	2.5	**0.27 J**	0.051 U	0.052 U	0.054 U	0.38 U	0.052 U	**0.29 J**	0.051 U	0.11 U	**0.87**	0.055 U	**0.21 J**	0.052 U	**0.18 J**	0.048 U	**0.21 J**	0.053 U	0.049 U	0.053 U	**0.16 J**	**0.091 J**
4,4'-DDE	5.1	6.3	1.0	**0.93**	0.058 U	0.059 U	0.061 U	**0.75**	0.059 U	**1.2**	0.058 U	0.059 U	**1.6**	0.062 U	**0.57**	0.059 U	**0.37 J**	0.054 U	**0.84**	0.060 U	0.055 U	0.060 U	**1.1**	**0.39 J**
Endosulfan I	3,700 n	NA	NA	0.056 U	0.061 U	0.062 U	0.065 U	0.056 U	0.062 U	0.056 U	0.062 U	0.063 U	**0.097 J**	0.066 U	0.051 U	0.062 U	0.055 U	0.057 U	0.055 U	0.064 U	0.058 U	0.063 U	0.054 U	0.058 U
Dieldrin^	0.11^ c	0.13	8.0	**0.056 J**	0.060 U	0.061 U	0.064 U	0.054 U	0.061 U	**0.14 J**	0.060 U	0.061 U	**0.097 J**	0.064 U	**0.090 J**	0.061 U	0.054 U	0.056 U	0.054 U	0.063 U	0.057 U	0.062 U	0.053 U	0.057 U
Endrin	180 n	230	0.2	0.081 U	0.089 U	0.091 U	0.094 U	0.081 U	0.090 U	0.081 U	0.090 U	0.091 U	0.079 U	0.096 U	0.074 U	0.090 U	0.080 U	0.083 U	0.080 U	0.093 U	0.085 U	0.092 U	0.078 U	0.085 U
4,4'-DDD	7.2	9	1.0	0.19 U	0.20 U	0.21 U	0.21 U	0.18 U	0.21 U	0.19 U	0.20 U	0.21 U	0.18 U	0.22 U	0.17 U	0.21 U	0.18 U	0.19 U	0.18 U	0.21 U	0.19 U	0.21 U	0.18 U	0.19 U
Endosulfan II	3,700 n	NA	NA	**0.22 J**	0.052 U	0.053 U	0.055 U	**0.28 J**	0.053 U	**0.18 J**	0.053 U	0.053 U	**0.31 J**	0.056 U	**0.19 J**	0.053 U	**0.059 J**	0.049 U	**0.13 J**	0.055 U	**0.12 J**	0.054 U	**0.072 J**	**0.071 J**
4,4'-DDT	7.0	6.3	1.0	0.26 U	0.29 U	0.30 U	0.31 U	0.26 U	0.29 U	**0.29 J**	0.29 U	0.30 U	0.26 U	0.31 U	**0.25 J**	0.29 U	0.26 U	0.27 U	0.26 U	0.30 U	0.27 U	0.30 U	0.25 U	0.28 U
Endrin aldehyde (based on Endrin)	180 n	230	0.2	0.052 U	0.057 U	0.058 U	0.060 U	0.052 U	0.058 U	0.052 U	0.057 U	0.058 U	0.050 U	0.061 U	0.047 U	0.058 U	0.051 U	0.053 U	0.051 U	0.059 U	0.054 U	0.059 U	0.050 U	0.054 U
Methoxychlor	3,100 n	3,800	100	0.29 U	0.32 U	0.33 U	0.34 U	0.29 U	0.33 U	0.29 U	0.32 U	0.33 U	0.28 U	0.35 U	0.27 U	0.33 U	0.29 U	0.30 U	0.29 U	0.34 U	0.31 U	0.33 U	0.28 U	0.31 U
Endosulfan sulfate	3,700 n	NA	NA	**0.21 J**	0.098 U	0.10 U	0.10 U	**0.16 J**	0.099 U	**0.15 J**	0.098 U	0.10 U	**0.29 J**	0.11 U	**0.26 J**	0.099 U	**0.38 J**	0.091 U	**0.14 J**	0.10 U	0.093 U	0.10 U	**0.14 J**	0.093 U

Notes:

All analytical results for soil given in mg/kg on a dry weight basis.

-06SB Samples were collected in the 0 to 6 inch bgs depth interval
-03SB, -05SB, -10SB Samples were collected in the 3-foot, 5-foot, or 10-foot bgs depth 'interval, respectively

U = Not detected at specified reporting limit
J = Estimated value below reporting limit

Boldface entries indicate detected constituents/compounds (including those detected between MDL and RL - 'J' flagged)

Exceeds Title 22 Hazardous Waste Criteria

Exceeds one or more of the risk-based criteria (PRGs or CHHSLs)

Exceeds the corresponding 95% Upper Confidence Limit on the geometric mean for Background Soils (using samples from all depths)

c = Cancer PRG
n = Noncancer PRG
c* = where: n screening level < 100x cancer screening level
m = concentration may exceed ceiling limit
^ = MDL's for this method are less than or equal to the screening level.

1 = USEPA Region IX Preliminary Remediation Goals (PRGs) 2008
2 = California Human Health Screening levels
3 = Total Threshold Limit Concentration (wet weight basis) that is hazardous waste criteria under California Code of Regulation, Title 22, Division 4.5, Chapter 11, Section 66261.24.

Table D-1. Summary of Soil Sample Analytical Results, Phase II Environmental Site Assessment, CPV Vaca Station, Vacaville, California

Sample ID	PRGs[1] Industrial Soil (mg/kg)	CHHSL's[2] Industrial Soil (mg/kg)	TTLC[3] Wet wt basis (mg/kg)	C1-06SB	C1-03SB	C2-06SB	C2-03SB	C3-06SB	C3-03SB	C4-06SB	C4-03SB	C4-05SB	C4-10SB C4-05SB-FD	D1-06SB	D1-03SB	D2-06SB	D2-03SB	D2-05SB	D3-06SB	D3-03SB	D4-06SB	D4-03SB	E1-06SB	E1-03SB
% Moisture (SW3550)				3	13	4	18	4	17	4	14	19	18	2	18	2	19	19	2	16	3	11	2	17
Metals (SW6010B)																								
Antimony	410 n	380	500	0.94 U	0.17 U	0.95 U	0.19 U	0.93 U	0.23 U	0.89 U	0.17 U	0.18 U	0.20 U	0.91 U	0.23 U	0.97 U	0.20 U	0.18 U	1.0 U	0.20 U	0.93 U	0.19 U	0.96 U	0.21 U
Arsenic	1.6 c	0.24	500	**10.5**	**10.6**	**7.6**	**10.6**	**7.5**	**7.96**	**8.9**	**6.74**	**12.4**	**19.0**	**8.3**	**12.5**	**8.4**	**11.4**	**11.8**	**10.1**	**10.1**	**6.5**	**9.09**	**6.2**	**10.8**
Barium	190,000 nm	63,000	10,000	**171**	**237**	**155**	**289**	**163**	**309**	**162**	**146**	**411**	**2830**	**194**	**386**	**135**	**374**	**79.8**	**158**	**577**	**148**	**464**	**159**	**285**
Beryllium	2,000 n	1,700	75	**0.79**	**0.85**	**0.79**	**0.87**	**0.70**	**0.80**	**0.77**	**0.71**	**0.76**	**0.73**	**0.79**	**0.86**	**0.73**	**0.83**	**0.79**	**0.75**	**0.76**	**0.65**	**0.83**	**0.60**	**0.96**
Cadmium	810 n	7.5	100	0.47 U	**0.32 J**	0.48 U	**0.20 J**	0.47 U	**0.03 J**	0.45 U	**0.11 J**	**0.26 J**	**0.032 J**	0.45 U	**0.071 J**	0.49 U	**0.11 J**	**0.057 J**	0.50 U	0.010 U	0.47 U	**0.056 J**	0.48 U	**0.14 J**
Chromium *(based on III)*	1,400 c	10,000	2,500	**43.7**	**41.3**	**45.4**	**42.3**	**40.1**	**36.8**	**44.2**	**36.1**	**38.0**	**37.2**	**43.3**	**42.4**	**42.2**	**36.0**	**27.5**	**37.9**	**37.8**	**34.3**	**40.7**	**33.4**	**48.0**
Chromium *(based on VI)*	200 c*	37	500	**43.7**	**41.3**	**45.4**	**42.3**	**40.1**	**36.8**	**44.2**	**36.1**	**38.0**	**37.2**	**43.3**	**42.4**	**42.2**	**36.0**	**27.5**	**37.9**	**37.8**	**34.3**	**40.7**	**33.4**	**48.0**
Cobalt	300 n	3,200	8,000	**11.3**	**24.7**	**10.6**	**20.3**	**9.7**	**28.4**	**11.1**	**10.7**	**15.4**	**11.8**	**11.4**	**16.4**	**11.2**	**15.0**	**21.5**	**11.5**	**9.69**	**12.5**	**14.1**	**11.6**	**9.74**
Copper	41,000 nc	38,000	2,500	**43.6**	**36.9**	**47.6**	**34.7**	**44.8**	**33.9**	**46.5**	**30.8**	**34.8**	**31.4**	**42.2**	**36.0**	**41.3**	**28.1**	**26.8**	**43.0**	**29.9**	**44.3**	**34.1**	**37.0**	**40.4**
Lead	800 n	3,500	1,000	**13.3**	**14.0**	**12.5**	**11.7**	**12.4**	**10.7**	**12.7**	**9.19**	**10.8**	**9.13**	**12.9**	**11.4**	**11.8**	**10.6**	**9.62**	**12.9**	**9.36**	**12.7**	**10.4**	**11.5**	**11.3**
Mercury (SW7471A)	28 ns	180	20	**0.097**	**0.041**	**0.091**	**0.058**	**0.088**	**0.036**	**0.091**	**0.045**	**0.064**	**0.091**	**0.11**	**0.042**	**0.058**	**0.036**	**0.018 J**	**0.062**	**0.052**	**0.092**	**0.036**	**0.095**	**0.036**
Molybdenum	5,100 n	4,800	3,500	2.4 U	**0.50 J**	2.4 U	**0.51 J**	2.3 U	**0.36 J**	2.2 U	0.16 U	0.17 U	0.19 U	2.3 U	**0.35 J**	2.4 U	**0.37 J**	**0.31 J**	2.5 U	**0.29 J**	2.3 U	**0.25 J**	2.4 U	**0.26 J**
Nickel *(assumed soluble salts)*	20,000 n	16,000	2,000	**30.5**	**31.9**	**31.0**	**39.7**	**26.0**	**41.2**	**30.4**	**27.1**	**42.5**	**39.5**	**30.9**	**33.6**	**27.3**	**31.0**	**28.5**	**26.9**	**31.1**	**25.0**	**26.8**	**23.2**	**31.7**
Selenium	5,100 n	4,800	100	2.8 U	**1.57 J**	2.9 U	**1.94 J**	2.8 U	1.40 U	2.7 U	**2.58 J**	**4.67**	1.21 U	2.7 U	1.38 U	**3.1**	**1.43 J**	**1.18 J**	**3.5**	**2.21 J**	2.8 U	1.16 U	**3.7**	**4.15**
Silver	5,100 n	4,800	500	**1.1**	0.044 U	**1.4**	0.050 U	**1.5**	**0.58 J**	**1.3**	0.045 U	0.046 U	**0.31 J**	**1.2**	**0.37 J**	**1.5**	**0.13 J**	**0.32 J**	**1.3**	**0.45 J**	**1.4**	**0.25 J**	**1.6**	**0.073 J**
Thallium	66 n	63	700	1.9 U	0.49 U	1.9 U	**0.67 J**	1.9 U	0.68 U	1.8 U	0.51 U	0.52 U	**0.99 J**	1.8 U	0.67 U	1.9 U	0.59 U	0.54 U	2.0 U	0.61 U	1.9 U	0.57 U	1.9 U	0.62 U
Vanadium	5,200 n	6,700	2,400	**82.1**	**77.2**	**82.6**	**77.1**	**71.1**	**65.5**	**80.5**	**61.2**	**75.7**	**72.2**	**81.4**	**77.4**	**74.8**	**64.6**	**59.4**	**68.2**	**67.4**	**61.4**	**73.6**	**56.3**	**86.5**
Zinc	31,000 nm	100,000	5,000	**83.7**	**72.7**	**82.4**	**71.3**	**79.2**	**69.8**	**82.4**	**59.5**	**64.6**	**62.1**	**81.3**	**70.7**	**74.5**	**57.4**	**54.8**	**79.9**	**63.7**	**74.6**	**64.1**	**66.1**	**77.8**
Pesticide Organics (SW8081A)																								
alpha-BHC (based on Lindane)	0.27 c	2.0	4.0	0.21 U	0.23 U	0.20 U	0.24 U	0.21 U	0.24 U	0.20 U	0.22 U	0.24 U	0.25 U	0.19 U	0.23 U	0.21 U	0.24 U	0.25 U	0.19 U	0.24 U	0.20 U	0.21 U	0.20 U	0.23 U
gamma-BHC (Lindane)	2.1 c	2.0	4.0	0.11 U	0.12 U	0.11 U	0.13 U	0.11 U	0.13 U	0.11 U	0.12 U	0.13 U	0.13 U	0.10 U	0.12 U	**0.14 J**	0.13 U	0.13 U	**0.12 J**	0.13 U	0.11 U	0.11 U	0.21 J	0.12 U
beta-BHC (based on Lindane)	0.96 c	2.0	4.0	**0.14 J**	0.10 U	0.092 U	0.11 U	0.095 U	0.11 U	0.090 U	0.10 U	0.11 U	0.11 U	0.086 U	0.10 U	0.093 U	0.11 U	0.11 U	0.085 U	0.11 U	0.092 U	0.096 U	**0.19 J**	0.10 U
delta-BHC (based on Lindane)	0.96 c	2.0	4.0	0.26 U	0.29 U	0.26 U	0.31 U	0.27 U	0.30 U	**0.28 J**	0.28 U	0.30 U	0.32 U	0.24 U	0.29 U	0.26 U	0.31 U	0.32 U	**0.28 J**	0.31 U	0.26 U	0.27 U	0.25 U	0.29 U
Heptachlor	0.38 c	0.52	4.7	**0.089 J**	0.092 U	0.083 U	0.098 U	0.085 U	0.096 U	0.081 U	0.090 U	0.097 U	0.10 U	0.077 U	0.094 U	**0.087 J**	0.098 U	0.10 U	0.076 U	0.098 U	0.083 U	0.086 U	0.081 U	0.092 U
Aldrin^	0.13^	0.13^	1.4	0.12 U	0.14 U	0.12 U	0.15 U	0.13 U	0.14 U	0.12 U	0.13 U	0.14 U	0.15 U	0.11 U	0.14 U	0.12 U	0.15 U	0.15 U	0.11 U	0.14 U	0.12 U	0.13 U	0.12 U	0.14 U
Heptachlor epoxide	0.19 c*	0.52	4.7	0.23 U	0.25 U	0.23 U	0.27 U	0.24 U	0.27 U	0.22 U	0.25 U	0.27 U	0.28 U	0.21 U	0.26 U	0.23 U	0.27 U	0.28 U	0.21 U	0.27 U	0.23 U	0.24 U	0.22 U	0.26 U
gamma-Chlordane	6.5 c*	1.7	2.5	0.28 U	0.31 U	0.28 U	0.33 U	0.29 U	0.32 U	**0.33 J**	0.30 U	0.32 U	0.34 U	0.26 U	0.32 U	0.28 U	0.33 U	0.34 U	0.26 U	0.33 U	**0.29 J**	0.29 U	0.27 U	0.31 U
alpha-Chlordane	6.5 c*	1.7	2.5	**0.20 J**	0.051 U	**0.27 J**	0.054 U	0.047 U	0.053 U	0.045 U	0.050 U	0.053 U	0.055 U	**0.18 J**	0.052 U	**0.34 J**	0.054 U	0.056 U	**0.22 J**	0.054 U	**0.44 J**	0.048 U	**0.28 J**	0.051 U
4,4'-DDE	5.1	6.3	1.0	**0.70**	0.057 U	**0.5**	0.061 U	**1.01**	0.060 U	**1.3**	0.056 U	0.060 U	0.063 U	**0.71**	0.059 U	**0.93**	0.061 U	0.063 U	**1.2**	0.061 U	**1.2**	0.054 U	**0.61**	0.057 U
Endosulfan I	3,700 n	NA	NA	0.055 U	0.061 U	0.055 U	0.065 U	0.056 U	0.063 U	0.053 U	0.060 U	0.064 U	0.066 U	0.051 U	0.062 U	0.055 U	0.065 U	0.066 U	0.050 U	0.064 U	0.055 U	0.057 U	0.053 U	0.061 U
Dieldrin^	0.11^ c	0.13	8.0	**0.15 J**	0.059 U	0.053 U	0.063 U	0.055 U	0.062 U	**0.055 J**	0.058 U	0.062 U	0.065 U	**0.069 J**	0.061 U	**0.10 J**	0.063 U	0.065 U	0.054 J	0.063 U	**0.12 J**	0.056 U	0.052 U	0.059 U
Endrin	180 n	230	0.2	0.080 U	0.088 U	0.079 U	0.094 U	0.082 U	0.092 U	0.078 U	0.087 U	0.093 U	0.097 U	0.074 U	0.090 U	**0.080 J**	0.094 U	0.097 U	0.074 J	0.094 U	0.079 U	0.083 U	0.078 U	0.088 U
4,4'-DDD	7.2	9	1.0	0.18 U	0.20 U	0.18 U	0.21 U	0.19 U	0.21 U	0.18 U	0.20 U	0.21 U	0.22 U	0.17 U	0.21 U	0.18 U	0.21 U	0.22 U	0.17 U	0.21 U	0.18 U	0.19 U	0.18 U	0.20 U
Endosulfan II	3,700 n	NA	NA	**0.12 J**	0.052 U	**0.16 J**	0.055 U	0.048 U	0.054 U	**0.24 J**	0.051 U	0.054 U	0.057 U	**0.11 J**	0.053 U	**0.17 J**	0.055 U	0.057 U	**0.17 J**	0.055 U	**0.35 J**	**0.11 J**	**0.13 J**	0.052 U
4,4'-DDT	7.0	6.3	1.0	**0.34 J**	0.29 U	0.26 U	0.31 U	0.27 U	0.30 U	**0.38 J**	0.28 U	0.30 U	0.31 U	**0.28 J**	0.29 U	0.26 U	0.31 U	0.31 U	**0.26 J**	0.30 U	0.26 U	0.27 U	**0.35 J**	0.29 U
Endrin aldehyde (based on Endrin)	180 n	230	0.2	0.051 U	0.056 U	0.051 U	0.060 U	0.052 U	0.059 U	0.050 U	0.056 U	0.059 U	0.062 U	0.047 U	0.058 U	0.051 U	0.06 U	0.062 U	0.047 U	0.060 U	0.051 U	0.053 U	0.050 U	0.057 U
Methoxychlor	3,100 n	3,800	100	0.29 U	0.32 U	0.29 U	0.34 U	0.29 U	0.33 U	0.28 U	0.31 U	0.34 U	0.35 U	0.27 U	0.33 U	0.29 U	0.34 U	0.35 U	0.26 U	0.34 U	0.29 U	0.30 U	0.28 U	0.32 U
Endosulfan sulfate	3,700 n	NA	NA	**0.22 J**	0.097 U	**0.11 J**	0.10 U	0.09 U	0.10 U	**0.18 J**	0.095 U	0.10 U	0.11 U	**0.15 J**	0.099 U	**0.22 J**	0.10 U	0.11 U	**0.19 J**	0.10 U	**0.13 J**	0.091 U	**0.10 J**	0.097 U

Notes:

All analytical results for soil given in mg/kg on a dry weight basis.

-06SB Samples were collected in the 0 to 6 inch bgs depth interval
-03SB, -05SB, -10SB Samples were collected in the 3-foot, 5-foot, or 10-foot bgs depth 'interval, respectively

U = Not detected at specified reporting limit
J = Estimated value below reporting limit

Boldface entries indicate detected constituents/compounds (including those detected between MDL and RL - 'J' flagged)

Exceeds Title 22 Hazardous Waste Criteria

Exceeds one or more of the risk-based criteria (PRGs or CHHSLs)

Exceeds the corresponding 95% Upper Confidence Limit on the geometric mean for Background Soils (using samples from all depths)

c = Cancer PRG
n = Noncancer PRG
c* = where: n screening level < 100x cancer screening level
m = concentration may exceed ceiling limit
^ = MDL's for this method are less than or equal to the screening level.

1 = USEPA Region IX Preliminary Remediation Goals (PRGs) 2008
2 = California Human Health Screening levels
3 = Total Threshold Limit Concentration (wet weight basis) that is hazardous waste criteria under California Code of Regulation, Title 22, Division 4.5, Chapter 11, Section 66261.24.

Table D-1. Summary of Soil Sample Analytical Results, Phase II Environmental Site Assessment, CPV Vaca Station, Vacaville, California

Sample ID	PRGs[1] Industrial Soil (mg/kg)	CHHSL's[2] Industrial Soil (mg/kg)	TTLC[3] Wet wt basis (mg/kg)	E1-05SB	E1-10SB E1-05SB-FD	E2-06SB	E2-03SB	E3-06SB	E3-03SB	E4-06SB	E4-03SB	BG1-06SB	BG1-06.5SB	BG1-09.5SB	BG2-06SB	BG2-05SB	BG2-08SB	BG3-06SB	BG3-04SB	BG3-07SB	BG4-06SB	BG4-03SB	BG4-05SB	BG5-06SB	BG5-03SB	BG5-05SB
% Moisture (SW3550)				17	16	2	17	3	20	3	16	2	16	17	2	22	17	Not collected	17	17	3	17	22	2	17	16
Metals (SW6010B)																										
Antimony	410 n	380	500	0.22 U	0.22 U	0.93 U	0.19 U	0.91 U	0.21 U	0.95 U	0.17 U	0.94 U	0.22 U	0.20 U	1.0 U	0.23 U	0.21 U		0.20 U	0.19 U	0.99 U	0.20 U	0.19 U	0.91 U	0.20 U	0.18 U
Arsenic	1.6 c	0.24	500	**14.1**	**13.2**	**8.5**	**11.9**	**7.4**	**11.3**	**8.5**	**9.94**	**9.0**	**9.51**	**13.0**	**7.4**	**9.79**	**12.0**		**11.2**	**7.06**	**9.0**	**10.4**	**11.5**	**9.8**	**9.52**	**11.7**
Barium	190,000 nm	63,000	10,000	**1360**	**499**	**136**	**277**	**150**	**228**	**149**	**233**	**169**	**309**	**133**	**174**	**142**	**185**		**225**	**63.6**	**230**	**191**	**135**	**157**	**177**	**127**
Beryllium	2,000 n	1,700	75	**0.77**	**0.75**	**0.57**	**0.82**	**0.71**	**0.80**	**0.61**	**0.83**	**0.72**	**0.81**	**0.84**	**0.67**	**0.73**	**0.79**		**0.73**	**0.61**	**0.69**	**0.83**	**0.76**	**0.71**	**0.82**	**0.73**
Cadmium	810 n	7.5	100	**0.062 J**	**0.055 J**	0.46 U	**0.17 J**	0.46 U	**0.19 J**	0.48 U	**0.033 J**	0.47 U	**0.047 J**	**0.14 J**	0.51 U	0.012 U	**0.24 J**		**0.041 J**	**0.029 J**	0.50 U	**0.069 J**	**0.20 J**	0.46 U	**0.046 J**	**0.22 J**
Chromium *(based on III)*	1,400 c	10,000	2,500	**40.3**	**36.9**	**30.8**	**39.4**	**38.9**	**43.3**	**33.7**	**32.0**	**38.1**	**39.5**	**44.0**	**36.6**	**37.7**	**40.5**		**38.0**	**39.0**	**34.8**	**40.1**	**44.9**	**38.4**	**41.3**	**39.3**
Chromium *(based on VI)*	200 c*	37	500	**40.3**	**36.9**	**30.8**	**39.4**	**38.9**	**43.3**	**33.7**	**32.0**	**38.1**	**39.5**	**44.0**	**36.6**	**37.7**	**40.5**		**38.0**	**39.0**	**34.8**	**40.1**	**44.9**	**38.4**	**41.3**	**39.3**
Cobalt	300 n	3,200	8,000	**13.3**	**18.2**	**9.1**	**7.49**	**11.3**	**18.8**	**10.7**	**11.3**	**10.9**	**10.3**	**16.3**	**11.0**	**8.51**	**12.4**		**10.7**	**10.2**	**24.0**	**8.37**	**11.6**	**11.3**	**12.4**	**14.6**
Copper	41,000 nc	38,000	2,500	**36.2**	**33.3**	**37.0**	**32.1**	**46.8**	**35.8**	**59.8**	**27.3**	**32.6**	**31.9**	**41.3**	**34.2**	**34.1**	**34.9**		**28.2**	**26.7**	**32.6**	**29.5**	**37.4**	**34.2**	**31.9**	**30.9**
Lead	800 n	3,500	1,000	**10.2**	**11.3**	**10.4**	**11.1**	**12.9**	**10.5**	**15.9**	**10.4**	**9.3**	**9.59**	**12.4**	**10.1**	**8.36**	**9.61**		**10.3**	**7.97**	**14.1**	**9.01**	**10.6**	**11.5**	**10.5**	**11.0**
Mercury (SW7471A)	28 ns	180	20	**0.044**	**0.07**	**0.063**	**0.088**	**0.11**	**0.045**	**0.22**	**0.077**	**0.090**	**0.036**	**0.067**	**0.093**	**0.029**	**0.055**		**0.059**	**0.036**	**0.035**	**0.066**	**0.06**	**0.037**	**0.036**	**0.025**
Molybdenum	5,100 n	4,800	3,500	**0.36 J**	**0.42 J**	2.3 U	0.18 U	2.3 U	0.20 U	2.4 U	**0.25 J**	2.4 U	**0.36 J**	**0.21 J**	2.5 U	0.22 U	**0.49 J**		**0.26 J**	0.18 U	2.5 U	**0.25 J**	**0.24 J**	2.3 U	**0.30 J**	0.17 U
Nickel *(assumed soluble salts)*	20,000 n	16,000	2,000	**35.3**	**34.1**	**22.9**	**35.7**	**26.5**	**32.6**	**24.4**	**31.6**	**36.9**	**32.1**	**54.1**	**33.0**	**26.8**	**39.5**		**27.3**	**36.8**	**29.4**	**38.1**	**34.0**	**29.3**	**28.0**	**37.8**
Selenium	5,100 n	4,800	100	1.35 U	1.32 U	2.8 U	**2.17 J**	2.7 U	**3.79**	2.9 U	**1.94 J**	2.8 U	1.33 U	**2.63 J**	3.0 U	1.38 U	**1.91 J**		**3.67**	1.17 U	3.0 U	1.25 U	**2.59 J**	2.7 U	**2.52 J**	**2.86**
Silver	5,100 n	4,800	500	**0.18 J**	**0.40 J**	**1.4**	0.050 U	**1.5**	**0.091 J**	**2.1**	**0.17 J**	**1.0**	**0.41 J**	0.053 U	**1.2**	**0.57 J**	**0.19 J**		**0.25 J**	**0.28 J**	**1.2**	**0.22 J**	0.050 U	**0.98**	**0.21 J**	**0.062 J**
Thallium	66 n	63	700	0.66 U	0.64 U	1.9 U	0.56 U	1.8 U	0.61 U	1.9 U	0.51 U	1.9 U	0.65 U	0.60 U	2.0 U	0.67 U	0.62 U		0.60 U	0.57 U	2.0 U	0.61 U	0.57 U	1.8 U	0.58 U	0.52 U
Vanadium	5,200 n	6,700	2,400	**73.9**	**73.5**	**54.6**	**72.4**	**64.3**	**76.8**	**57.5**	**59.8**	**69.1**	**70.5**	**79.8**	**61.9**	**69.5**	**73.0**		**67.5**	**58.7**	**65.9**	**70.8**	**76.8**	**69.6**	**71.7**	**72.2**
Zinc	31,000 nm	100,000	5,000	**74.9**	**69.5**	**67.3**	**65.3**	**80.4**	**67.0**	**89.4**	**52.1**	**65.2**	**59.3**	**71.4**	**61.6**	**69.2**	**68.0**		**56.8**	**58.0**	**68.0**	**54.7**	**78.0**	**69.0**	**61.6**	**16.5**
Pesticide Organics (SW8081A)																										
alpha-BHC (based on Lindane)	0.27 c	2.0	4.0	0.23 U	0.22 U	0.20 U	0.23 U	0.20 U	0.25 U	0.21 U	0.24 U	0.20 U	0.23 U	0.24 U	0.20 U	0.26 U	0.24 U		0.23 U	0.24 U	0.21 U	0.23 U	0.25 U	0.21 U	0.24 U	0.24 U
gamma-BHC (Lindane)	2.1 c	2.0	4.0	0.12 U	0.12 U	0.11 U	0.12 U	**0.13 J**	0.13 U	0.11 U	0.13 U	**0.13 J**	0.12 U	0.13 U	0.10 U	0.14 U	0.13 U		0.12 U	0.13 U	0.11 U	0.12 U	0.13 U	0.11 U	0.13 U	0.13 U
beta-BHC (based on Lindane)	0.96 c	2.0	4.0	0.10 U	0.10 U	0.091 U	0.10 U	0.091 U	0.11 U	0.096 U	0.11 U	0.090 U	0.10 U	0.11 U	0.088 U	0.12 U	0.11 U		0.10 U	0.11 U	0.094 U	0.10 U	0.11 U	0.093 U	0.11 U	0.11 U
delta-BHC (based on Lindane)	0.96 c	2.0	4.0	0.29 U	0.28 U	0.26 U	0.29 U	0.25 U	0.32 U	0.27 U	0.30 U	0.25 U	0.29 U	0.30 U	0.25 U	0.33 U	0.31 U		0.29 U	0.31 U	0.26 U	0.29 U	0.32 U	0.26 U	0.30 U	0.30 U
Heptachlor	0.38 c	0.52	4.7	0.093 U	0.091 U	0.082 U	0.093 U	**0.085 J**	0.1 U	0.086 U	0.097 U	0.081 U	0.092 U	0.096 U	0.079 U	0.10 U	0.098 U		0.093 U	0.098 U	0.085 U	0.093 U	0.10 U	0.083 U	0.097 U	0.097 U
Aldrin^	0.13^	0.13^	1.4	0.14 U	0.13 U	0.12 U	0.14 U	0.12 U	0.15 U	0.13 U	0.14 U	0.12 U	0.14 U	0.14 U	0.12 U	0.16 U	0.15 U		0.14 U	0.15 U	0.13 U	0.14 U	0.15 U	0.12 U	0.14 U	0.14 U
Heptachlor epoxide	0.19 c*	0.52	4.7	0.26 U	0.25 U	0.23 U	0.26 U	0.23 U	0.29 U	0.24 U	0.27 U	0.22 U	0.25 U	0.27 U	0.22 U	0.29 U	0.27 U		0.26 U	0.27 U	0.23 U	0.26 U	0.28 U	0.23 U	0.27 U	0.27 U
gamma-Chlordane	6.5 c*	1.7	2.5	0.31 U	0.30 U	0.27 U	0.31 U	0.27 U	0.35 U	**0.72**	0.32 U	**0.34 J**	0.31 U	0.32 U	**0.38 J**	0.35 U	0.33 U		0.31 U	0.33 U	0.28 U	0.31 U	0.34 U	0.28 U	0.33 U	0.32 U
alpha-Chlordane	6.5 c*	1.7	2.5	0.051 U	0.050 U	**0.32 J**	0.051 U	**0.52**	0.057 U	0.047 U	0.053 U	**0.42 J**	0.050 U	0.053 U	**0.50**	0.058 U	0.054 U		0.051 U	0.054 U	0.047 U	0.051 U	0.056 U	**0.050 J**	0.054 U	0.053 U
4,4'-DDE	5.1	6.3	1.0	0.058 U	0.057 U	**0.77**	0.058 U	**0.78**	0.064 U	**0.89**	0.060 U	**0.48**	0.057 U	0.060 U	**0.39 J**	0.065 U	0.061 U		0.058 U	0.061 U	**0.96**	0.058 U	0.063 U	**1.3**	0.061 U	0.060 U
Endosulfan I	3,700 n	NA	NA	0.061 U	0.060 U	0.054 U	0.062 U	0.054 U	0.068 U	0.056 U	0.064 U	0.053 U	0.060 U	0.063 U	0.052 U	0.069 U	0.065 U		0.061 U	0.065 U	0.056 U	0.061 U	0.067 U	0.055 U	0.064 U	0.064 U
Dieldrin^	0.11^ c	0.13	8.0	0.060 U	0.058 U	**0.13 J**	0.060 U	**0.099 J**	0.066 U	**0.24 J**	0.062 U	**0.12 J**	0.059 U	0.062 U	**0.21 J**	0.068 U	0.063 U		0.060 U	0.063 U	**0.11 J**	0.060 U	0.066 U	**0.14 J**	0.063 U	0.062 U
Endrin	180 n	230	0.2	0.089 U	0.087 U	0.078 U	0.090 U	0.078 U	0.099 U	0.082 U	0.093 U	0.078 U	0.088 U	0.092 U	0.076 U	0.10 U	0.094 U		0.089 U	0.094 U	0.081 U	0.089 U	0.098 U	0.080 U	0.093 U	0.093 U
4,4'-DDD	7.2	9	1.0	0.20 U	0.20 U	0.18 U	0.20 U	0.18 U	0.22 U	**0.20 J**	0.21 U	**0.21 J**	0.20 U	0.21 U	0.17 U	0.23 U	0.21 U		0.20 U	0.21 U	0.18 U	0.20 U	0.22 U	0.18 U	0.21 U	0.21 U
Endosulfan II	3,700 n	NA	NA	0.052 U	0.051 U	**0.24 J**	0.053 U	**0.30 J**	0.058 U	**0.27 J**	0.054 U	**0.22 J**	0.052 U	0.054 U	**0.14 J**	0.059 U	0.055 U		0.052 U	0.055 U	**0.39 J**	0.052 U	0.057 U	**0.097 J**	0.055 U	0.054 U
4,4'-DDT	7.0	6.3	1.0	0.29 U	0.28 U	**0.31 J**	0.29 U	0.25 U	0.32 U	0.27 U	0.30 U	**0.28 J**	0.29 U	0.30 U	0.25 U	0.33 U	0.31 U		0.29 U	0.31 U	**0.43 J**	0.29 U	0.32 U	0.26 U	0.30 U	0.30 U
Endrin aldehyde (based on Endrin)	180 n	230	0.2	0.057 U	0.056 U	0.050 U	0.057 U	0.050 U	0.063 U	0.053 U	0.059 U	0.050 U	0.056 U	0.059 U	0.049 U	0.064 U	0.060 U		0.057 U	0.060 U	0.052 U	0.057 U	0.063 U	0.051 U	0.060 U	0.059 U
Methoxychlor	3,100 n	3,800	100	0.32 U	0.31 U	0.28 U	0.32 U	0.28 U	0.36 U	0.30 U	0.33 U	0.28 U	0.32 U	0.33 U	0.27 U	0.36 U	0.34 U		0.32 U	0.34 U	0.29 U	0.32 U	0.35 U	0.29 U	0.34 U	0.34 U
Endosulfan sulfate	3,700 n	NA	NA	0.097 U	0.095 U	**0.16 J**	0.098 U	**0.11 J**	0.11 U	0.090 U	0.10 U	0.20 U	0.096 U	0.10 U	**0.21 J**	0.11 U	0.10 U		0.098 U	0.10 U	0.089 U	0.098 U	0.11 U	**0.16 J**	0.10 U	0.10 U

Notes:

All analytical results for soil given in mg/kg on a dry weight basis.

-06SB Samples were collected in the 0 to 6 inch bgs depth interval
-03SB, -05SB, -10SB Samples were collected in the 3-foot, 5-foot, or 10-foot bgs depth 'interval, respectively

U = Not detected at specified reporting limit
J = Estimated value below reporting limit

Boldface entries indicate detected constituents/compounds (including those detected between MDL and RL - 'J' flagged)

Exceeds Title 22 Hazardous Waste Criteria

Exceeds one or more of the risk-based criteria (PRGs or CHHSLs)

Exceeds the corresponding 95% Upper Confidence Limit on the geometric mean for Background Soils (using samples from all depths)

c = Cancer PRG
n = Noncancer PRG
c* = where: n screening level < 100x cancer screening level
m = concentration may exceed ceiling limit
^ = MDL's for this method are less than or equal to the screening level.

1 = USEPA Region IX Preliminary Remediation Goals (PRGs) 2008
2 = California Human Health Screening levels
3 = Total Threshold Limit Concentration (wet weight basis) that is hazardous waste criteria under California Code of Regulation, Title 22, Division 4.5, Chapter 11, Section 66261.24.

Table D-2. Summary of Groundwater Analytical Results, Phase II Environmental Site Assessment, CPV Vaca Station, Vacaville, California

Sample ID	PRGs[1] Tap Water (µg/L)	Title 22 Hazardous Waste Toxicity Characteristic (µg/L)	Dissolved (filtered) metals				
			A1-12GW	B3-12GW	B3-12GW-FD	D2-12GW	MW-05
Metals (SW6010B)							
Antimony	15 n	NA	**3.34 J**	3.29 U	3.29 U	3.29 U	**6.11 J**
Arsenic^	0.045 c	5,000	11.6 U	11.6 U	11.6 U	11.6 U	11.6 U
Barium	7,300 n	100,000	**103**	**70.9**	**43.5**	**37.2**	43.3
Beryllium	73 n	NA	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
Cadmium	18 n	1,000	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
Chromium *(based on III)*	55,000 n	5,000	**2.34 J**	0.98 U	0.98 U	**2.48 J**	**2.63 J**
Chromium *(based on VI)*	110 n	5,000	**2.34 J**	0.98 U	0.98 U	**2.48 J**	**2.63 J**
Cobalt	11 n	NA	0.32 U	0.32 U	0.32 U	0.32 U	0.32 U
Copper	1,500 n	NA	1.66 U	1.66 U	1.66 U	1.66 U	1.66 U
Lead	15 (MCL)	5,000	1.53 U	1.53 U	1.53 U	1.53 U	1.53 U
Mercury **(SW7470A)**	0.63 n	200	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
Molybdenum	180 n	NA	**4.95 J**	**9.06 J**	1.43 U	**1.50 J**	1.43 U
Nickel *(assumed soluble salts)*	730 n	NA	1.41 U	1.41 U	1.41 U	1.41 U	1.41 U
Selenium	180 n	1,000	25.4 U	**40.0**	25.4 U	25.4 U	**28.6 J**
Silver	180 n	5,000	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Thallium^	2.4 n	NA	9.91 U	9.91 U	9.91 U	9.91 U	9.91 U
Vanadium	180 n	NA	**1.34 J**	0.71 U	**1.66 J**	0.71 U	**1.73 J**
Zinc	11,000 n	NA	**4.96 J**	**5.20 J**	**5.15 J**	**4.96 J**	**6.35 J**
Pesticide Organics (SW8081A) MRL = 0.51							
alpha-BHC	0.011 c	400	0.0029 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U
gamma-BHC (Lindane)	0.061 c	400	**0.009**	**0.0045 J**	**0.0022 J**	0.0014 U	0.0014 U
beta-BHC	0.037 c	400	**0.0055**	0.0058 U	0.0058 U	0.0058 U	0.0058 U
delta-BHC (based on technical chlordane)	0.037 c	400	**0.0047 J**	0.0037 U	0.0037 U	0.0037 U	0.0037 U
Heptachlor	0.015 c	8	0.0018 U	0.0016 U	0.0016 U	0.0016 U	0.0016 U
Aldrin^	0.004	NA	0.0016 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
Heptachlor epoxide (based on Heptachlor)	0.015 c	8	**0.026**	**0.0015 J**	0.0011 U	0.0011 U	**0.0015 J**
gamma-Chlordane	0.19 c*	30	0.0043 U	0.0040 U	0.0040 U	0.0040 U	0.004 U
alpha-Chlordane	0.19 c*	30	**0.0017 J**	0.00090 U	0.00090 U	0.00089 U	0.00089 U
4,4'-DDE	0.20 c	NA	**0.0031 J**	0.0012 U	0.0012 U	0.0012 U	0.0012 U
Endosulfan I	220 n	NA	0.0016 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
Dieldrin^	0.0042 c	NA	0.0011 U	0.00099 U	0.00099 U	0.00098 U	0.00099 U
Endrin	11 n	20	0.0016 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U
4,4'-DDD	0.28 c	NA	0.0011 U	0.0010 U	0.0010 U	**0.0011 J**	**0.0026 J**
Endosulfan II	220 n	NA	0.0015 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U
4,4'-DDT	0.20 c	NA	**0.0076**	**0.0057**	0.0048 U	0.0048 U	0.0048 U
Endrin aldehyde	11 n	20	0.0026 U	0.0024 U	0.0024 U	0.0024 U	0.0024 U
Methoxychlor	180 n	10000	0.0078 U	0.0072 U	0.0073 U	0.0072 U	0.0072 U
Endosulfan sulfate	220 n	NA	**0.0033 J**	0.0020 U	0.0020 U	0.0020 U	0.0020 U

Notes:

GW - Groundwater sample; FD- Field duplicate
NA - No criteria given for this analyte
U = Not detected at specified reporting limit
J = Estimated value below reporting limit (RL) but above the method detection limit (MDL)

Boldface entries indicate detected constituents/compounds (including those detected between MDL and RL - 'J' flagged)

Exceeds the risk-based criteria (PRGs)

c = Cancer PRG
n = Noncancer PRG
c* = where: n screening level < 100x cancer screening level
^ = MDL's for this method are less than or equal to the screening level.

1 = USEPA Region IX Preliminary Remediation Goals (PRGs) 2008 - based on drinking water maximum contaminant level (MCL) where noted

July 22, 2009

sierra research

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Ms. Courtney Graham
Yolo-Solano AQMD
1947 Galileo Ct., Suite 103
Davis, CA 95618

Dear Ms Graham:

On behalf of Competitive Power Ventures (CPV), Sierra Research is submitting additional information related to its application for permits for the CPV Vaca Station (CPVVS) project. This letter addresses the following issues:

- Revisions to fire pump engine specifications; and
- BACT analyses for fire pump engines, emergency engines, and cooling towers.

Revisions to Fire Pump Engine Specifications

As discussed in the BACT analyses below, existing regulations affecting stationary Diesel engines will require emission levels to be reduced significantly over the next few years. It has always been CPV's intention to utilize the cleanest engines available at the time the equipment is ordered.

The fire pump engine specifications contained in the original permit application reflected the lowest emissions available from Model Year 2008 engines in the size range needed. These emission levels were used in the air quality impact analysis to demonstrate compliance with air quality standards. Model Year 2009 fire pump engines have much lower emissions.

Because of the long lead time between initial permit application and construction, it is likely that the engines that are actually purchased will have even lower emissions. Any engine that is purchase for this project will have to comply with state and federal requirements, including 60 CFR subpart IIII. The 2008 Clarke JU6H-UF40, for example, does not comply with currently applicable federal emission requirements and is no longer available.

We therefore propose to substitute the Clarke JU6H-UFAD98 for the fire pump engine previously submitted. We also request that the permit for the fire pump be written to authorize the installation of a Clarke JU6H-UFAD98 fire pump engine or equivalent, and that the engine purchased must comply with the EPA Tier standards applicable at the time of purchase. Equivalence should be determined based on engine capacity expressed as Brake Horse Power.

The following tables present the specifications for the Model Year 2008 fire pump engine previously proposed and the 2009 fire pump engine currently available.

2008 Model Year Fire Pump		
Fire Pump Mfr		Clarke
Engine Mfr		John Deere
Model		JU6H-UF40
Useable Horsepower	hp	300
Power Production	kw	n/a
Speed	rpm	2100
Fuel		CA Diesel
Specific Gravity		0.825
Fuel Sulfur Content	wt %	0.0015%
Fuel Consumption	gph	14
Exhaust Flow	acfm	1740
Stack Velocity	ft/sec	212.7
Exhaust Temperature	deg. F	770
Exhaust Pipe Diameter	in	5
Exhaust Stack Height	ft	40
Pump		
Speed	rpm	N/A
Capacity	gpm	N/A
Pump Efficiency	%	N/A
Brake Horsepower	bhp	N/A
Operating Profile		
Annual Operation	hrs	50
Emissions		
NOx	g/bhp-hr	4.36
CO	g/bhp-hr	0.32
ROC	g/bhp-hr	0.29
PM10	g/bhp-hr	0.12
NOx	lb/hr	2.88
CO	lb/hr	0.21
ROC	lb/hr	0.19
PM10	lb/hr	0.08
SO2	lb/hr	0.0029

2009 Model Year Fire Pump		
Fire Pump Mfr		Clarke
Engine Mfr		John Deere
Model		JU6H-UFAD98
Useable Horsepower	hp	315
Power Production	kw	n/a
Speed	rpm	1760
Fuel		CA Diesel
Specific Gravity		0.825
Fuel Sulfur Content	wt %	0.0015%
Fuel Consumption	gph	15
Exhaust Flow	acfm	1400
Stack Velocity	ft/sec	171.1
Exhaust Temperature	deg. F	961
Exhaust Pipe Diameter	in	5
Exhaust Stack Height	ft	40
Pump		
Speed	rpm	N/A
Capacity	gpm	N/A
Pump Efficiency	%	N/A
Brake Horsepower	bhp	N/A
Operating Profile		
Annual Operation	hrs	50
Emissions		
NOx	g/bhp-hr	2.69
CO	g/bhp-hr	0.45
ROC	g/bhp-hr	0.06
PM10	g/bhp-hr	0.055
NOx	lb/hr	1.87
CO	lb/hr	0.31
ROC	lb/hr	0.04
PM10	lb/hr	0.04
SO2	lb/hr	0.0032

BACT for Fire Pumps, Emergency Engines, and Cooling Towers

As requested by the District, supplemental BACT analyses have been prepared for these three sources, and are attached to this memorandum. BACT is required for the following pollutants:

- Fire Pump: NOx
- Emergency Engines: NOx, CO
- Cooling Tower: PM_{10}

Please call me if you have any comments or questions.

Sincerely,

for Gabriel McAuliffe

Steve Hill

Attachments

cc: Rod Jones, CEC
Gerardo Rios, USEPA Region 9
Andrew Welch, CPV
Mike Carroll, Latham & Watkins

Best Available Control Technology (BACT) Analysis

BACT for the Diesel-Fueled Emergency Standby Fire Water Pump Engine

Under YSAQMD Rule 3-4 Section 301, BACT is required for each pollutant that a source has a Potential to Emit (PTE) in excess of the following thresholds:

Reactive organic compounds	10 lb/day
Nitrogen oxides	10 lb/day
Sulfur oxides	80 lb/day
PM_{10}	80 lb/day
Carbon monoxide	250 lb/day
Lead	3.3 lb/day

The Standby Fire Water Pump Engine triggers BACT for NOx, based on 24 hours per day of operation under emergency conditions.

As summarized in the following sections, the BACT analyses conclude the following for a Diesel fire pump, with a maximum work output of 315 bhp:

- Compliance with Tier 3 Certification requirements (4.0 g/bhp) constitutes BACT for a Diesel fire pump. At a combined NOx + VOC emission rate of 2.75 g/bhp-hr, the proposed fire pump will comply with the NOx BACT guideline.

1. <u>Published BACT Guidelines</u>

Table 1 summarizes published BACT determinations from the San Joaquin Valley APCD (SJVAPCD), Bay Area AQMD (BAAQMD), and the South Coast AQMD (SCAQMD) for Diesel fire pumps. The SJVAPCD's BACT guidelines identify a NOx limit of 6.9 g/bhp-hr as achieved in practice. The BAAQMD BACT Guidelines do not contain determinations for Diesel fire pumps. A BAAQMD guideline for compression ignition (i.e., Diesel) ICEs rated at more than 50 bhp defines BACT as currently applicable EPA Tier standards; however, direct-drive fire pump engines are explicitly excluded. The SCAQMD BACT guidelines for fire pumps list four BACT determinations for fire pumps. The BACT determinations for these sources specify a BACT emission level of 6.9 g/bhp, or use of cooling water and fuel injection timing retard as BACT technology.

Table 1 BACT Guidelines For Emergency Fire Pump Engine (300 Hp)		
Agency	Pollutant	BACT For Diesel Engines Driving Fire Pumps
SJVAPCD	NOx	6.9 g/bhp-hr or less (SJVAPCD BACT Guideline 3.1.4)
BAAQMD	NOx	No published guideline for fire pumps
SCAQMD	NOx	6.9 g/bhp-hr or use of cooling water and timing retard

2. Federal NSPS

40 CFR 60, Subpart IIII specifies emission limits for stationary compression ignition ICEs. Table 4 of Subpart IIII specifies that the current NOx emission standard is 4.0 g/bhp-hr for fire pumps between 300 and 600 HP. This emission level is equivalent to Tier 3 Certification levels contained in 40 CFR Part 89. This standard applies to manufacturers of fire pumps; therefore any new fire pump must meet this limit before it can be sold.

3. District Prohibitory Rules

Published prohibitory rules from the SJVAPCD, BAAQMD, SCAQMD, Sacramento Metropolitan AQMD (SMAQMD), and San Diego APCD (SDAPCD) were reviewed to identify the NOx standards that govern existing Diesel fire pumps. Each district has adopted a prohibitory rule for ICEs. SDAPCD Rule 69.4.1 (Stationary Reciprocating ICEs – Best Available Retrofit Control Technology) specifies CO and NOx limits of 4,500 ppmv @ 3% O_2 and 6.9 g/bhp-hr for emergency Diesel fire pumps. SCAQMD Rule 1470, requires use of a Tier 3 Certified engine for new direct drive fire pumps. Every other listed District exempts emergency fire pumps from the emission limits of its Internal Combustion Engine (ICE) prohibitory rules.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. The standard contained in SCAQMD Rule 1470 constitutes the most stringent emission limits for NOx. Based upon the results of this analysis, the emission limits summarized in Table 2 were determined to constitute BACT for Diesel fire pumps.

Table 2 **Comparison of Proposed Control Level with BACT – Fire Pump**		
Pollutant	BACT	Proposed Control Level
NOx	Use of a Tier 3 Certified Engine	Design Emission Rate = 2.75 g/bhp-hr [1]

[1] Reflects the combined NOx and VOC emission rate.

Best Available Control Technology (BACT) Analysis

BACT for the Emergency Diesel Engine

Under YSAQMD Rule 3-4 Section 301, BACT is required for each pollutant for which a source has a Potential to Emit (PTE) in excess of the following thresholds:

Reactive organic compounds	10 lb/day
Nitrogen oxides	10 lb/day
Sulfur oxides	80 lb/day
PM_{10}	80 lb/day
Carbon monoxide	250 lb/day
Lead	3.3 lb/day

The Emergency Engine triggers BACT for NOx and CO.

As summarized in the following sections, the BACT analyses conclude the following for a Diesel emergency generator, with a maximum work output of 1500 bhp:

- A CO emission limit of 1.4 g/bhp constitutes BACT for a Diesel emergency generator with a work output of 1500 bhp. At a CO emission rate of 0.19 g/bhp-hr, the proposed emergency generator will comply with the CO BACT guideline.

- A NOx+VOC emission limit of 4.8 g/bhp constitutes NOx BACT for a Diesel emergency generator with a work output of 1500 bhp. At a combined NOx+VOC emission rate of 4.8 g/bhp-hr, the proposed emergency generator will comply with the NOx BACT guideline.

1. <u>Published BACT Guidelines</u>

Table 1 summarizes published BACT determinations from the SJVAPCD, BAAQMD, and SCAQMD for Diesel emergency generators. The SJVAPCD's BACT guidelines contain several specific determinations for Diesel emergency generators rated at least 400 bhp. The BAAQMD BACT Guidelines incorporate the EPA Tier requirements as BACT. The SCAQMD database contains several determinations for emergency Diesel ICEs. However, none was more recent than 2003 and the determinations failed to specify the actual emission limits that constituted BACT. The SCAQMD does not consider the emission limits in these determinations to establish BACT, because some later determinations have higher levels than earlier ones.

Table 1 BACT Guidelines for Emergency Diesel Engine (1500 Hp)		
Agency	Pollutant	BACT for Diesel Engines
SJVAPCD	NOx	6.9 g/bhp-hr or less (SJVAPCD BACT Guideline 3.1.3 D)
BAAQMD	NOx	current Tier standard =Tier 2 (4.8 g/bhp) (BAAQMD BACT Guideline 96.1.3)
SCAQMD	NOx	BACT not specified
SJVAPCD	CO	1.4 g/bhp-hr or less (SJVAPCD BACT Guideline 3.1.3 B)
BAAQMD	CO	current Tier standard =Tier 2 (2.6 g/bhp) (BAAQMD BACT Guideline 96.1.3)
SCAQMD	CO	BACT not specified

2. Federal NSPS

40 CFR 60, Subpart IIII established emission limits for stationary CI ICEs. 40 CFR 89.112 contains USEPA's Tier 2 non-road compression ignition engine standards that constitute the Subpart IIII emission limits for Diesel emergency generators:

- CO – 2.6 g/bhp-hr;
- NOx + VOC – 4.8 g/bhp-hr

3. YSAQMD Prohibitory Rules

Published prohibitory rules from the SJVAPCD, BAAQMD, SCAQMD, SMAQMD, and SDAPCD were reviewed to identify the emission standards that govern existing Diesel emergency generators. Each district has adopted a prohibitory rule for ICEs. Every listed District but one—SDAPCD—exempts emergency generators from the emission limits of their ICE prohibitory rules. SDAPCD Rule 69.4.1 (Stationary Reciprocating ICEs – Best Available Retrofit Control Technology) specifies CO and NOx limits of 4,500 ppmv @ 3% O2 and 6.9 g/bhp-hr for emergency Diesel emergency generators.

4. Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. The SJVAPCD's BACT determinations constitute the most stringent emission limit for CO. The NSPS constitutes the most stringent emission limits for NOx. Based upon the results of this analysis, the emission limits summarized in Table 2 were determined to constitute BACT for Diesel emergency generators.

Table 2 **Comparison of Proposed Control Level with BACT – Emergency Generator**		
Pollutant	BACT	Proposed Control Level
CO	Emission Limit = Engine emission certification of 1.4 g/bhp-hr	Design Emission Rate = 0.19 g/bhp-hr
NOx	Compliance with EPA Tier standard applicable at time of purchase (currently Tier 2 = 4.8 g/bhp-hr)	Design Emission Rate = 4.82 g/bhp-hr [1]

Best Available Control Technology (BACT) Analysis

BACT for the Cooling Tower

Under YSAQMD Rule 3-4 Section 301, BACT is required for each pollutant that a source has a Potential to Emit (PTE) in excess of the following thresholds:

Reactive organic compounds	10 lb/day
Nitrogen oxides	10 lb/day
Sulfur oxides	80 lb/day
PM_{10}	80 lb/day
Carbon monoxide	250 lb/day
Lead	3.3 lb/day

The Cooling Tower triggers BACT for PM_{10}.

To evaluate BACT for the proposed cooling tower, published BACT guidelines from Bay Area AQMD (BAAQMD) and San Joaquin Valley APCD (SJVAPD) for cooling towers were reviewed. The CARB RACT/BACT clearinghouse was also consulted. The relevant BACT determinations for this analysis are shown in Table 1.

Additionally, the FDOCs prepared by the Districts for projects approved by CEC in 2008 and 2009 were reviewed. Most of these did not address BACT for cooling towers. The results of this review are show in Table 2.

Table 1
BACT Guidelines For Cooling Towers

Agency	Pollutant	BACT For Cooling Towers
SJVAPCD	PM_{10}	Use of a cellular type drift eliminator (SJVAPCD BACT Guideline 3.3/10)
BAAQMD	PM_{10}	No published guideline
CARB	PM_{10}	No published determinations

Table 2 BACT Determinations for Cooling Towers in CEC Proceedings (Approval Dates in 2008 and 2009)		
Agency	Project	BACT For PM_{10} Cooling Towers
SCAQMD	Walnut Creek	Drift rate of 0.0005% (FDOC amended 1/22/08)
MDAQMD	Victorville 2	Drift rate of 0.0005% (FDOC 1/10/08)
Colusa County AQMD	Colusa	No BACT determination (FDOC 6/12/07)
NCUAQMD	Humboldt	No BACT determination (FDOC 4/23/08)
SJVAPCD	Starwood	No BACT determination (FDOC 7/19/07)

Based upon the above information, BACT is use of a high-efficiency drift eliminator with a drift rate of 0.0005% or less. The proposed cooling tower complies with this BACT level.

Supplemental CTG CO Top-Down BACT Analysis
CPV Vaca Station
Competitive Power Ventures, LLC

I. Introduction

The Prevention of Significant Deterioration Program (PSD) (Clean Air Act §160-169A, 42 USC §7470-7491; 40 CFR Parts 51 and 52) requires review and facility permitting for construction of new or modified major stationary sources of air pollution. PSD review applies with respect to "attainment pollutants" (criteria pollutants for which the area has been designated attainment or unclassified). PSD review includes a federal requirement to apply Best Available Control Technology (BACT) on a pollutant-by-pollutant basis, depending on facility emission rates.

The CPVVS project is required to use best available control technology on the combustion turbine/HRSG. This supplemental BACT analysis focuses on CO emissions. For sources subject to PSD, BACT is defined in 40 CFR 52.21(j) as:

> "an emissions limitation…based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…"

CO emissions from combustion sources are the result of incomplete combustion of the fuel. Good combustor design can minimize the amount of CO produced. Oxidation catalyst technology is commonly used to further reduce CO levels.

CO emission calculations are based on exhaust gas outlet concentrations, corrected to a standard oxygen content (15% O2 is typically used for gas turbines). Correcting the concentration to a standard oxygen content eliminates dilution as an issue when comparing control levels.

BACT for CO emissions is required under PSD.

III. Top-Down BACT Analysis

Steps in a Top-Down BACT Analysis

Step 1 – Identify All Possible Control Technologies

The first step in a top-down analysis is to identify, for the emissions unit and pollutant in question, all available control options. Available control options are those air pollution control technologies or techniques, including alternate basic equipment or processes, with a practical potential for application to the emissions unit in question. The control alternatives should include not only existing controls for the source category in question, but also, through technology transfer, controls applied to similar source categories and gas streams.

BACT must be at least as stringent as what has been achieved in practice (AIP) for a category or class of source. Additionally, USEPA guidelines require that a technology that is determined to be AIP for one category of source be considered for transfer to other source categories. There are two types of potentially transferable control technologies: (1) exhaust stream controls, and (2) process controls and modifications. For the first type, technology transfer must be considered between source categories that produce similar exhaust streams. For the second type, technology transfer must be considered between source categories with similar processes.

Candidate control options that do not meet basic project requirements (i.e., alternative basic designs that "redefine the source") are eliminated at this step.

Step 2 – Eliminate Technologically Infeasible Options

To be considered, the candidate control option must be technologically feasible for the application being reviewed.

Step 3 – Rank Remaining Control Options by Control Effectiveness

All feasible options are ranked in the order of decreasing control effectiveness for the pollutant under consideration. In some cases, a given control technology may be listed more than once, representing different levels of control (e.g., the use of SCR for control of NOx may be evaluated at 2 and 2.5 parts per million by volume, dry [ppmvd]). Any control option less stringent than what has been already achieved in practice for the category of source under review must also be eliminated at this step.

Step 4 – Evaluate Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

To be required as BACT, the candidate control option must be cost effective, considering energy, environmental, economic, and other costs. The most stringent control technology for control of one pollutant may have other undesirable environmental or economic impacts. The purpose of Step 4 is to either validate the suitability of the top control option or provide a clear justification as to why that option should not be selected as BACT.

Once all of the candidate control technologies have been ranked, and other impacts have been evaluated, the most stringent candidate control technology is deemed to be BACT, unless the other impacts are unacceptable.

Step 5 – Determine BACT/Present Conclusions

BACT is determined to be the most effective control technology subject to evaluation, and not rejected as infeasible or having unacceptable energy, environmental, or cost impacts.

CO Emissions

Step 1 – Identify All Possible Control Technologies

Potential control technologies were identified by searching the following sources for determinations pertaining to combustion gas turbines:

- SCAQMD BACT Guidelines;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT Guidelines;
- USEPA RACT/BACT/LAER Clearinghouse;
- Other districts' and states' BACT Guidelines; and
- BACT/LAER requirements in New Source Review permits issued by Districts or other agencies.

Oxidation catalyst technology is commonly used to control CO emissions. Combustion controls alone have been determined to be BACT in some regions, but catalyst technology is necessary to achieve the emission levels commonly required in California. Because combustion controls alone will not achieve the stringent levels achievable by other candidate technologies, combustion controls alone will not be considered as a potential control technology in this analysis.

Step 2 – Eliminate Technologically Infeasible Options

The only technology under consideration is use of an oxidation catalyst in combination with combustion controls. This combination of technologies has been demonstrated to be feasible in many applications. No other technologies capable of comparable levels of control have been identified. As a result, the goal of the rest of this analysis is to determine the appropriate emission limit that constitutes BACT for this application.

The ARB's BACT guidance document for electric generating units rated at greater than 50 MW indicates that BACT for the control of CO emissions from stationary gas turbines used for combined-cycle and cogeneration power plants is 6 ppmvd @ 15% O_2.

The BAAQMD's BACT guidelines specify that, for natural gas-fired combined-cycle gas turbines larger than 40 MW, a CO limit of 4 ppmv @ 15% O_2 has been "achieved in practice."

The SJVAPCD's BACT guidelines contain determinations for gas turbines larger than 50 MW with uniform load and heat recovery. The District concluded that a CO exhaust concentration of 6 ppmv @ 15% O_2 constituted BACT that had been achieved in practice, while 4.0 ppmv @ 15% O_2 is considered technologically feasible.

A summary of recent CO BACT determinations for large, combined-cycle gas turbines is shown in Table 2. Similar facilities using oxidation catalysts have been permitted at between 2.0 and 4.0 ppm CO.

There is an important distinction between BACT and the emission limits contained in a permit. BACT is an existing demonstrably achievable emission limit. Achievability may be demonstrated in one of two ways: (1) an existing similar source has consistently and continuously demonstrated compliance with the proposed limit; or (2) the control technology is in use on another source that has enough similarity to make the technology transfer uncontroversial.

The CARB BACT Clearinghouse does not distinguish between these two types of BACT determinations. Muddying the waters still further, some agencies report emission limits that have been accepted by applicants as BACT determinations, when in fact these limits go beyond BACT (that is, they have not been demonstrated in practice, and, while they may be technologically feasible, they may not be cost effective). Once consistent and continuous compliance with the limit has been demonstrated, however, the limit becomes "achieved in practice."

It is therefore important to bear in mind that just because a limit is included in a permit and listed in Table 2 does not mean that the limit is achieved in practice, or even that it is technologically feasible. More information is required to make either determination.

The SJVAPCD recently issued a Final Determination of Compliance for the Avenal Energy Project. At the applicant's request, the FDOC included a 2 ppmc CO limit. Although the District's FDOC and the CEC's Final Staff Assessment both indicated that a CO limit of 2 ppmc went beyond BACT, the District staff have since asserted that the 2 ppmc CO limit should be considered "technologically feasible" for purposes of a BACT determination.

Published prohibitory rules from the BAAQMD, Sacramento Metropolitan AQMD (SMAQMD), San Diego APCD (SDAPCD), SJVAPCD, and SCAQMD were reviewed to identify the CO standards that govern existing natural gas-fired combined-cycle combustion gas turbines. Of the five prohibitory rules reviewed, the SJVAPCD prohibitory rule for combustion gas turbines is the only one that includes an emission limit for CO (200 ppmv @ 15% O_2). The applicable NSPS (40 CFR 60 Subpart KKKK) does not include a CO limit.

This "top-down" CO BACT analysis will consider the following CO emission limitations:

- 2 ppmvd @ 15% O_2
- 3 ppmvd @ 15% O_2
- 4 ppmvd @ 15% O_2

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

The control technologies under consideration are ranked as follows:

- Oxidation catalyst unit capable of achieving 2 ppmvd @ 15% O_2
- Oxidation catalyst unit capable of achieving 3 ppmvd @ 15% O_2
- Oxidation catalyst unit capable of achieving 4 ppmvd @ 15% O_2

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

This step evaluates any source-specific environmental, energy, or economic impacts which demonstrate that the top alternative listed in the previous step is inappropriate as BACT.

"Achieved in Practice" Criterion

As discussed above, BACT may not be less stringent than the most stringent emission limit that has been achieved in practice. The most stringent CO emission limit that has been achieved in practice for a source similar to the one proposed is 4 ppmc.

As shown in Table 2, a number of recent projects have received permits with CO emission limits below 4 ppmc. As discussed below, however, no documentation is available that demonstrates that any of these projects have achieved a more stringent level in practice.

The Magnolia Power Project was permitted with a CO limit of 2 ppm on a 1-hour average basis in 2004 and, according to the SCAQMD staff, has been in operation for several years. EPA staff report that District permit engineers have said that Magnolia completed its performance testing (including for CO) in December 2005. EPA reports that the District source testing staff reviewed the test, and determined the test to be acceptable with all permit conditions and limits being met. However, this indicates only that the Magnolia project met the 2 ppm CO limit during a single initial source test, and provides no information regarding continuous compliance over an extended period. No CEMS data have been provided, and without those data there is no means of determining whether the project has demonstrated continuous compliance with a 2 ppm CO limit during the nearly 4-year period during which the project has apparently been operating. In the absence of CEMS data demonstrating continuous compliance, this installation cannot be the basis for a determination that 2 ppm CO has been achieved in practice.

Even if CEMS data were available, however, the Magnolia permit could not form the basis for a determination that would apply to the proposed project. This is because the NOx limit for the Magnolia permit is 2 ppm averaged over 3 hours. This limit is considered by most permitting agencies to be equivalent to a 2.5 ppm limit averaged over 1 hour.

NOx and CO limits must be considered together, because the combustion conditions that reduce CO tend to increase NOx, and vice versa. To establish a new lower BACT limit for CO, the NOx limit must be taken into account, and must be comparable. Because the NOx limit for the Magnolia project is less stringent than current BACT for NOx, the Magnolia project cannot be used as a basis for demonstrating that 2 ppm CO is achieved in practice for a turbine that must meet 2 ppmc NOx (1 hour average). It can, however, be used to demonstrate the technological feasibility of CO control.

The Berrien Energy Center project was also permitted with a CO limit of 2 ppm. However, the NOx limit for the project is 2.5 ppm on a 24-hour average basis. As in the case of Magnolia, because the NOx limit for the Berrien project is less stringent than current BACT for NOx, the Berrien project also cannot be used as a basis for

demonstrating that 2 ppm CO is achieved in practice for a turbine that must meet 2 ppm NOx on a 1-hour average basis.

The Vernon City Power & Light project was also permitted with a CO limit of 2 ppm. However, the Vernon CTG is based on an Alstom GTX100 gas turbine, which is rated at 43 MW. This is a much smaller gas turbine than the 180 MW F-class gas turbine that will be used at the proposed project, and is considered under a separate SJVAPCD BACT category because of its size. Again, this project cannot be used to demonstrate that the limit has been achieved in practice for this class and category of source.

The Colusa Generating Station (CGS) has been permitted with a 3 ppmc CO limit; however, that project is still under construction so that limit has not yet been achieved in practice at CGS.

Numerous projects have been permitted with and have demonstrated continuous compliance with a 4 ppmc CO limit, so 4 ppmc is considered achieved in practice.

CPVVS has proposed to meet a 3 ppm limit on a 3-hour average basis. This level is more stringent than the current BACT achieved in practice.

TABLE 2

Recent CO BACT Determinations for Combustion Turbines/HRSGs

Facility	District/State	CO Limit (ppmc[a])	Averaging Period (hours)	Control Method Used	Date Permit Issued	Source
Russell City Energy Center	BAAQMD	4.0	3	oxidation catalyst	December 2008	BAAQMD website
Colusa Generating Station	EPA Region 9	3.0	3	oxidation catalyst	May 2008	EPA AQIA
Blythe Energy LLC (Blythe II)[b]	MDAQMD	4.0	3	oxidation catalyst	April 2007	PSD permit
San Joaquin Valley Energy Center	EPA Region 9	4.0	1	oxidation catalyst	August 2006	PSD permit
Magnolia Power Project	SCAQMD	2.0	1	oxidation catalyst	February 2004	SCAQMD website
Vernon City Power & Light	SCAQMD	2.0	3	oxidation catalyst	February 2004	SCAQMD website
PSO Southwestern Power Plant	Oklahoma	25	--	oxidation catalyst	February 2007	EPA RBLC
Rocky Mountain Energy Center	Colorado	3.0	--	oxidation catalyst	May 2006	EPA RBLC
Sierra Pacific Power Company	Nevada	3.5	3	oxidation catalyst	August 2005	EPA RBLC
Wanapa Energy Center[c]	Oregon	2.0	3	oxidation catalyst	August 2005	EPA RBLC
Crescent City Power, LLC	Louisiana	4.0[c]	annual	oxidation catalyst	June 2005	EPA RBLC
Berrien Energy, LLC	Michigan	2.0	3	oxidation catalyst	April 2005	EPA RBLC
Turner Energy Center[d]	Oregon	2.0/3.0	1	oxidation catalyst	January 2005	EPA RBLC

Notes:

a. parts per million by volume, dry @ 15% O_2

b. Construction on hold.

c. Separate CO limit set for duct burners; this limit is for turbines only.

d. Not built.

Technologically Feasible/Cost Effective Criterion

As discussed above, a CO limit of 4 ppmc has been achieved in practice for the CTGs being considered for the Project. Lower CO limits may be technologically feasible, but have not yet been achieved in practice. EPA's top-down BACT guidance allows the consideration of energy, environmental, economic, and other costs in determining whether an emission limitation considered technologically feasible should also be considered BACT.

Two cost-effectiveness analyses are presented, one based on total cost and one based on incremental cost. The calculations are attached. The calculations follow the procedure outlined in OAQPS guidance and use cost data provided by Siemens. The District's cost-effectiveness analysis uses uncontrolled emissions as a baseline and sets a recommended cost threshold for CO of $300 per ton. The uncontrolled CO emissions from the Siemens CTGs during normal operation are 20 ppmvd @ 15% O_2. Using the annual operating assumptions presented for the project in the AFC, annual CO emissions with no CO control would be 453.2 tpy per turbine, while annual CO emissions controlled to 2 ppm during normal operation would be 94.3 tpy per turbine, for an annual reduction of 358.9 tpy per turbine. The annualized cost is $664,739 per year per turbine, for a cost effectiveness of $1,852 per ton. This cost exceeds the District's $300 per ton recommended cost threshold, so under this calculation, the 2 ppm CO limit would not be cost-effective.[1]

The incremental effect of reducing CO during normal operations from 4 ppm to 2 ppm is 6.6 tpy per turbine, at a cost of $63,412 per year per turbine The cost effectiveness is therefore $9,608 per ton, also well in excess of the District's recommended cost threshold.

Determine BACT/Present Conclusions

BACT must be at least as stringent as the most stringent level achieved in practice, required in a federal NSPS or district prohibitory rule, or considered technologically feasible. More stringent levels (e.g., 2 or 3 ppmc) may be technologically feasible, but because the costs of achieving these levels exceed the District's cost threshold and because of other energy and environmental considerations, these lower levels are not considered to be BACT for the proposed project.

Because 4 ppmc has been achieved in practice, and because a more stringent limitation does not meet cost-effectiveness criteria, BACT for CO for the Project turbines is 4 ppmc.

The proposed CO emission limit of 3 ppmvd @ 15% O_2 on a 3-hour average basis is more stringent than the level currently considered BACT.

Further, the applicant does not believe that any significant environmental benefit would be derived from reducing the CO emissions limit for the CPVVS project from 3 to 2 ppm.

[1] The cost of controlling CO emissions to 4 ppm is $562,591 per turbine, and the emission reduction from uncontrolled to 4 ppm is 352.3 tpy per turbine. The cost effectiveness of achieving the current BACT level of 4 ppm is therefore $1,597 per ton. Current achieved-in-practice BACT levels already exceed the cost effectiveness criterion for BACT. Although the cost of controlling CO greatly exceeds the environmental benefits, PSD requires the use of achieved-in-practice controls.

A change from 3 to 2 ppm would reduce annual CO emission by 12.2 tpy out of 201 tpy. A reduction in the CO limit would not affect the project's demonstrations of compliance with the AAQS, because those demonstrations are based on maximum hourly and 8-hour average emissions, which occur during startups, while startup emissions would not be affected by a change in the permit limit for normal operation.

Finally, at the applicant's proposed CO limit of 3 ppm, in-stack CO levels will already be much lower than the federal ambient air quality standards (9.3 ppm, 8-hr and 35 ppm, 1-hr). Therefore, it is physically impossible for the project's operating emissions to cause or contribute to a violation of the AAQS at the 3 ppm CO limit currently proposed.

Conclusions

BACT must be at least as stringent as the most stringent level achieved in practice, required in a federal NSPS or district prohibitory rule, or considered technologically feasible. More stringent levels (e.g. 2 or 3 ppm) may be technologically feasible, but because the costs of achieving these levels exceed the District's cost threshold and because of other energy and environmental considerations, these lower ppm levels are not considered to be BACT for the proposed project.

Because 4 ppm has been achieved in practice, and because a more stringent limitation does not meet cost-effectiveness criteria, BACT for CO for the CPVVS turbines is 4 ppm.

The proposed CO emission limit of 3 ppmvd @ 15% O_2 on a 3-hour average basis is more stringent than the level currently considered BACT.

CPV Vaca Station

CO Cost-Effectiveness Analysis: Oxidation Catalyst: 4 ppm to 2 ppm (per turbine)

Description of Cost		Cost Factor	Cost	Source
Direct Capital Costs (DC)				
Purchase Equipment Costs (PE)				
Basic Equipment			$ 100,000	catalyst vendor
Instrumentation: included			--	OAQPS
Taxes		0.08*(A+B)	$ 8,000	current sales tax rate
Freight		0.03*(A+B)	$ 3,000	OAQPS typical
	PE Total		$ 111,000	
Direct Installation Costs (DI)				
Foundation and supports		0.08 PE	$ 8,880	OAQPS
Handling and Erection		0.14 PE	$ 15,540	OAQPS
Electrical		0.04 PE	$ 4,440	OAQPS
Piping		0.02 PE	$ 2,220	OAQPS
Insulation		0.01 PE	$ 1,110	OAQPS
Painting		0.01 PE	$ 1,110	OAQPS
	DI Total		$ 33,300	
DC Total = PE + DI			$ 144,300	
Indirect Costs (IC)				
Engineering		0.10 PE	$ 11,100	OAQPS
Construction and Field Expensies		0.05 PE	$ 5,550	OAQPS
Contractor Fees		0.10 PE	$ 11,100	OAQPS
Start-up		0.02 PE	$ 2,220	OAQPS
Performance Testing		0.01 PE	$ 1,110	OAQPS
Contingencies		0.03 PE	$ 3,330	OAQPS
	IC Total		$ 34,410	
Total Capital Investments (TCI = DC + IC)			$ 178,710	
Annualized Total Capital Investment (ATCI):			$ 29,084	
Direct Annual Costs (DAC)				
O&M				
Operating Costs			$0	est based on vendor info
Maintenance Costs			$0	est based on vendor info
Utility Costs (U)				
Performance loss in output	30 kW		0.011%	catalyst vendor
Electricity Cost	$0.0696 per kWH		$ 10,905	NCPA
Catalyst Replacement		3 year lifetime	$ 16,275	catalyst vendor
Catalyst Disposal		included	included	
Indirect Annual Costs (IAC)				
Overhead		60% of O&M	$ -	
Administrative		0.02 TCI	$ 3,574	
Insurance		0.01 TCI	$ 1,787	
Property Tax		0.01 TCI	$ 1,787	
Total Annual Cost (ATCI + DAC + IAC)			**$ 63,412**	
CO emissions (Achieved in Practice)	4 ppm		105.9	tons/yr
CO emissions (Tech Feasible)	2 ppm		99.3	tons/yr
CO Reduction			6.6	tons/yr
MCET			**$ 1,980**	
Cost-Effectiveness			**$ 9,608**	

CPV Vaca Station
CO Cost-Effectiveness Analysis: Oxidation Catalyst: 20 ppm to 2 ppm

Description of Cost		Cost Factor	Cost	Source	
Direct Capital Costs (DC)					
Purchase Equipment Costs (PE)					
Basic Equipment			$ 800,000	catalyst vendor	
Instrumentation: included			--	OAQPS	
Taxes		0.08*(A+B)	$ 64,000	current sales tax rate	
Freight		0.03*(A+B)	$ 24,000	OAQPS typical	
	PE Total		$ 888,000		
Direct Installation Costs (DI)					
Foundation and supports		0.08 PE	$ 71,040	OAQPS	
Handling and Erection		0.14 PE	$ 124,320	OAQPS	
Electrical		0.04 PE	$ 35,520	OAQPS	
Piping		0.02 PE	$ 17,760	OAQPS	
Insulation		0.01 PE	$ 8,880	OAQPS	
Painting		0.01 PE	$ 8,880	OAQPS	
	DI Total		$ 266,400		
DC Total = PE + DI			$1,154,400		
Indirect Costs (IC)					
Engineering		0.10 PE	$ 88,800	OAQPS	
Construction and Field Expensies		0.05 PE	$ 44,400	OAQPS	
Contractor Fees		0.10 PE	$ 88,800	OAQPS	
Start-up		0.02 PE	$ 17,760	OAQPS	
Performance Testing		0.01 PE	$ 8,880	OAQPS	
Contingencies		0.03 PE	$ 26,640	OAQPS	
	IC Total		$ 275,280		
Total Capital Investments (TCI = DC + IC)			$1,429,680		
Annualized Total Capital Investment (ATCI):			$ 232,674		
Direct Annual Costs (DAC)					
O&M					
Operating Costs			$15,000	est based on vendor info	
Maintenance Costs			$12,000	est based on vendor info	
Utility Costs (U)					
Performance loss in output	110 kW		0.039%	catalyst vendor	
Electricity Cost	$0.0696 per kWH		$ 38,736	NCPA	
Catalyst Replacement		3 year lifetime	$ 292,942	catalyst vendor	Year (3-10)
Catalyst Disposal		included	included		3 yr lifetime
					$1,800,000 estimated
Indirect Annual Costs (IAC)					
Overhead		60% of O&M	$ 16,200		
Administrative		0.02 TCI	$ 28,594		
Insurance		0.01 TCI	$ 14,297		
Property Tax		0.01 TCI	$ 14,297		
Total Annual Cost (ATCI + DAC + IAC)			**$ 664,739**	1,329,477.75	
CO emissions (Siemens)	20		453.2	tons/yr	
CO emissions (Tech Feasible)	2		94.3	tons/yr	
CO Reduction			358.9	tons/yr	
MCET			**$ 107,670**		
Cost-Effectiveness			**$ 1,852**		

Cooling Tower Top-Down BACT Analysis
CPV Vaca Station
Competitive Power Ventures, LLC

I. Introduction

The Prevention of Significant Deterioration Program (PSD) (Clean Air Act §160-169A, 42 USC §7470-7491; 40 CFR Parts 51 and 52) requires review and facility permitting for construction of new or modified major stationary sources of air pollution. PSD review applies with respect to "attainment pollutants" (criteria pollutants for which the area has been designated attainment or unclassified). PSD review includes a federal requirement to apply Best Available Control Technology (BACT) on a pollutant-by-pollutant basis, depending on facility emission rates.

The CPVVS project is required to use BACT for PM_{10} on the cooling tower. For sources subject to PSD review, BACT is defined in 40 CFR 52.21(j) as:

> "an emissions limitation…based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…"

II. Calculation of PM, PM_{10}, and $PM_{2.5}$ Emissions from the Proposed Cooling Tower

Wet cooling towers cool water by evaporating a portion of the water through contact with the air. The nature of the contact is such that water droplets are entrained in the air and are carried out of the cooling tower. The entrained droplets are called "drift." Modern cooling towers have high efficiency drift eliminators which recover much of the entrained water. The high-efficiency drift eliminator proposed for this project will reduce drift to less than 0.0005% of circulated cooling tower water.

The water that is entrained contains dissolved solids. When a water droplet that contains solids evaporates, the dissolved solids form a single particle, which remains suspended in the air. The volume of a droplet can be calculated if its diameter is known. The mass of water in the droplet can be calculated from the volume. The mass of solids in the droplet (and the resulting particle) can be calculated from the mass of the water droplet and the concentration of solids in the water. The volume of the particle can be calculated if the density of the solid is known. The diameter of a spherical particle can be calculated from the particle volume. The size of the final aerosol particle depends on the volume fraction of solid material and the droplet diameter as follows:

$$D_s = D_d \times (F_v)^{1/3}$$

Where:

D_s = diameter of solid particle
D_d = diameter of liquid droplet
F_v = volume fraction of solid material

This equation can be converted to calculate the resulting particle diameter for a cooling tower by accounting for the density of the particle:

$$D_s = D_d \times (\rho_d/\rho_s \times TDS/1{,}000{,}000)^{1/3}$$

Where:

D_s = diameter of solid particle
D_d = diameter of liquid droplet
ρ_d = density of droplet = 1 g/cm^3
ρ_s = density of solid particle = 2.2 g/cm^3 for sodium chloride
TDS = total dissolved solids, ppmw

The above equation predicts the physical diameter of a particle formed from a cooling tower droplet. This equation assumes that a single particle will be formed when a droplet evaporates, because there is no evidence that multiple particles will be formed.

The term "aerodynamic diameter" has been developed by aerosol physicists in order to provide a simple means of categorizing the sizes of particles having different shapes and densities with a single dimension. The aerodynamic diameter is the diameter of a spherical particle having a density of 1 gm/cm^3 that has the same inertial properties (i.e., terminal settling velocity in the gas as the particle of interest). The PM_{10} and $PM_{2.5}$ standards refer to aerodynamic diameter.

Therefore, in order to calculate PM_{10} and $PM_{2.5}$ emissions, the aerodynamic diameter of the cooling tower particles must be calculated as follows:[1]

$$D_a = D_s \times (\rho_s)^{0.5}$$

The following table represents the predicted mass distribution of drift droplet size for cooling tower drift dispersed from Marley TU12 Excel Drift Eliminators. This table was provided by the cooling tower vendor.

[1] *http://www.epa.gov/air/oaqps/eog/bces/module3/diameter/diameter.htm* accessed August 8, 2008

Table 2 Predicted Drift Droplet Size Distribution		
Mass in Droplets (%)		Droplet Size (Microns)
0.2	Larger Than	525
1.0	Larger Than	375
5.0	Larger Than	230
10.0	Larger Than	170
20.0	Larger Than	115
40.0	Larger Than	65
60.0	Larger Than	35
80.0	Larger Than	15
88.0	Larger Than	10

Using the equations described above, a solids density of 2.2 gm/cm^3 (based on the density of sodium chloride), and the droplet size distribution in the previous table, the following particle diameter distribution can be derived:

Table 3 Predicted Particle Aerodynamic Size Distribution		
Mass in Droplets (%)		Aerodynamic Particle Size (Microns)
0.2	Larger Than	124.5
1.0	Larger Than	89.0
5.0	Larger Than	54.6
10.0	Larger Than	40.3
20.0	Larger Than	27.3
40.0	Larger Than	15.4
60.0	Larger Than	8.3
80.0	Larger Than	3.6
88.0	Larger Than	2.4

Based upon this particle size distribution, 44% of the particles emitted from the cooling tower will be PM_{10} or smaller. Fifteen percent of the particles emitted from the cooling tower will be $PM_{2.5}$ or smaller.

PM emissions from the cooling tower were calculated using the tower design parameters listed in Table 4. PM_{10} and $PM_{2.5}$ fractions were calculated using the mass fractions calculated above. PM, PM_{10}, and $PM_{2.5}$ emissions are shown in Table 4.

Table 4 **PM, PM_{10}, and $PM_{2.5}$ Emissions from Cooling Tower[1]**	
Pollutant, units	Emissions
PM, lb/hr PM, lb/day PM, tpy	3.19 76.6 13.99
PM_{10}, lb/hr PM_{10}, lb/day PM_{10}, tpy	1.41 33.7 6.15
$PM_{2.5}$, lb/hr $PM_{2.5}$, lb/day $PM_{2.5}$, tpy	0.48 11.5 2.10

[1]Based on June 2009 tower design parameters:
142,000 gal/min, Drift = 0.005%, TDS = 9000 ppm, 24 hours/day, 365 days/year

Based on the above calculations, the cooling tower does not trigger the District's BACT requirement for PM_{10}, even if all of the PM is assumed to be PM_{10}. BACT for PM_{10} emissions is required under PSD.

III. Top-Down BACT Analysis

Step 1 – Identify All Possible Control Technologies

The first step in a top-down analysis is to identify, for the emissions unit and pollutant in question, all available control options. Available control options are those air pollution control technologies or techniques, including alternate basic equipment or processes, with a practical potential for application to the emissions unit in question. The control alternatives should include not only existing controls for the source category in question, but also through technology transfer, controls applied to similar source categories and gas streams.

The emissions unit for which BACT is being considered is a recirculating wet (evaporative) cooling tower.

Potential control technologies were identified by searching the following sources for entries pertaining to cooling towers:

- SCAQMD BACT Guidelines
- SJVAPCD BACT Clearinghouse
- BAAQMD BACT Guidelines
- USEPA RACT/BACT/LAER Clearinghouse
- Other districts' and states' BACT Guidelines
- BACT/LAER requirements in New Source Review permits issued by AQMD or other agencies

BACT determinations from the SCAQMD, SJVAPCD, BAAQMD, and USEPA are summarized in Table 5.

Table 5
Summary of PM_{10} BACT Clearinghouse Guidelines

Permitting Agency	Guideline	Operation	PM_{10} BACT for Cooling Towers
SCAQMD	None	N/A	N/A
SJVAPCD	8.3.10	Induced Draft Evaporative Cooling Tower	Cellular Type Drift Eliminator
BAAQMD	None	N/A	N/A
USEPA	Numerous	Cooling Towers for Combined-Cycle and Cogeneration Power Plants	Drift Eliminators 0.0005% Drift Rate

Recent BACT determinations approved by the California Energy Commission (CEC) through the Application for Certification (AFC) process are summarized in Table 6. These determinations were made by the indicated permitting authority.

Table 6
PM_{10} BACT Determinations for Cooling Towers in CEC Proceedings
(CEC Approval Dates in 2008 and 2009)

Permitting Agency	Project	PM_{10} BACT for Cooling Towers
BAAQMD	Russell City	Drift rate of 0.0005% (FDOC amended 12/12/08)
MDAQMD	Victorville 2	Drift rate of 0.0005% (FDOC 1/10/08)
Colusa County AQMD	Colusa	No BACT determination (FDOC 6/12/07)
SJVAPCD	Starwood	No BACT determination (FDOC 7/19/07)

BACT must be at least as stringent as what has been achieved in practice (AIP) for a category or class of source. Additionally, USEPA guidelines require that technology that is determined to be AIP for one category of source be considered for transfer to other source categories. There are two types of potentially transferable control technologies: (1) exhaust stream controls, and (2) process controls and modifications. For the first type, technology transfer must be considered between source categories that produce similar exhaust streams. For the second type, technology transfer must be considered between source categories with similar processes. In order to be considered, the candidate control technology must be technologically feasible for the application being reviewed. In order to be required as BACT, the candidate technology must be cost effective, considering energy, environmental, economic, and other costs.

Three possible alternate basic technologies were identified from background technical materials prepared during the rulemaking of USEPA's National Pollutant Discharge Elimination System (NPDES): Regulations Addressing Cooling Water Intake Structures for New Facilities (Federal Register 66:24, December 18, 2001). The NPDES regulation establishes national technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities using once-through cooling. During the rulemaking process, USEPA also evaluated alternatives to once-through cooling, including recirculating wet cooling systems, dry cooling systems and hybrid cooling systems.

Recirculating Wet Cooling Tower with High Efficiency Drift Eliminator
In conventional closed-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. Approximately 80% of the heat transfer (cooling) occurs due to evaporation, and 20% of the heat transfer occurs due to

convection.[2] Therefore, wet cooling towers are more effective in areas of low relative humidity.

Dry Cooling Tower
Dry cooling systems (towers) use either a natural or a mechanical air draft to transfer heat from the condenser tubes to air. Their effectiveness is independent of relative humidity and purely a function of the ambient (dry-bulb) temperature. Therefore, dry cooling towers are more effective in areas of low ambient temperature. One of the stated objectives of CPVVS is to take advantage of the recycled water available from the City of Vacaville's Easterly Wastewater Treatment Plant. The use of dry cooling would not achieve this objective. However, dry cooling will be retained beyond Step 1 in the top-down analysis and will be evaluated in further steps.

Hybrid Cooling Tower (Plume-Abated Wet Cooling)
There are two types of hybrid wet-dry cooling towers. One type is essentially a wet cooling tower with an additional dry section installed on top which reduces visible plumes by heating the wet air from the wet section. This is done to reduce or eliminate the visible condensation plume.

Hybrid Cooling Tower (Spray-Enhanced Dry Cooling)
The second type of hybrid system is essentially a dry cooling tower that enhances heat transfer in the condenser tubes by spraying water on the outside of the tubes.

Once-though Cooling
Once-through cooling systems eliminate the cooling tower entirely by drawing cooling water from a water source (such as a river or the ocean), using the water to cool the condensers, and then discharging the heated water, usually back to the original water source.

Step 2 – Eliminate Technologically Infeasible Options

The next step in the top-down BACT procedure is to eliminate technologically infeasible options.

Recirculating Wet Cooling Tower
As shown in Table 6, recirculating wet cooling towers equipped with high-efficiency (0.0005%) drift eliminators is the proposed technology and has been achieved in practice.

Dry Cooling
USEPA has adopted standards for new facilities that draw cooling water from waters of the US.[3] The regulation established the best technology available for minimizing adverse environmental impacts associated with the use of cooling water intake structures.

[2] Hensley, John C., ed. 2006. *Cooling Tower Fundamentals*. SPX Cooling Technologies, Inc. 2006.
[3] 66 Federal Register 65255, December 18, 2001

As part of the rulemaking process, USEPA considered the technical issues, cost, and environmental impacts associated with replacing once-through cooling with recirculating cooling towers and dry cooling. USEPA rejected dry cooling as the best replacement technology due to all three of these factors. For the purposes of this BACT analysis, the technical issues are evaluated in this step. The environmental impacts and cost considerations of dry cooling are evaluated in the following step.

The three main technical issues associated with dry cooling towers are increased steam turbine backpressure, increased space needs, and increased downwash effects. Dry cooling results in increased steam turbine backpressure because of its inability to condense steam at 100% capacity on very hot days. For safety reasons, steam turbines are designed so that a plant shutdown will be triggered if back pressure limits are exceeded. The thermal inefficiency of dry cooling has caused turbine back pressure limits to be exceeded at existing plants, which in turn, has triggered plant shutdowns. Because the potential for increased steam turbine backpressure is most severe when the ambient temperature is highest, the resulting plant shutdowns occur when electricity demand is at its peak.

Another potential issue associated with dry cooling towers is space. Because dry cooling systems rely only on convective and radiant heat transfer, they require a significantly larger footprint compared to wet cooling towers. For existing facilities, this may constitute a practical obstacle to installation of dry cooling. For a new facility, however, the need for additional space is more a question of cost than feasibility.

A third potential issue associated with dry cooling towers is increased downwash effects. When the wind blows over large structures, a wake effect on the leeward side of the building can pull the air down toward the ground, a meteorological condition known as building wake downwash. Because structures for dry cooling are much larger than comparable wet cooling towers, the downwash effect is potentially greater. Increased downwash can result in higher ambient concentrations from nearby emissions sources.

For the purposes of this analysis, dry cooling was not eliminated as a potential BACT option due to increased turbine backpressure or space constraints. It is possible that these issues would prohibit the use of dry cooling at CPVVS; however, a more detailed engineering analysis would be required. As shown in the next steps, the environmental and energy impacts of dry cooling preclude its selection as the appropriate BACT option.

Hybrid Cooling (Plume-Abated Wet Cooling Tower)

Hybrid wet-dry (plume abated) cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers. In general, a hybrid cooling tower is used only where a visible plume presents a threat to public safety by its interference with major infrastructure, such as airports or in some cases if the plume will block prominent landscape features or scenic coastal areas.

Hybrid cooling towers offer only insignificant changes in PM, $PM_{10,}$ $PM_{2.5}$, and emissions compared to wet cooling towers. After the warm, moist air passes through the drift eliminators of the wet section, it is mixed with warm dry air that passed through the

dry section. This step speeds the evaporation that would normally occur after the plume was released. While most remaining liquid drift may be eliminated within the cooling tower via evaporation, the particulate nuclei are not reduced or eliminated by any physical process and are exhausted through the top of the cooling tower.

Even though this option does not decrease PM emissions from the cooling tower, it also has not been deemed technologically infeasible as appropriate BACT for the CPVVS cooling tower. Therefore the environmental and economic impacts of this option are discussed in the following steps.

Hybrid Cooling Tower (Spray-Enhanced Dry Cooling)
A spray-enhanced hybrid cooling tower works essentially as a dry cooling tower that enhances heat transfer in the condenser tubes by spraying water on the outside of the tubes. The addition of the evaporating water spray can help alleviate both of the technical issues associated with dry cooling. Increased cooling decreases the likelihood of turbine backpressure events and may allow for fewer, more efficient dry cooling cells to be installed, thus shrinking the plant footprint required for the cooling tower. Therefore, this BACT option has not been deemed technologically infeasible; however, it is possible that the same technical issues associated with dry cooling could render spray-enhanced dry cooling infeasible pursuant to a detailed engineering analysis.

Once-through Cooling
Once-through cooling involves the water withdrawn from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters. In general, once-though cooling is only technologically feasible when a large surface water body exists in immediately proximity to the power plant. Since this situation does not exist for the CPVVS project, once-though cooling has been deemed a technologically infeasible BACT option and will not be further evaluated.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Aside from the proposed BACT technology of a wet cooling tower with high-efficiency drift eliminators, the remaining three technologies employ full or partial dry cooling in various ways. In evaluating once-though cooling replacement technologies, USEPA determined that dry cooling costs are sufficient to pose a barrier to entry to the marketplace for some projected new facilities. Additionally, dry cooling was determined to have a detrimental effect on electricity production by reducing energy efficiency of steam turbines, also known as the "energy penalty."[4]

The energy penalty results from the power producer utilizing more energy than would otherwise be required with recirculating wet cooling to produce the same amount of power. Dry cooling results in increased parasitic loads from larger recirculation pumps and fans required by dry cooling. Additionally, because the degree of cooling of the water affects the efficiency of the steam turbine, dry cooling can result in raising the

[4] 66 Federal Register 65255, December 18, 2001, p. 65282

overall "heat rate" of the power plant by increasing the backpressure to the steam turbine. These effects are discussed in further detail in Chapter 3 of the Technical Development Document for the NPDES Regulation, entitled: *Energy Penalties, Air Emissions, and Cooling Tower Side-Effects*\.

Dry Cooling

As a result of the analysis for the NPDES rule, USEPA concluded that energy penalties associated with dry cooling tower systems pose a significant feasibility problem in some climates. It follows that the energy penalty would be the highest in climates that exhibit (1) high ambient (dry bulb) temperatures, and (2) low relative humidity. As the ambient temperature increases, the convection rate between the "hot" water and the "hot" ambient air decreases in a dry cooling tower. Also, as relative humidity decreases, the rate of evaporation (which is responsible for 80% of the cooling) increases in a wet cooling tower. The opportunity cost of not using the most efficient cooling technology in a particular climate adds to the energy penalty. For the CPVVS project, it is noted that the energy penalty would be highest at the time of peak demand, i.e., summer heat episodes with typically low relative humidity when the plant would expected to be operating at its peak load.

In Chapter 3 of the Technical Development Document, USEPA estimated the mean annual performance penalty of a full dry cooling system relative to recirculating wet cooling tower in four separate US climates—Boston, Massachusetts; Jacksonville, Florida; Chicago, Illinois; and Seattle, Washington. Of these climates, Jacksonville would most closely resemble the climate of Vacaville due to having the highest ambient temperatures. Because Jacksonville experiences high relative humidity compared to Vacaville, any energy penalties calculated for Jacksonville would be even higher in Vacaville due to the factors discussed in the previous paragraph. Therefore, the energy penalties calculated at Jacksonville are an extremely conservative estimate of the energy penalties that would be experienced by CPVVS.

The Technical Development Document calculated the total energy penalties of dry cooling by summing the individual penalties of turbine efficiency losses with increased energy usage by pumps and fans. In Table 3-15, the turbine efficiency losses of a dry cooling tower compared to a wet cooling tower were calculated to be 1.96% of the total electrical output of a combined cycle power plant operating in Jacksonville. This represents the annual average penalty experienced while the plant's steam turbine is operating at 67% of its maximum design load. In Table 3-20, the energy penalties of increased water pumping and fan usage were calculated to be 0.42% of the total electrical output of a combined cycle power plant (independent of location and turbine load). Therefore, the total energy penalty associated with dry cooling at a Jacksonville combined cycle power plant equals 2.38% of total electrical output, which will also be assumed for CPVVS.

Hybrid Cooling (Plume-Abated Wet Cooling)

A plume-abated wet cooling tower is no more effective in eliminating drift and particulate matter compared to a wet cooling tower, but carries some of the energy

penalties associated with dry cooling.[5] For this reason, a plume abated cooling tower is ranked lower than a wet cooling tower for PM_{10} BACT purposes. Since this technology is less effective than the proposed technology when taking into account the technologies environmental impacts, it is eliminated from consideration and no further analysis is necessary.

Hybrid Cooling (Spray Enhanced Dry Cooling)

As discussed in the previous step, spray-enhanced dry cooling results in lower turbine efficiency losses compared to a full dry cooling system. The additional pumps for water spray would increase fan and pump losses by a small degree. The effectiveness of the water spray recovering a portion of the energy penalties was evaluated in a study entitled, *Spray Enhancement of Dry Air-Cooled Condensers*, prepared by the Electric Power Research Institute for the California Energy Commission, dated September 2003. The report conducted empirical testing on a single dry cooling cell located at the Crockett Cogeneration Co. located in Crockett, California (approximately 25 miles southwest of the proposed CPVVS project). The report concluded that during hot and dry periods (over 100º F), spray enhancement could reduce the temperature of the airflow through the cooling tower by as much as 75% of the wet bulb depression, or about 18º F. The corresponding reduction of steam turbine backpressure was determined using a curve of ambient temperature versus backpressure, and the corresponding increase in plant efficiency was determined using a curve of turbine backpressure versus electrical output. The overall conclusion of the study was that under certain conditions, approximately half of the turbine's lost output could be restored.[6]

For the purpose of this analysis, the turbine efficiency loss energy penalty of spray-enhanced dry cooling was assumed to be 50% of that associated with dry cooling, or 0.98%. This was added to the pumping and fan losses of dry cooling (0.42%) to determine an overall energy penalty of 1.40%.

Because of energy penalties, power producers using dry cooling or hybrid spray-enhanced dry cooling burn more fuel and produce more air emissions per kilowatt-hour of energy produced. For the purpose of this evaluation, the increases in air emissions were estimated as percent increases in the effective annual emissions of criteria pollutants emitted by the project. It should be noted that the actual effect of the performance penalty would be to reduce CPPVS' peak production capacity on days when demand is highest, necessitating dispatch to other plants with even higher emissions.[7]

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[5] This is because the amount of heat transferred in the dry section of the hybrid cooling tower is the amount of sensible heat needed to lower the relative humidity and eliminate the visible plume from the wet section exhaust—a very small fraction of the total heat transfer in the tower. This results in an insignificant change in the circulating water flow rate in the hybrid tower as compared to a standard wet cooling tower, and, consequently, similar particulate emission rates as compared to a standard wet cooling tower.

[6] p. 7-8

[7] Since gas-fired power plants in California are dispatched on an economic basis which is closely tied to plant operating costs and hence plant efficiency, plants that are more efficient than CPVVS would already be operating during these peak days. Consequently, additional generation required to make up for an energy penalty at CPVVS would, of necessity, come from a less efficient plant which, by definition, would have higher fuel use for every kwh of electricity produced.

The effective annual CTG/DB emission rates due to a 2.38% energy penalty for dry cooling and a 1.40% energy penalty for spray-enhanced dry cooling compared to a recirculating wet cooling tower are shown in Table 7. The emission rates for the CTG/DB's using wet cooling are twice those listed Table 5.1-17 of the AFC.

Table 7
Annual Emissions Per Cooling Technology—Both CTGs Combined

	Wet Tower	Dry Tower	Spray-Enhanced Dry Tower
Pollutant	tons/year	tons/year	tons/year
NO_x	156.5	160.2	158.7
SO_2*	14.2	14.5	14.4
CO	200.8	205.6	203.6
ROC	51.9	53.1	52.6
PM_{10}	71.0	72.7	72.0

*Based on maximum short-term natural gas sulfur content of 1.0 gr/100 scf.

The effective net change in annual criteria pollutant emissions from CPVVS are shown in Table 8. The net emissions change reflects the elimination of 8.0 tons/year of PM_{10} emissions from the cooling tower (shown in Table 5.1-17 of the AFC) for the dry cooling tower and spray-enhanced dry cooling tower options.

Table 8
Effective Net Change in Stationary Source Emissions Compared to Wet Cooling

	Dry Tower	Spray-Enhanced Dry Tower
Pollutant	Tons/year	Tons/year
NO_x	3.72	2.19
SO_2*	0.34	0.20
CO	4.78	2.81
ROC	1.23	0.73
PM_{10}	-6.31	-7.00

*Based on maximum short-term natural gas sulfur content of 1.0 gr/100 scf.

In addition to criteria pollutant emissions, the energy penalty of dry cooling will result in a similar increase in greenhouse gas (GHG) emissions. GHG emissions were calculated in Table 5.1A-13B of the AFC Appendix, and are summarized in Table 9.

Table 9
CPV Vaca Station Greenhouse Gas Emissions (Using Wet Cooling)

Unit	Maximum Emissions, metric tons/year			
	CO_2	CH_4	N_2O	SF_6
CTG, base load	1,139,034	19.39	2.15	0.00
CTG, peak load	954,272	16.24	1.80	0.00
Auxiliary boiler	7,531	0.13	0.01	0.00
Breakers	0	0.00	0.00	4.72E-03
Total	2,100,837	35.76	3.97	4.72E-03
CO_2eq	2,100,837	751	1,232	113
			TOTAL	**2,102,933**

By applying the same energy penalty percentages noted previously (2.38% for dry cooling and 1.4% for spray-enhanced dry cooling) to the CTG/DB operating under both base and peak loads, the net change in GHG emissions can be calculated. This is shown in Table 10.

Table 10
Effective Net Change in Stationary Source GHG Emissions Compared to Wet Cooling

Pollutant	Dry Tower (metric tons/year)	Spray-Enhanced Dry Tower (metric tons/year)
CO_2	49,821	29,306
CH_4	0.85	0.50
N_2O	0.09	0.06
SF_6	0	0
CO_2eq	49,868	29,334

The remaining technologies were ranked according to PM_{10} reductions, as shown in Table 11. The corresponding effect on the emissions of other criteria pollutants and GHGs are shown along with the associated energy penalty.

Table 11 Effective Net Change in Maximum Annual Criteria Pollutant Emissions, GHG Emissions, and Energy Usage							
Equipment	Net Emission Change, TPY						Energy
	PM_{10}	SO_2	CO	ROC	NOx	CO_2e	
Hybrid Spray-Enhanced Dry Cooling Tower	-7.00	0.20	2.81	0.73	2.19	29,334	2.38% annual average penalty
Dry Cooling Tower	-6.31	0.34	4.78	1.23	3.72	49,868	1.40% annual average penalty
Recirculating Wet Cooling Tower with High-Efficiency (0.0005%) Drift Eliminators	0	0	0	0	0	0	None
Hybrid Plume-Abated Wet Cooling Tower	0	0	0	0	0	0	Unquantified energy penalty due to plume abatement system

Step 4 – Evaluation of Environmental, Energy, and Cost Impacts

This step evaluates any source-specific environmental, energy, or economic impacts which demonstrate that the top alternative shown in Table 11 is inappropriate as BACT.

As demonstrated in the previous steps, the main concern associated with both dry cooling and spray-enhanced dry cooling is the associated energy penalty and the collateral increases in emissions of criteria pollutants and GHGs emitted by the project to overcome this penalty. In order to evaluate whether the reduction in PM_{10} emissions is outweighed by the increases in emissions of other criteria pollutants, the YSAQMD BACT cost-effectiveness thresholds (shown in Table 12) were employed to determine a multi-pollutant cost effectiveness threshold.

Table 12 YSAQMD BACT Cost-Effectiveness Thresholds	
Pollutant	$/ton
NO_x	24,500
SO_2	3,900
CO	300
ROC	17,500
PM_{10}	5,700

The cost-effectiveness thresholds are used by the District to determine whether a proposed control technology is cost-effective (i.e., that the environmental benefits of reducing emissions justify the added expense to the applicant to employ the control technology).

Because the use of alternative cooling tower PM_{10} control techniques results in a significant increase in other criteria pollutants, it is necessary to determine whether the environmental benefits from reducing PM_{10} outweigh the environmental cost of increasing combustion emissions. One way of doing this is to perform a multi-pollutant cost-effectiveness analysis.

In conducting this analysis, it is assumed that the $/ton cost-effectiveness threshold is a good characterization of the relative environmental impact of each pollutant. If one pollutant's threshold is 10 times higher than another pollutant's threshold, it is assumed that the environmental impact of the first pollutant is 10 times that of the second.

Multiplying the PM_{10} emission decrease by the PM_{10} cost-effectiveness threshold gives the annual cost, in dollars, that is justified by the emission reduction. Multiplying the increase in other pollutants by the corresponding cost-effectiveness thresholds gives the annual cost, in dollars, that would be justified by avoiding those emissions. The cost justified by the alternative control technique can be calculated by subtracting the cost justified by controlling the increased pollutants from the cost justified by controlling the PM_{10}.

Table 13 Multi-pollutant Cost Effectiveness Calculation						
Emissions/Equipment	PM_{10}	SO_2	CO	ROC	NOx	Weighted Cost Effectiveness
Hybrid Spray-Enhanced Dry Cooling Tower	-7.00	0.20	2.81	0.73	2.19	-$28,153
Dry Cooling Tower	-6.31	0.34	4.78	1.23	3.72	-$79,458
Recirculating Wet Cooling Tower with High-Efficiency (0.0005%) Drift Eliminators	0	0	0	0	0	-
Hybrid Plume-Abated Wet Cooling Tower	0	0	0	0	0	Negative

Table 13 shows that the two top-ranked control technologies have maximum annualized costs that are negative. This is because dry cooling and spray-enhanced dry cooling cause increases in emissions of other pollutants due to the energy penalty. A negative cost effectiveness means that the environmental value of PM_{10} reductions is outweighed by the increases in SO_2, CO, ROC, and NOx emissions.

Other environmental considerations weighing against these two technologies are the increase in GHG emissions and increased energy use. In water-limited areas, these increases may be acceptable, especially if limits on water use are so severe as to render a recirculating wet cooling tower technologically infeasible. However, in the case of CPVVS, sufficient makeup water (reclaimed effluent from the nearby Easterly Wastewater Treatment Plant) is available to compensate for evaporation and blowdown. For these reasons, it is concluded that dry cooling and spray-enhanced dry cooling are inappropriate as BACT and would actually have a detrimental effect on regional air quality.

While not calculated, hybrid plume-abated wet cooling would also have negative annualized cost. Similar to any cooling option that employs dry technology, an associated energy penalty is created by the forced evaporation of the plume within the cooling tower structure. Since the same particulate matter emissions are emitted through the cooling tower, the overall facility emission increase by the same percentage as the energy penalty. For this reason, hybrid plume abated cooling towers are only used in locations where the safety concerns or adverse visual impacts of the plume outweigh the increase in emissions and energy usage. Since plume visibility is not an issue of CPVVS, hybrid plume-abated wet cooling is inappropriate BACT.

Step 5 – Select BACT

Based upon the above information, BACT is use of a high-efficiency drift eliminator with a drift rate of 0.0005% or less. The proposed cooling tower complies with this BACT level.

Additional Impacts Analysis[1]
CPV Vaca Station

Introduction

USEPA's *New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting* states the following:

> *Although each applicant for a **PSD** permit must perform an additional impacts analysis, the depth of the analysis generally will depend on existing air quality, the quantity of emissions, and the sensitivity of local soils, vegetation, and visibility in the source's impact area.*[2]

As a part of the application for a Prevention of Significant Deterioration (PSD) permit for the CPV Vaca Station (CPVVS), Region 9 of the U.S. Environmental Protection Agency (USEPA) has requested the applicant to submit a summary of the additional impacts analysis conducted for the Project as required by federal regulation.[3] The response below is divided into three parts, as follows: Class II visual impact analysis, impacts on soils and vegetation, and growth-inducing impacts.

Class II Visibility Impairment Analysis

The Class II Visibility Impairment Analysis is distinct from the Class I visibility analysis. The goal of the analysis is to determine the degree to which the PSD project will impair visibility in sensitive areas such as state parks, wilderness areas, scenic sites, and overlooks.

A Class II Visibility Impairment Analysis was performed for this project. The methodology and the results are presented below.

METHODOLOGY

In general, the Class II Visibility Analysis methodology follows the methodology for a Class I Visibility Analysis. To expedite the analysis, a series of screening analyses of increasing complexity are performed. If any screening step indicates that the project's potential to impair visibility in a sensitive area is insignificant, then the analysis is complete. Otherwise, the next level of analysis is performed.

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[1] USEPA. *New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting (draft)*, Chapter D, October 1990.
[2] *Ibid*, page D.1.
[3] *Ibid*.

Step 1 – Determine the Study Area

The first step is to determine the area for which visibility impacts will be considered. The study area is the ***significant impact area*** (defined below), or a 50 km circle centered on the project site, whichever is larger. The study area may extend beyond the significant impact area (out to the 50 km circle) because the goal of the analysis is to determine the potential for a project plume to interfere with visibility in a sensitive area.

The significant impact area (for visibility purposes) is the area where the project's modeled ground-level concentrations exceed the following PSD significant impact levels for one or more of the three visibility-related criteria pollutants:

- NO_2 (annual average): 1 µg/m^3
- SO_2 (annual average): 1 µg/m^3
- SO_2 (24-hour average): 5 µg/m^3
- SO_2 (3-hour average): 25 µg/m^3
- PM_{10} (annual average): 1 µg/m^3
- PM_{10} (24-hour average): 5 µg/m^3

Step 2 – Identify Sensitive Class II Areas Within the Study Area

The second step is to determine the Class II areas ("sensitive" Class II areas) that need to be evaluated within the study area defined in Step 1. Candidate sensitive Class II areas are state and national parks, state and national recreation areas, and designated national wilderness areas within the study area that are not Class I areas. If there are no sensitive Class II areas contained—in whole or in part—within the study area, then the screening procedure is completed; otherwise, a Visibility Screening Analysis must be conducted.

Step 3 – Conduct Visibility Screening Analysis

Screening Level 0

The Federal Land Manager[4] (FLM) informal screening criterion[5] and significance threshold[6] are used to determine if the proposed source has emissions high enough to potentially affect the visibility of the sensitive Class II areas within the study area. If the FLM informal screening value is less than the threshold of 10, then no further analysis of potential visibility impacts on Class II areas is necessary. If the value is greater than 10, then proceed to Screening Level 1.

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[4] The Federal Land Managers with the most land areas of concern for PSD impact analysis include the National Park Service, National Forest Service, and Bureau of Land Management.

[5] The FLM informal screening criterion is the ratio of visibility-related emissions (i.e., NOx + SOx + PM_{10}) in tons per year divided by the distance in kilometers to the Class I or II area being evaluated.

[6] The screening criterion threshold for determining if the impact is significant is a ratio of 10. Note that this criterion defines a maximum distance (=[tons of emissions/10] km) where the project might potentially impact visibility. Any Class I or Class II area beyond this distance is deemed be insignificantly affected. .

Although Screening Level 0 is not described in the 1990 draft NSR guidance, it is the procedure that has subsequently been developed for reviewing visibility impacts on Class I areas. As previously mentioned, and as described in the NSR guidance, the Class II Visibility Impact Analysis follows the procedures for the Class I analysis.

Screening Level 1

The Level 1 visibility screening analysis is a series of conservative calculations designed to identify those emission sources that have little potential of adversely affecting visibility. The VISCREEN model is used in the Level 1 analysis to model visibility impacts for observers located at each sensitive Class II site for which the FLM screening value is exceeded. Calculated values relating source emissions to visibility impacts are compared to a standardized screening value. Those sources with calculated values greater than the screening criteria are judged to have potential visibility impairments. If potential visibility impairments are identified, then the Level 2 analysis is undertaken.

The relevant visibility parameters are "apparent contrast" and "delta E", which can be computed by the screening visibility model VISCREEN. The significance thresholds for these two visibility parameters, used as significance criteria in the Class II screening analysis, are the Class I area thresholds (i.e., 0.05 and 2.00 for apparent contrast and delta E, respectively) increased by the ratio of the PSD Class II PM_{10} increment to the PSD Class I PM_{10} increment (i.e., 30 $\mu g/m^3$ divided by 8 $\mu g/m^3$). As shown in Table 1, the thresholds are an apparent contrast of 0.19 and a delta E of 7.50.

Screening Level 2

The Level 2 screening procedure is similar to the Level 1 analysis in that its purpose is to estimate impacts during worst-case meteorological conditions; however, more specific information regarding the source, topography, regional visual range, and meteorological conditions is assumed to be available. The analysis may be performed with the aid of either hand calculations, reference tables, and figures, or a computer-based visibility model called "PLUVUE II."

If the Levels 1 and 2 screening analyses indicate the possibility of visibility impairment, a still more detailed analysis is undertaken in Level 3.

Level 3 Analysis

The Level 3 analysis, no longer a screening analysis, uses the plume visibility model and meteorological and other regional data to provide an accurate description of the magnitude and frequency of occurrence of impact. The procedures for utilizing the plume visibility model are described in the document *User's Manual for the Plume Visibility Model,* which is available from EPA.

Table 1 Visibility Parameter Significance Thresholds					
Visibility Parameter or Criteria Pollutant	Averaging Period/Units	Federal Class I Area PSD Ambient Air Increment	Federal Class II Area PSD Ambient Air Increment	Federal Class I Area Significance Threshold	Federal Class II Area Significance Threshold
Apparent Contrast	1 hour [a]/(-)	NA	NA	0.05[b]	0.19[c]
Delta E	1 hour [a]/(-)	NA	NA	2.00[b]	7.50[c]
PM_{10}	24 hours/ ($\mu g/m^3$)	8[d]	30[d]	Not used	Not used

NA = not applicable

[a] Shortest period emission rates of visibility-related criteria pollutants used in VISCREEN model. USEPA, *Workbook for Plume Visual Impact Screening and Analysis (Revised)*, EPA-454/R-92-023, October 1992.

[b] VISCREEN model

[c] Estimated by multiplying the federal Class I area significance threshold for the visibility parameter by the ratio of the 24-hr average federal Class II and Class I area PM_{10} PSD increments.

[d] These maximum allowable increases are found in the Code of Federal Regulations, Title 40, Part 52, Section 52.21(c), *Ambient air increments*.

RESULTS

Step 1

The ambient air quality analysis presented in the AFC indicates that the project results in air quality impacts that exceed the PSD significant impact levels (SILs). Annual NO_2 impacts and 1-hour and 24-hour and annual PM_{10} impacts exceed the corresponding SILs. The extent of the significant impact is a small area to the northeast of the plant containing agricultural fields. The impact areas are shown in the attached Figures 1, 2, and 3.

The significant impact area is the circular area, centered on the project, with a radius that includes the most distant modeled significant impact. The significant impact area was reviewed for potentially sensitive state or federal parks, forests, monuments, or recreation areas (No such state or federal areas are located in this area.[7])

The study area for the visibility impacts analysis is the circular area extending 50 km from the center of the project site. Several California state parks are located in the study area and are evaluated in Step 2.

[7] The nearest park is Brannan Island State Recreational Area, located 30.5 km SE of the project site.

Step 2

The following five California state parks were identified as being wholly or partially located within a 50 km radius of the property, with the minimum distance to the project as indicated. The California State Capitol will be evaluated as a surrogate for several other state parks located in close proximity within the City of Sacramento since it is the largest and most likely to experience potential visible impacts. Also, Benicia Capitol State Historic Park and the Woodland Opera House State Historic Park were determined not to be sensitive to potential visibility impacts because of their urban settings.

Table 2
Sensitive Class II Areas in Study Area

Site	Distance from Project (km)	FLM Screening Value (tons/km)
Brannan Island State Recreational Area	30.5	8.2
Frank's Tract State Recreational Area	38.1	6.6
Benicia State Recreational Area	38.6	6.5
California State Capital	43.9	5.7
Cowell Ranch/ John Marsh Property	49.7	5.0

Screening Level 0 (FLM screening)

The sum of the project's annual combined emissions of NOx, SOx, and PM_{10} is 250.8 tons/year[8]. Under the FLM screening procedure, the project will cause no significant impairment to visibility for any observer located more than 25.1 km from the project site.

Because the closest sensitive Class II site is 30.5 km from the project site, none of the ratios exceeded the FLM informal screening value threshold of 10. The highest ratio of 8.2 occurs at the Brannan Island State Recreational Area. No further analysis is required.

Screening Level 1 (VISCREEN modeling)

At the request of Region 9 staff, a Level 1 screening analysis was conducted for informational purposes. The results are presented below.

[8] From AFC, Table 5.1-17: NOx = 157.6 tons/year, SOx = 14.2 tons/year, and PM10 = 79.0 tons/year

As recommended by the EPA Visibility Workbook (Revised 1992), the analysis began with a coherent plume analysis for each of the sensitive Class II areas in the study area by performing a Level 1 VISCREEN analysis. The Level 1 analysis assumes worst-case meteorology: F stability and a 1-meter per second wind that persists for 12 hours and carries the plume to a hypothetical observer located in the Class I area. The default ozone background level of 0.04 ppm was used. In accordance with the examples included in the EPA Visibility Workbook, the VISCREEN modeling was conducted using expected operating emissions for the new equipment. The default background visual range for each park was determined using Figure 9 of the EPA Visibility Workbook.

The VISCREEN results and model output for all five parks are summarized in Tables 3 through 7. The final four columns show the Level 1 screening criteria and results for the project's plume. The color and contrast screening criteria are not exceeded by the proposed facility against both sky and terrain and views both within and outside of the sensitive Class II areas. It is therefore concluded that the CPV project will not cause a significant visibility impact on sensitive Class II areas.

Table 3
CPV VACA Station Visibility Impacts on Brannan Island State Recreational Area

Background Visual Range: 40 km
Source-Observer Distance: 30.5 km
Min. Source-Class I Distance: 30.5 km
Max. Source-Class I Distance: 31.4km

Maximum Visual Impacts INSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	84	30.5	84	7.5	0.955	0.19	0.004
Sky	140	84	30.5	84	7.5	0.374	0.19	-0.008
Terrain	10	84	30.5	84	7.5	0.651	0.19	0.008
Terrain	140	84	30.5	84	7.5	0.122	0.19	0.005
Maximum Visual Impacts OUTSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	0	1.0	168	7.5	1.248	0.19	0.012
Sky	140	0	1.0	168	7.5	0.245	0.19	-0.011
Terrain	10	0	1.0	168	7.5	1.851	0.19	0.02
Terrain	140	0	1.0	168	7.5	0.531	0.19	0.019

Table 4
CPV VACA Station Visibility Impacts on Frank's Tract State Recreational Area

Background Visual Range: 40 km
Source-Observer Distance: 38.1 km
Min. Source-Class I Distance: 38.1 km
Max. Source-Class I Distance: 43.9 km

Maximum Visual Impacts INSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	84	38.1	84	7.5	0.752	0.19	0.003
Sky	140	84	38.1	84	7.5	0.281	0.19	-0.006
Terrain	10	84	38.1	84	7.5	0.423	0.19	0.005
Terrain	140	84	38.1	84	7.5	0.083	0.19	0.003
Maximum Visual Impacts OUTSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	40	31.4	129	7.5	0.792	0.19	0.003
Sky	140	40	31.4	129	7.5	0.276	0.19	-0.007
Terrain	10	0	1.0	168	7.5	0.947	0.19	0.009
Terrain	140	0	1.0	168	7.5	0.279	0.19	0.009

Table 5
CPV VACA Station Visibility Impacts on Benicia State Recreational Area

Background Visual Range: 25 km
Source-Observer Distance: 38.6 km
Min. Source-Class I Distance: 38.6 km
Max. Source-Class I Distance: 39.7 km

Maximum Visual Impacts INSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	84	38.6	84	7.5	0.457	0.19	0.002
Sky	140	84	38.6	84	7.5	0.137	0.19	-0.004
Terrain	10	84	38.6	84	7.5	0.15	0.19	0.002
Terrain	140	84	38.6	84	7.5	0.033	0.19	0.002
Maximum Visual Impacts OUTSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	70	36.7	99	7.5	0.462	0.19	0.002
Sky	140	70	36.7	99	7.5	0.139	0.19	-0.004
Terrain	10	55	34.5	114	7.5	0.173	0.19	0.002
Terrain	140	55	34.5	114	7.5	0.039	0.19	0.002

Table 6
CPV VACA Station Visibility Impacts on California State Capital

Background Visual Range: 60 km
Source-Observer Distance: 43.9 km
Min. Source-Class I Distance: 43.9 km
Max. Source-Class I Distance: 44.5 km

Maximum Visual Impacts INSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	84	43.9	84	7.5	0.623	0.19	0.003
Sky	140	84	43.9	84	7.5	0.224	0.19	-0.005
Terrain	10	84	43.9	84	7.5	0.309	0.19	0.004
Terrain	140	84	43.9	84	7.5	0.062	0.19	0.003
Maximum Visual Impacts OUTSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	50	38.4	119	7.5	0.649	0.19	0.003
Sky	140	50	38.4	119	7.5	0.225	0.19	-0.006
Terrain	10	0	1	168	7.5	0.569	0.19	0.005
Terrain	140	0	1	168	7.5	0.169	0.19	0.005

Table 7
CPV VACA Station Visibility Impacts on Cowell Ranch/John Marsh Property

Background Visual Range: 40 km
Source-Observer Distance: 49.7 km
Min. Source-Class I Distance: 49.7 km
Max. Source-Class I Distance: 54.3 km

Maximum Visual Impacts INSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	84	49.7	84	7.5	0.469	0.19	0.002
Sky	140	84	49.7	84	7.5	0.163	0.19	-0.004
Terrain	10	84	49.7	84	7.5	0.208	0.19	0.003
Terrain	140	84	49.7	84	7.5	0.043	0.19	0.002
Maximum Visual Impacts OUTSIDE Class II Area								
					Delta E		Contrast	
Background	Theta	Azi	Dist	Alpha	Criterion	Plume	Criterion	Plume
Sky	10	50	43.4	119	7.5	0.538	0.19	0.002
Sky	140	50	43.4	119	7.5	0.179	0.19	-0.005
Terrain	10	50	43.4	119	7.5	0.271	0.19	0.004
Terrain	140	50	43.4	119	7.5	0.059	0.19	0.003

Impacts on Soils and Vegetation

For most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects because the secondary NAAQS are set to protect public welfare, including animals, plants, soils, and materials. One section of the AFC submitted to the CEC provides a discussion of the Facility's potential impacts on soils and vegetation: Section 5.2 – Biological Resources. This section was included as part of the PSD permit application.

EPA provided guidance[9] in 1980 to determine if maximum modeled ground-level concentrations of Project-emitted criteria pollutants NO_2, SO_2, and CO could have an impact on plants, soils, and animals. As shown in Table 8, the maximum modeled concentrations from the Project are well below the thresholds.

Table 8
Project Maximum Concentrations and EPA Guidance Levels

Criteria Pollutant and Guidance [a] Averaging Time	EPA Screening Concentration ($\mu g/m^3$)	Modeled Maximum Concentrations [b] ($\mu g/m^3$)	Averaging time
SO_2 1-Hour	917	12.9	1 hour
SO_2 3-Hour	786	7.1	3 hour
SO_2 Annual	18	0.2	Annual
NO_2 4-Hours	3,760	170.1	1 hour
NO_2 1-Month	564	170.1	1 hour
NO_2 Annual	94	2.3	Annual
CO Weekly	1,800,000	23.6	8 hour

[a] A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals," EPA 450/2-81-078, December 1980
[b] Tables 5.1-24 and 5.1-27 of Section 5.1

Growth-Inducing Impacts

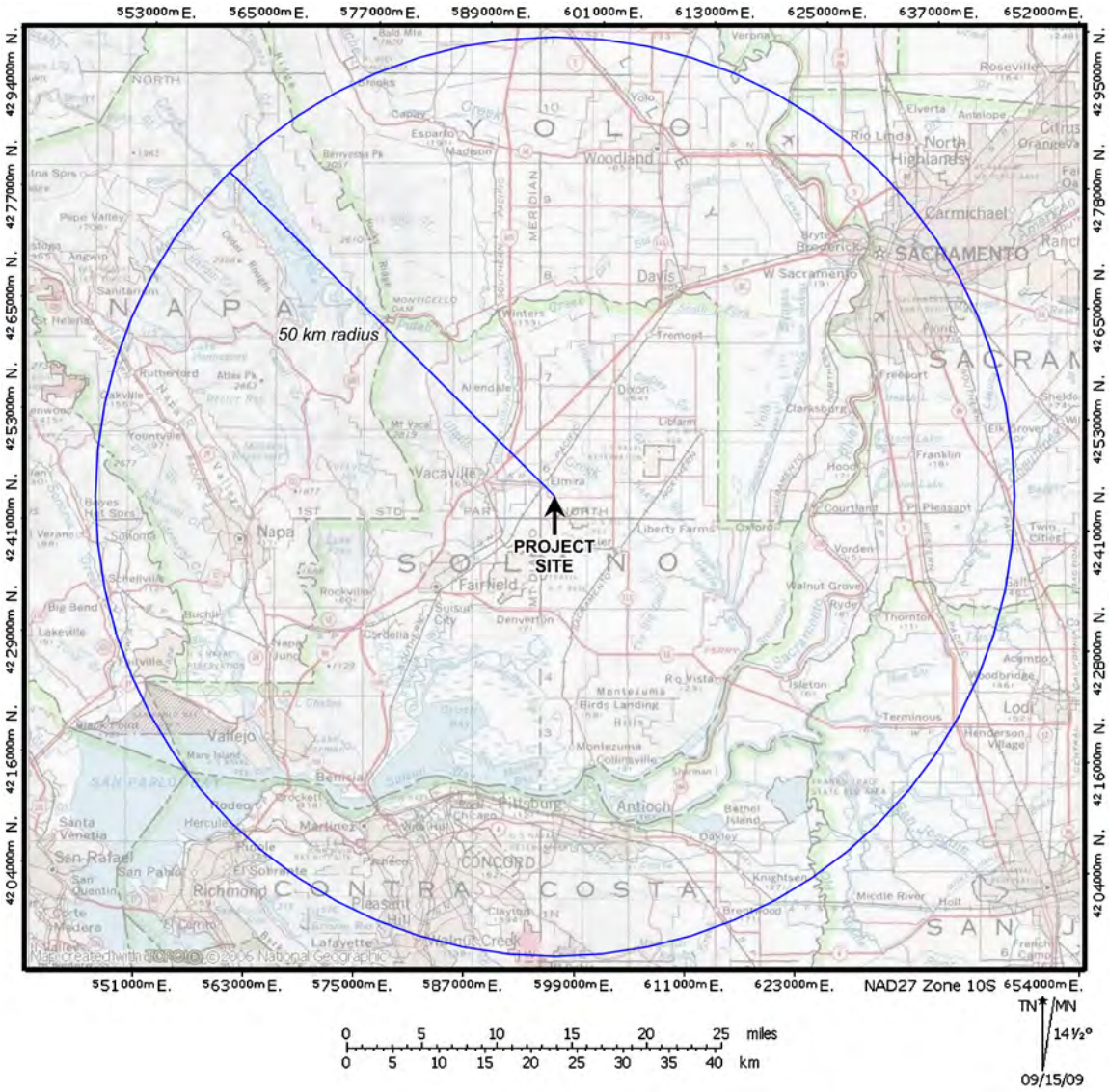
The project's less-than-significant potential growth-inducing impacts on population, housing, schools, utilities, and emergency and other services are discussed in the AFC, Section 5.10 – Socioeconomics, pages 5.10-12 through 5.10-21.

[9] USEPA. *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals," EPA 450/2-81-078, December 1980.*

Little to no associated commercial growth is expected as a result of the project. The proposed project is an electrical generating station. The proposed plant will be located immediately adjacent to the an existing wastewater treatment plant which will be the source of water used by the project. The area where the proposed project will be located is used primarily for agricultural purposes. Therefore, little or no associated industrial, commercial, and residential source growth is expected to occur in the area due to the project.

Figure 1

CPV Study Area



Note: Project impact area and project boundary are too small to be visible at this scale.

Figure 2

NOx Annual Average Impacts > 1 µg/m^3

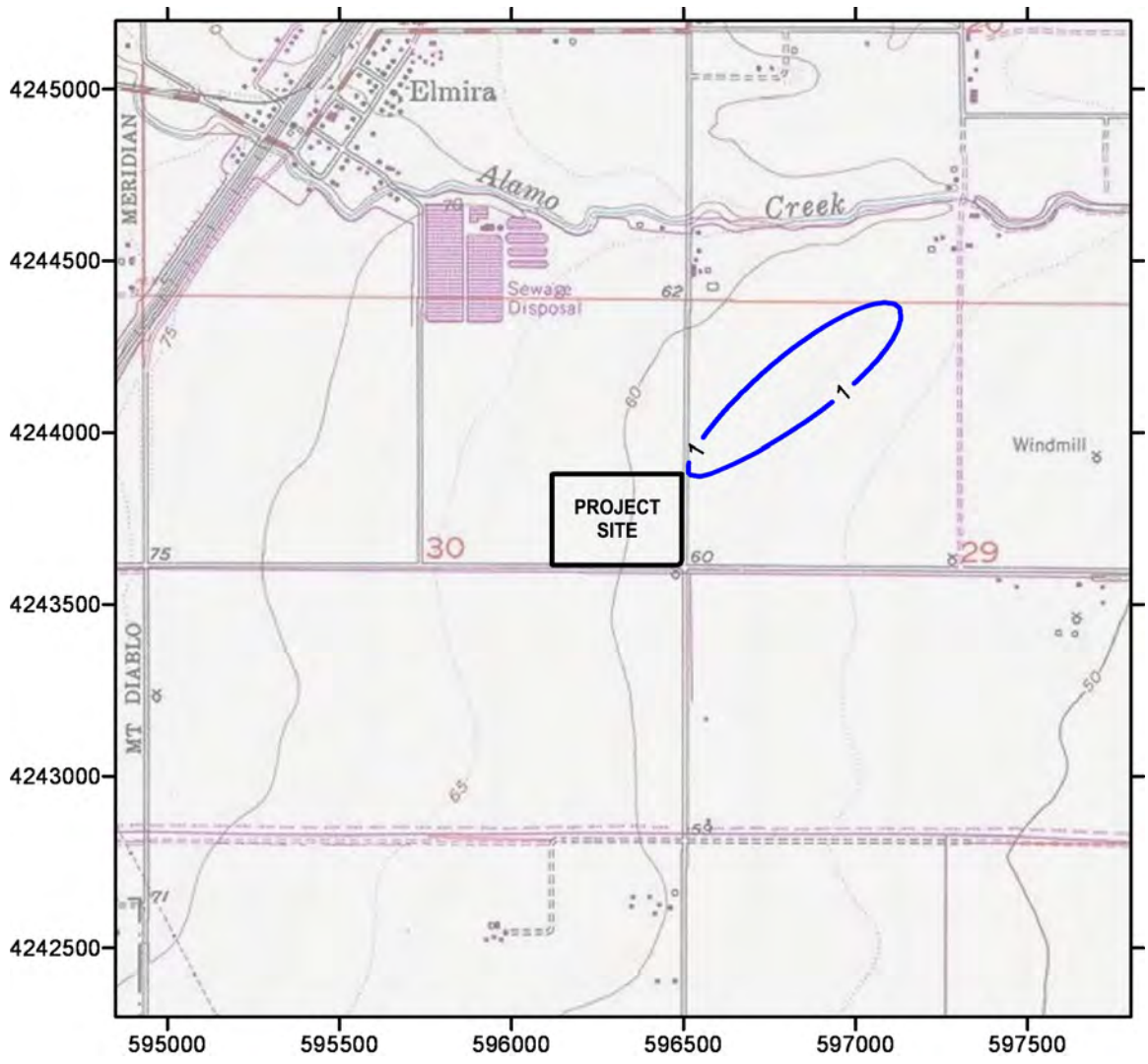


Figure 3

24-Hour $PM_{2.5}$ Impacts > 5 µg/m^3

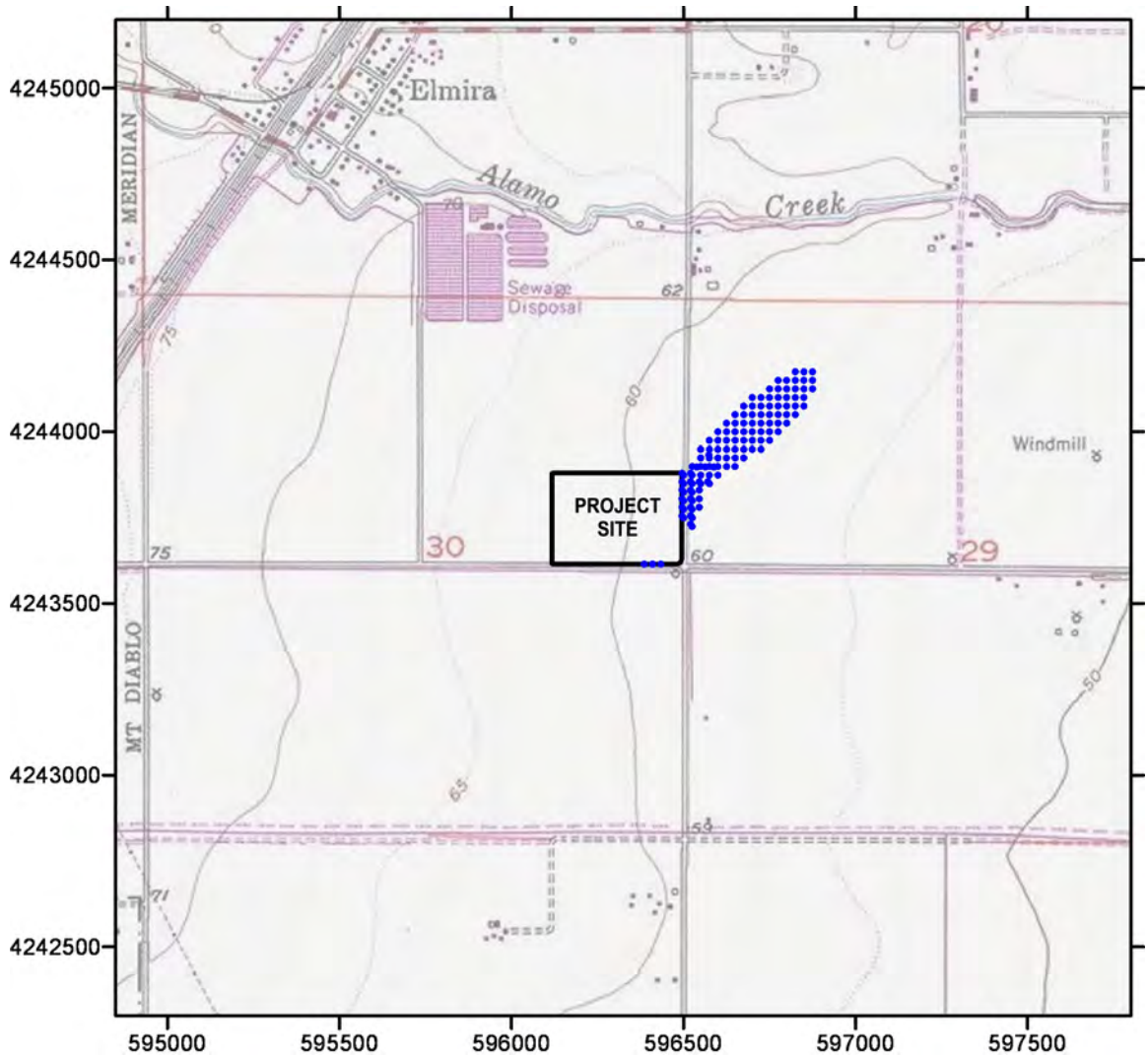
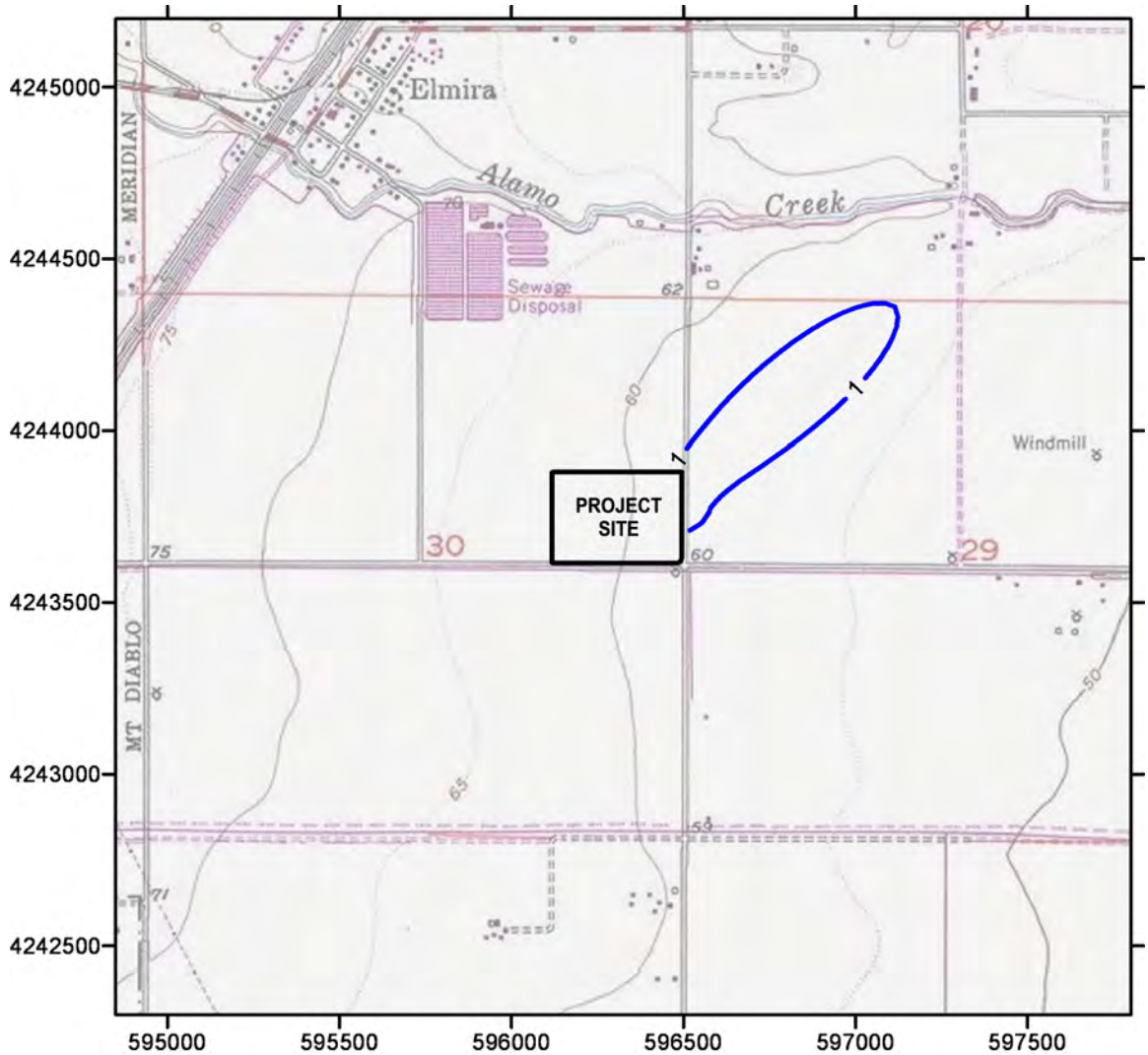


Figure 4

Annual $PM_{2.5}$ Impacts > 1 µg/m^3



STATE OF CALIFORNIA
ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

In the Matter of:	)	Docket No. 08-AFC-11
	)	
Application for Certification,	)	**PROOF OF SERVICE**
for the CPV VACA STATION POWER PLANT	)	
PROJECT	)	(June 3, 2009)
by CPV Vacaville, LLC	)	
	)	

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CPV VACA STATION POWER PLANT PROJECT
CEC Docket No. 08-AFC-11

DECLARATION OF SERVICE

I, Paul Kihm, declare that on November 24, 2009, I served and filed copies of the attached:

LETTER FROM STEVE HILL TO GERARDO RIOS RE RESPONSE TO PSD APPLICATION INCOMPLETE LETTER (JULY 23, 2009)

to all parties identified on the Proof of Service List above in the following manner:

California Energy Commission Docket Unit

☒ Transmission via electronic mail and by depositing a copy via FedEx overnight mail delivery service at Costa Mesa, California, with delivery fees thereon fully prepaid and addressed to the following:

CALIFORNIA ENERGY COMMISSION
Attn: DOCKET NO. 08-AFC-11
1516 Ninth Street, MS-4
Sacramento, California 95814-5512
docket@energy.state.ca.us

For Service to All Other Parties

☒ Transmission via electronic mail to all email addresses on the Proof of Service list; and

☒ by depositing one paper copy with the United States Postal Service via first-class mail at Costa Mesa, California, with postage fees thereon fully prepaid and addressed as provided on the Proof of Service list to those addresses **NOT** marked "email preferred."

I further declare that transmission via electronic mail and U.S. Mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 24, 2009, at Costa Mesa, California.

Paul Kihm