



November 7, 2005

Alameda County Dept. of Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway
Alameda, California 94502-6577
Attn: Bob Schultz

**RE: Groundwater Monitoring Results, First through Fourth Quarter 2004
Cargill Salt – Alameda Facility, Alameda, California**

Dear Mr. Shultz,

The attached report presents the groundwater monitoring results for First through Fourth Quarter 2004 for the Cargill Salt Alameda facility. Results of groundwater transect sampling and the initial sampling of three groundwater monitoring wells installed in November 1999 were reported in the January 31, 2000 submittal, "Groundwater Characterization and Monitoring Well Installation" prepared by Crawford Consulting, Inc. and Conor Pacific/EFW. The monitoring wells were installed to help characterize and monitor the occurrence of volatile organic compounds, primarily tetrachloroethene (PCE) and its breakdown product, trichloroethene (TCE), in groundwater at the site. Since the initial groundwater monitoring well sampling event, groundwater monitoring has been conducted on a quarterly basis. The quarterly monitoring data generally confirm the results of the groundwater transect sampling and initial sampling of the monitoring wells.

Off-site characterization activities, including installation of a fourth groundwater monitoring well, were conducted in November and December 2001 to evaluate the off-site extent of VOCs in the soil and groundwater. The results of these activities were submitted in the August 21, 2002 report "Off-Site Groundwater Characterization" prepared by Conor Pacific/EFW.

To the best of my knowledge the attached report is true, complete, and correct. Should you have any questions concerning the report, please don't hesitate to call me at (510) 790-8625.

Sincerely,

A handwritten signature in cursive script, appearing to read "Teri Peterson".

Teri Peterson
Environmental Manager

Groundwater Monitoring Results
First through Fourth Quarter 2004
Cargill Salt - Alameda Facility
Alameda, California
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Alameda County
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Environmental Health

**Groundwater Monitoring Results
First through Fourth Quarter 2004
Cargill Salt – Alameda Facility
Alameda, California**

Prepared for:

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**Project No. CS1605
November 7, 2005**

Contents

1	Introduction	1
1.1	Background Information	1
1.1.1	Site Description	1
1.1.2	Summary of Investigative and Remedial Activities	2
1.1.3	Source of VOC Impact.....	3
1.2	Reporting Period Activities	3
2	Groundwater Flow Analysis	4
2.1	Water-Level Measurement.....	4
2.2	Groundwater Flow Direction and Gradient	4
2.3	Groundwater Velocity	5
3	Groundwater Sampling and Analysis.....	6
3.1	Sample Collection and Analysis	6
3.2	Analytical Results	6
3.2.1	Quality Control.....	6
3.2.2	Groundwater Results	9
3.3	Discussion.....	10
	Professional Certification	
	References	
	Limitations	

Tables

- Table 1. Groundwater Level Data
- Table 2. Relative Percent Difference Based on Duplicate Samples
- Table 3. Summary of Groundwater Monitoring Well Data

Illustrations

- Figure 1. Site Location
- Figure 2. Groundwater Monitoring Well Locations
- Figure 3. Graphical Summary of Groundwater Elevation Data
- Figure 4. Groundwater Elevation Contours - March 2004
- Figure 5. Groundwater Elevation Contours - June 2004
- Figure 6. Groundwater Elevation Contours - September 2004
- Figure 7. Groundwater Elevation Contours - December 2004
- Figure 8. VOC Concentrations in Groundwater - March through December 2004
- Figure 9. Graphical Summary of PCE Concentrations

Appendices

(presented in electronic format only)

- Appendix A. Field Data Sheets
- Appendix B. Groundwater Velocity Calculations
- Appendix C. Certified Analytical Reports and Chain-of-Custody Documentation

Electronic File

Entire report presented in electronic file format (pdf) on CD-ROM inside back cover.

1 Introduction

Crawford Consulting, Inc. (Crawford) has prepared this report on behalf of Cargill Salt for the Cargill Salt Dispensing Systems Division facility (hereafter, the Site) in Alameda, California.

Results of groundwater transect sampling and the initial sampling of three groundwater monitoring wells installed in November 1999 were presented in the January 31, 2000 report, *Groundwater Characterization and Monitoring Well Installation, Cargill Salt - Alameda Facility, Alameda, California* (Crawford Consulting, Inc. and Conor Pacific/EFW). The purpose of the groundwater transect sampling and the monitoring well installation and sampling was to help characterize and monitor the occurrence of volatile organic compounds (VOCs), primarily tetrachloroethene (PCE) and its breakdown product, trichloroethene (TCE), previously detected in groundwater at the Site.

One of the recommendations in the report was to confirm the groundwater analytical results of the newly installed monitoring wells (wells MW-1, MW-2, and MW-3) and the groundwater flow direction and gradient via quarterly monitoring. Since the initial groundwater monitoring well sampling event in November 1999, groundwater monitoring has been conducted on a quarterly basis and reported annually.

Cargill Salt conducted additional characterization activities in November and December 2001 to evaluate the off-site extent of VOCs in the soil and groundwater. Soil and groundwater samples were collected and analyzed from a neighboring residential property and along Clement Avenue, slug tests were performed in the three existing monitoring wells, and a groundwater monitoring well (MW-4) was installed in Clement Avenue.

Background information and a summary of the groundwater monitoring activities for the first through fourth quarters of 2004 are presented below.

1.1 Background Information

A description of the Site and a summary of the development of characterization and monitoring programs for the Site are presented in this section.

1.1.1 Site Description

Alameda is an island on the east side of San Francisco Bay, separated from Oakland by a tidal canal (Figure 1). The Cargill Salt Dispensing Systems Division facility is located on a rectangular lot in an industrial and residential neighborhood. The facility building occupies approximately one-third of the site and is separated from the vacant, unpaved side of the lot by an asphalt driveway (Figure 2). The site is bordered by a sheet-metal shop and a residential lot to the northwest, an apartment complex to the southwest, and a residential lot to the southeast.

From 1951 to 1978, the Alameda facility produced salt-dispensing units, which required casting and milling aluminum parts. Casting now occurs off site; the facility still mills and repairs salt-dispensing units.

Constituents of concern associated with site operations have included casting sands with elevated concentrations of metals, and solvents, machine oils, and grease used in casting and milling operations. As discussed below, previous investigations and remedial activities have investigated and remediated metals and solvents (VOCs) in vadose-zone soil.

1.1.2 Summary of Investigative and Remedial Activities

Cargill Salt initiated site investigative activities in 1993 to determine if facility operations had impacted site soils. Cargill Salt submitted the results of the soil sampling investigation to the Alameda County Environmental Health Services (ACEHS) in October 1993 along with a workplan for excavation and disposal of impacted soils and assessment of potential impact to groundwater (Groundworks Environmental, Inc. [Groundworks], 1993).

After approval of the workplan by ACEHS, Cargill Salt conducted several phases of soil remediation and groundwater characterization. Surficial soils impacted by metals were excavated for disposal off site. Vadose-zone soils with the highest degree of impact by VOCs were also excavated for off-site disposal (see "Soil excavation area" on Figure 2).

The results of these activities were submitted to the ACEHS in a report, *Soil and Groundwater Investigations and Remedial Activities, July 1993 - September 1994, Cargill Salt - Alameda Facility, Alameda, California* (Groundworks, 1995). Recommendations for additional work to further delineate the lateral and vertical extent of VOCs in groundwater beneath the site were presented in the report.

A workplan for the additional delineation of VOCs in groundwater, *Workplan for Groundwater Characterization and Monitoring Well Installation, 2016 Clement Avenue, Alameda, California* (CCI), was submitted to the ACEHS in July 1999.

After approval of the workplan by the ACEHS, Cargill Salt conducted groundwater sampling and well installation activities during August and November of 1999. The results of these activities were submitted to the ACEHS in a report, *Groundwater Characterization and Monitoring Well Installation, Cargill Salt - Alameda Facility, Alameda, California* (Crawford Consulting, Inc. and Conor Pacific/EFW, dated January 31, 2000). Since the initial groundwater monitoring well sampling event in November 1999, groundwater monitoring has been conducted on a quarterly basis and reported annually.

A workplan for remedial investigation activities, *Workplan for Off-Site Characterization, Cargill Salt - Alameda Facility, Alameda, California* (Conor Pacific/EFW), was submitted to the ACEHS in June 2001. After approval of the workplan by the ACEHS, Cargill Salt conducted characterization activities in November and December 2001 to evaluate off-site extent of VOCs in the soil and groundwater. Soil and groundwater samples were collected and analyzed from a neighboring residential property and along Clement Avenue, slug tests were performed in the three existing monitoring wells, and a groundwater monitoring well (MW-4) was installed in Clement Avenue. The results of these activities were submitted to the ACEHS in the August 21, 2002 submittal *Off-Site Groundwater Characterization, Cargill Salt - Alameda Facility, Alameda, California*, prepared by Conor Pacific/EFW.

1.1.3 Source of VOC Impact

As discussed in the 1995 report, the occurrence of VOCs in soils and groundwater at the site appears to be the result of a discharge or spill to surficial soils at a location near the rear property line at the southwestern corner of the property. The area with the highest degree of chemical impact was delineated prior to excavation and was then excavated using a backhoe and transported off-site for appropriate disposal. It is possible that the VOCs detected in soils and groundwater at this location were associated with waste products from facility operations. The VOCs may be associated with solvents previously used for degreasing operations at the facility, although there are no records indicating use of PCE. Site records indicate that the solvents used for degreasing operations were not PCE-based solvents.

It is also possible that the VOCs and oil and grease are associated with waste products discarded from neighboring properties. There is an apartment complex next to the rear property line of the facility, and the laundry room for this complex is in the utility shed immediately adjacent to the rear property line. This laundry room is only 4 feet away from the area of highest impact to soil. If PCE associated with laundry cleaning products were spilled in this laundry room, it is possible that it could have drained onto the Cargill Salt property.

1.2 Reporting Period Activities

Since the initial sampling and analysis event in November 1999, groundwater monitoring has been conducted on a quarterly basis. This report presents the results of groundwater monitoring data collected during the first through fourth quarters of 2004. For each quarterly period, groundwater levels in the Site monitoring wells were measured, groundwater samples were collected and analyzed, and the groundwater flow direction and gradient were determined. The quarterly monitoring schedule for 2004 is shown below.

Quarter of 2004	Field Dates
First	March 4, 2004
Second	June 2, 2004
Third	September 14, 2004
Fourth	December 8, 2004

Supervision of the quarterly monitoring events was conducted for Cargill Salt by Crawford. Groundwater level measurements and collection of groundwater samples were conducted by Field Solutions, Inc. The groundwater samples for the first through fourth quarters of 2004 were analyzed by STL Chromalab, Inc., a state-certified laboratory in Pleasanton, California.

2 Groundwater Flow Analysis

Groundwater levels were measured quarterly and groundwater contour maps were prepared for the first through fourth quarter 2004 reporting period.

2.1 Water-Level Measurement

Water levels in groundwater monitoring wells (MW-1, MW-2, MW-3, and MW-4) were measured each quarter, before any of the groundwater monitoring wells were purged for sampling for the quarterly monitoring event. The groundwater monitoring well locations are shown on Figure 2. The water levels were measured with an electric sounder. The depth to water at each well was recorded on a *Water Level Field Data* sheet (see Appendix A).

The water-level data through the fourth quarter of 2004 are shown on Table 1. The data in Table 1 include the date and time of measurement, the well casing elevation, the measured depth to groundwater, the groundwater elevation, and the change in elevation from the previous measurement. A plot of historical groundwater elevations is shown in Figure 3.

Groundwater levels in the on-site wells (MW-1, MW-2, and MW-3) showed a similar seasonal pattern in 2004 as in the previous four years (see Figure 3). Groundwater levels rose across the Site between the fourth quarter 2003 and first quarter 2004 measurements, reflecting winter-season recharge. Groundwater levels measured in the second and third quarters of 2004 fell relative to the previous quarter, reflecting dissipation of winter-season recharge. Groundwater levels rose between the third and fourth quarter 2004 measurements, reflecting recharge at the beginning of the 2004/2005 winter season.

2.2 Groundwater Flow Direction and Gradient

Groundwater contour maps for the first through fourth quarters of 2004 based on the March, June, September and December 2004 water-level data are shown on Figures 4 through 7.

The groundwater flow direction determined for each quarter of 2004 was to the northeast, consistent with the groundwater flow direction determined previously for the Site.

The horizontal hydraulic gradients measured for the first, second, third, and fourth quarters of 2004 were 0.025, 0.016, 0.013, 0.017, respectively.

2.3 Groundwater Velocity

Average linear groundwater flow velocities (V) were calculated using a form of Darcy's Law,

$$V = Ki/n,$$

where "K" is the hydraulic conductivity, "i" is the horizontal hydraulic gradient, and "n" is the effective porosity. The groundwater velocity calculations for the 2004 groundwater data are presented in Appendix B.

Using hydraulic conductivity and porosity values determined for saturated native materials at the site [based on slug tests and laboratory soil testing, respectively (Conor Pacific/EFW, 2002)], and the horizontal hydraulic gradients determined from the quarterly 2004 groundwater contour maps, groundwater flow velocities beneath the site are calculated to range from 1 to 2 feet per year (ft/yr).

3 Groundwater Sampling and Analysis

This section summarizes the sample collection and analytical methods, presents an evaluation of quality control data, and summarizes the results of the sampling events.

3.1 Sample Collection and Analysis

Groundwater samples were collected March 4, June 2, September 14, and December 8, 2004 from groundwater monitoring wells MW-1, MW-2, MW-3, and MW-4. Dedicated tubing was installed in wells MW-1, MW-2, and MW-3 prior to the first quarter 2000 sampling event and on December 17, 2001 in well MW-4 to facilitate sampling with a peristaltic pump. Dedicated fluorinated ethylene propylene resin (FEP)-lined polyethylene tubing was installed in each monitoring well. The tubing intake was placed about one foot above the well bottom in each of the wells. Viton[®] dedicated check valves were installed on the tubing intakes to prevent back-flow of water into the well. A short length of dedicated Viton[®] tubing was installed at the well head for use in a peristaltic pump head. Prior to sample collection for each quarterly monitoring event, the wells were purged using a peristaltic pump. Field parameters (pH, electrical conductivity, temperature, and turbidity) were measured in purged groundwater from each well prior to sampling; these data are recorded on the Sample Collection Field Data sheets presented in Appendix A. After purging, groundwater samples were collected using the peristaltic pump and the dedicated Viton[®] pump head discharge tubing.

The groundwater samples were analyzed for VOCs using U.S. Environmental Protection Agency (USEPA) Method 8021B. Results for all Method 8010 analytes were reported. The groundwater samples for first through fourth quarter 2004 were delivered with appropriate chain-of-custody documentation to STL Chromalab, Inc., a state-certified laboratory in Pleasanton, California, for chemical analysis.

3.2 Analytical Results

The results of field and laboratory quality control measures and the results of the groundwater monitoring well samples are reviewed in this section. The certified analytical reports and chain-of-custody documentation are presented in Appendix C.

3.2.1 Quality Control

Quality control (QC) samples were analyzed as part of the sampling and analysis program to evaluate the precision and accuracy of the reported groundwater chemistry data. QC samples included both field and laboratory samples. Descriptions of the purpose of specific field and laboratory QC samples used during the sampling and analysis program and an evaluation of field and laboratory QC results are presented below.

Field Quality Control Samples

A field duplicate was used during the first through fourth quarter 2004 sampling program for the site. A field duplicate is used to assess sampling and analytical precision. The duplicate is collected at a selected well (MW-1 [first quarter 2004] and MW-2 [second through fourth quarter 2004]) and then submitted "blind" to the laboratory for analysis with the same batch as the regular sample for the selected well. An estimate of precision is obtained by calculating the relative percent difference (RPD) between the regular sample and the duplicate sample using the following formula:

$$\text{RPD} = \frac{[x - y] 100}{0.5 (x + y)}$$

where: $[x - y]$ = the absolute value of the difference in concentration between the regular sample (x) and the duplicate sample (y).

Laboratory Quality Control Samples

The following types of laboratory QC samples were used during the first through fourth quarter 2004 analytical program for the Site:

- surrogate spikes
- matrix spikes/duplicate matrix spikes

A surrogate spike is a check standard added to a sample in a known amount prior to analysis. Surrogate spikes consist of analytes not normally found in environmental samples and not targeted by the analytical procedure. Surrogate spikes provide information on recovery efficiency by comparing the percent recovery of specific surrogate analyses to statistically derived acceptance limits developed by the USEPA or the laboratory (provided such laboratory-specific limits are stricter than those developed by the USEPA). If the recoveries fall within the acceptance limits for the analytes, the analysis exhibits an acceptable recovery efficiency. Recoveries that fall outside the acceptance limits indicate a potential problem with the recovery efficiency of analytes, which in turn indicates a potential bias with respect to the reported concentration of the environmental samples analyzed in the same batch.

Matrix spikes and duplicate matrix spikes are analyzed by the laboratory for the purpose of providing a quantitative measure of accuracy and precision, and to document the effect that the sample matrix has on the analysis. A selected sample is spiked in duplicate with known concentrations of analytes. The recoveries of the spiked analytes are compared to statistically derived acceptance limits developed by the USEPA or the laboratory (provided such laboratory-specific limits are stricter than those developed by the USEPA). If the recoveries fall within the acceptance limits for the analytes, the analysis has no statistically significant bias (i.e., the analysis is accurate). Recoveries that fall outside of the acceptance limits have a positive or negative bias, depending on whether the recovery is greater or less than the upper or lower acceptance limit, respectively. Analyses where analyte recoveries fall outside the acceptance limits should be regarded as estimates only.

Precision for matrix spikes is measured by calculating the relative percent differences (RPDs) between the measured concentration of analytes in the matrix and the duplicate matrix spike. The following equation is used for matrix spikes:

$$\text{RPD} = \frac{[\text{MS} - \text{MSD}] 100}{0.5 (\text{MS} + \text{MSD})}$$

where: [MS - MSD] = the absolute value of the difference in concentration between the matrix spike (MS) and the matrix spike duplicate (MSD)

First Quarter 2004 Field QC Results

One field duplicate (DUP-1) was analyzed as part of the first quarter 2004 sampling event at the Site. The duplicate sample was collected at groundwater monitoring well MW-1 and was analyzed for halogenated VOCs using USEPA Method 8021B (8010 list). Table 2 summarizes the calculated RPDs for MW-1 and MW-1 duplicate (DUP-1). Of the two parameters for which RPDs could be calculated (see Table 2), two parameters (TCE and PCE) exhibit a low RPD value (i.e., less than 10%) indicative of good precision.

Second Quarter 2004 Field QC Results

One field duplicate (DUP-1) was analyzed as part of the second quarter 2004 sampling event at the Site. The duplicate sample was collected at groundwater monitoring well MW-2 and was analyzed for halogenated VOCs using USEPA Method 8021B (8010 list). Table 2 summarizes the calculated RPDs for MW-2 and MW-2 duplicate (DUP-1). Of the two parameters for which RPDs could be calculated (see Table 2), two parameters (TCE and PCE) exhibit a low RPD value (i.e., less than 10%) indicative of good precision.

Third Quarter 2004 Field QC Results

One field duplicate sample (DUP-1) was analyzed as part of the third quarter 2004 sampling event at the Site. The duplicate sample was collected at groundwater monitoring well MW-2 and was analyzed for halogenated VOCs using USEPA Method 8021B (8010 list). Table 2 summarizes the calculated RPDs for MW-2 and MW-2 duplicate (DUP-1). Of the two parameters for which RPDs could be calculated (see Table 2), one parameter (PCE) exhibits a low RPD value (i.e., less than 10%) indicative of good precision, and one parameter (TCE) exhibits a medium RPD value (i.e., greater than 10% and less than 35%) indicative of fair precision.

Fourth Quarter 2004 Field QC Results

One field duplicate sample (DUP-1) was analyzed as part of the fourth quarter 2004 sampling event at the Site. The duplicate sample was collected at groundwater monitoring well MW-2 and was analyzed for halogenated VOCs using USEPA Method 8021B (8010 list). Table 2 summarizes the calculated RPDs for MW-2 and MW-2 duplicate (DUP-1). Of the two parameters for which RPDs could be calculated (see Table 2), two parameters (TCE and PCE) exhibit a low RPD value (i.e., less than 10%) indicative of good precision.

First through Fourth Quarter 2004 Laboratory QC Results

A review of the first through fourth quarter 2004 field data sheets and laboratory reports (presented in Appendices A and B, respectively) indicates that all analyses were performed within USEPA or California Department of Health Services (DHS) recommended maximum sample holding times.

QC data on surrogate spike recoveries and matrix spike recoveries are presented in the laboratory reports. These data indicate: (1) no surrogate spike recoveries were outside of the laboratory's acceptance limits; (2) no matrix spike or duplicate matrix spike recoveries were outside of the laboratory's control limits; and (3) RPD values for the matrix spikes and duplicate matrix spikes indicate a high overall degree of analytical precision. The laboratory QC data indicate that the results reported herein are of adequate quality for evaluation of site groundwater conditions.

3.2.2 Groundwater Results

The results of VOC analyses for each quarter for 2000 through 2004 are summarized in Table 3, which also shows the VOC results for the initial sampling event for monitoring wells MW-1, MW-2, and MW-3 in November 1999. The results for the 2004 monitoring events are also shown on Figure 8.

PCE and its breakdown products DCE and TCE were the only VOCs detected in groundwater at the Site during the first through fourth quarters of 2004.

For the first through fourth quarters of 2004, the concentrations of PCE detected ranged from 370 to 620 $\mu\text{g/L}$ in monitoring well MW-1, from 2,800 to 4,100 $\mu\text{g/L}$ in MW-2, from not detected to 0.90 $\mu\text{g/L}$ in monitoring well MW-3, and from 1.2 to 1.7 $\mu\text{g/L}$ in MW-4.

The concentrations of TCE detected ranged from 39 to 81 $\mu\text{g/L}$ in monitoring well MW-1 and from 30 to 49 $\mu\text{g/L}$ in MW-2. TCE was not detected in MW-3 or MW-4.

The concentrations of DCE detected in monitoring well MW-1 ranged from 5.8 to 6.6 $\mu\text{g/L}$. DCE was detected at 0.81 $\mu\text{g/L}$ in MW-3 during the fourth quarter event. DCE was not detected in MW-2 or MW-4.

As noted in previous monitoring reports, several parameters were detected at low concentrations in monitoring well MW-1 during the first quarter 2000 sampling event that were not detected in November 1999 and then were not detected in subsequent quarters (see Table 3). However, this may be primarily an artifact of the variations in the detection limits reported by the laboratory: detection limits for these parameters were higher for other quarters than for the first quarter of 2000. Crawford has coordinated with the lab to obtain consistent detection limits for subsequent sampling events. However, due to the elevated PCE levels in the samples, the lab needs to dilute the samples and is unable to reach the low levels obtained in the first quarter 2000.

3.3 Discussion

The results for the year 2004 quarterly monitoring events are generally similar to the results reported for the years 2000 through 2003 quarterly monitoring programs (see Figure 9).

Variations in VOC concentrations at monitoring well MW-2 correlate with variations in groundwater elevations at the site. An increase in VOC concentrations generally follows a rise in groundwater elevations, and a decrease in VOC concentration generally follows a fall in groundwater levels (compare Figures 3 and 9). The variations in VOC concentrations tend to lag one quarter behind the variations in groundwater elevation.

The concentrations of PCE detected in groundwater samples from MW-1 and MW-2 exceed California's primary drinking water standard for PCE, which is 5 $\mu\text{g/L}$. The concentrations of TCE detected in groundwater samples from MW-1 and MW-2 exceed California's primary drinking water standard for TCE, which is also 5 $\mu\text{g/L}$. One of the concentrations of DCE detected in the groundwater sample from MW-1 exceeded California's primary drinking water standard for DCE, which is 6 $\mu\text{g/L}$.

Although primary drinking water standards are exceeded in on-site groundwater, shallow groundwater in the vicinity of the site is not considered to be suitable as a source of drinking water (Groundworks, 1995; Hickenbottom and Muir, 1988).


Professional Certification

**Groundwater Monitoring Results
First through Fourth Quarter 2004
Cargill Salt - Alameda Facility
Alameda, California**

This report has been prepared by CRAWFORD CONSULTING, INC. with the professional certification of the California professional geologist whose signature appears below.



Dana C. Johnston
Project Manager



Mark C. Wheeler
Principal Geologist
P.G. 4563



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Limitations

This report and the evaluations presented herein have been prepared in accordance with generally accepted professional standards and is based solely on the scope of work and services described herein. This report has been prepared solely for the use of Cargill Salt for the purposes noted herein. Any use of this report, in whole or in part, by a third party for other than the purposes noted herein is at such party's sole risk.

Table 1. Groundwater Level Data

Well/ Piezometer	Date	Time	Casing Elevation (feet, MSL)	Depth to Water (feet)	Water Elevation (feet, MSL)	Elev. Change from Last Measurement (feet)
MW-1	11/16/1999	09:56	6.75	3.75	3.00	NA
MW-1	3/30/2000	10:09	6.75	2.81	3.94	0.94
MW-1	5/16/2000	09:43	6.75	3.32	3.43	-0.51
MW-1	7/28/2000	09:11	6.75	3.58	3.17	-0.26
MW-1	11/30/2000	08:36	6.75	3.52	3.23	0.06
MW-1	3/26/2001	08:47	6.75	3.15	3.60	0.37
MW-1	6/25/2001	10:19	6.75	3.53	3.22	-0.38
MW-1	9/28/2001	09:32	6.75	3.96	2.79	-0.43
MW-1	12/17/2001	10:47	6.75	3.23	3.52	0.73
MW-1	3/21/2002	07:28	6.75	2.89	3.86	0.34
MW-1	6/6/2002	08:03	6.75	3.50	3.25	-0.61
MW-1	9/20/2002	08:30	6.75	3.86	2.89	-0.36
MW-1	12/19/2002	08:38	6.75	3.13	3.62	0.73
MW-1	3/4/2003	10:31	6.75	3.08	3.67	0.05
MW-1	6/9/2003	08:32	6.75	3.29	3.46	-0.21
MW-1	9/8/2003	10:02	6.75	3.79	2.96	-0.50
MW-1	12/1/2003	10:16	6.75	3.78	2.97	0.01
MW-1	3/4/2004	09:31	6.75	2.88	3.87	0.90
MW-1	6/2/2004	08:42	6.75	3.45	3.30	-0.57
MW-1	9/14/2004	08:01	6.75	3.87	2.88	-0.42
MW-1	12/8/2004	07:44	6.75	3.23	3.52	0.64
MW-2	11/16/1999	11:15	9.81	5.22	4.59	NA
MW-2	3/30/2000	10:05	9.81	2.80	7.01	2.42
MW-2	5/16/2000	09:35	9.81	4.13	5.68	-1.33
MW-2	7/28/2000	09:17	9.81	4.85	4.96	-0.72
MW-2	11/30/2000	08:32	9.81	4.75	5.06	0.10
MW-2	3/26/2001	08:40	9.81	3.28	6.53	1.47
MW-2	6/25/2001	12:12	9.81	4.75	5.06	-1.47
MW-2	9/28/2001	12:20	9.81	5.41	4.40	-0.66
MW-2	12/17/2001	10:44	9.81	4.07	5.74	1.34
MW-2	3/28/2002	09:37	9.81	3.40	6.41	0.67
MW-2	6/6/2002	08:11	9.81	4.70	5.11	-1.30
MW-2	9/20/2002	08:34	9.81	5.28	4.53	-0.58
MW-2	12/19/2002	08:45	9.81	3.37	6.44	1.91
MW-2	3/4/2003	10:26	9.81	3.11	6.70	0.26
MW-2	6/9/2003	08:31	9.81	4.16	5.65	-1.05
MW-2	9/8/2003	10:08	9.81	5.26	4.55	-1.10
MW-2	12/1/2003	10:20	9.81	5.05	4.76	0.21
MW-2	3/4/2004	09:34	9.81	2.86	6.95	2.19
MW-2	6/2/2004	08:53	9.81	4.47	5.34	-1.61
MW-2	9/14/2004	07:59	9.81	5.26	4.55	-0.79
MW-2	12/8/2004	08:00	9.81	4.20	5.61	1.06
MW-3	11/16/1999	15:43	6.92	4.34	2.58	NA
MW-3	3/30/2000	10:01	6.92	2.77	4.15	1.57
MW-3	5/16/2000	09:46	6.92	3.44	3.48	-0.67
MW-3	7/28/2000	09:05	6.92	3.72	3.20	-0.28
MW-3	11/30/2000	08:34	6.92	3.73	3.19	-0.01
MW-3	3/26/2001	08:54	6.92	3.51	3.41	0.22
MW-3	6/25/2001	10:21	6.92	3.65	3.27	-0.14

Table 1. Groundwater Level Data

Well/ Piezometer	Date	Time	Casing Elevation (feet, MSL)	Depth to Water (feet)	Water Elevation (feet, MSL)	Elev. Change from Last Measurement (feet)
MW-3	9/28/2001	09:30	6.92	3.96	2.96	-0.31
MW-3	12/17/2001	10:38	6.92	3.28	3.64	0.68
MW-3	3/21/2002	07:28	6.92	3.10	3.82	0.18
MW-3	6/6/2002	08:07	6.92	3.63	3.29	-0.53
MW-3	9/20/2002	08:25	6.92	3.82	3.10	-0.19
MW-3	12/19/2002	08:42	6.92	3.10	3.82	0.72
MW-3	3/4/2003	10:36	6.92	3.29	3.63	-0.19
MW-3	6/9/2003	08:28	6.92	3.41	3.51	-0.12
MW-3	9/8/2003	10:00	6.92	3.85	3.07	-0.44
MW-3	12/1/2003	10:30	6.92	3.90	3.02	-0.05
MW-3	3/4/2004	09:22	6.92	3.11	3.81	0.79
MW-3	6/2/2004	08:46	6.92	3.53	3.39	-0.42
MW-3	9/14/2004	08:05	6.92	4.07	2.85	-0.54
MW-3	12/8/2004	07:40	6.92	3.73	3.19	0.34
MW-4	12/17/2001	10:40	6.01	2.55	3.46	NA
MW-4	3/28/2002	08:05	6.01	3.06	2.95	-0.51
MW-4	6/6/2002	07:57	6.01	2.85	3.16	0.21
MW-4	9/20/2002	08:28	6.01	3.21	2.80	-0.36
MW-4	12/19/2002	08:53	6.01	3.70	2.31	-0.49
MW-4	3/4/2003	10:34	6.01	3.14	2.87	0.56
MW-4	6/9/2003	08:29	6.01	2.82	3.19	0.32
MW-4	9/8/2003	10:04	6.01	3.43	2.58	-0.61
MW-4	12/1/2003	10:14	6.01	3.12	2.89	0.31
MW-4	3/4/2004	09:27	6.01	2.81	3.20	0.31
MW-4	6/2/2004	08:44	6.01	3.34	2.67	-0.53
MW-4	9/14/2004	08:03	6.01	3.51	2.50	-0.17
MW-4	12/8/2004	07:36	6.01	3.10	2.91	0.41

Key:

NA = Not available

feet, MSL = feet, relative to Mean Sea Level

Table 2.
Relative Percent Difference Based on Duplicate Samples

Analysis	First Quarter 2004			Second Quarter 2004			Third Quarter 2004			Fourth Quarter 2004		
	Well MW-1 Results	DUP-1 Results	RPD ¹ (%)	Well MW-2 Results	DUP-1 Results	RPD ¹ (%)	Well MW-2 Results	DUP-1 Results	RPD ¹ (%)	Well MW-2 Results	DUP-1 Results	RPD ¹ (%)
Organic Compounds (µg/L)												
1,1-Dichloroethene (1,1-DCE)	ND ²	ND	NM ³	ND	ND	NM	ND	ND	NM	ND	ND	NM
Trichloroethene (TCE)	53	55	3.7	49	52	5.9	37	45	19.5	30	31	3.3
Tetrachloroethene (PCE)	370	390	5.3	4,100	4,400	7.1	3,800	3,900	2.6	2,800	2,700	3.6
¹ RPD = relative percent difference ² ND = not detected ³ NM = not meaningful; RPD cannot be accurately calculated where one or both values are below the method reporting limit. All other 8010 analytes not detected (by 8021B).												

Table 3. Summary of Groundwater Monitoring Well Data
(results measured in $\mu\text{g/L}$)

Well No. Field Date	MW-1																				MCL ¹	
	11/16/99	3/30/00	5/16/00	7/28/00	11/30/00	3/26/01	6/25/01	9/28/01	12/17/01	3/21/02	6/6/02	9/20/02	12/19/02	3/4/03	6/9/03	9/8/03	12/1/03	3/4/04	6/2/04	9/14/04		12/8/04
DCE ²	<50.0	13	<10	15	14	<13	14	15	<13	<13	<13	<13	<13	<10	12	5.2	8.4	<5.0	5.8	6.6	<5.0	6
CFC 113 ³	na ⁴	1.4	<10	<10	<8.3	<50	<50	<50	<50	<13	<13	<13	<13	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	ne ⁵
DCA ⁶	<50.0	0.8	<10	<10	<4.2	<13	<13	<13	<13	<13	<13	<13	<13	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5
Chloroform	<50.0	0.6*	<10	<10	<8.3	<13	<13	<13	<13	<13	<13	<13	<13	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	ne
TCA ⁷	<50.0	1.6	<10	<10	<4.2	<13	<13	<13	<13	<13	<13	<13	<13	<10	<10	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	200
TCE ⁸	178	150	190	170	130	180	250	210	190	160	140	190	68	97	90	110	130	53	72	81	39	5
PCE ⁹	906	1,400	1,900	1,200	880	1,000	1,400	1,000	1,400	1,100	980	1,100	600	730	770	780	850	370	490	620	380	5
Other analytes ¹⁰	nd ¹¹	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	--

Notes:

¹ MCL = California Primary Drinking Water Standard - Maximum Contaminant Level
(in micrograms per liter [$\mu\text{g/L}$])

² DCE = 1,1-Dichloroethene

³ CFC 113 = Trichlorotrifluoroethane

⁴ na = not analyzed

⁵ ne = not established or none applicable

⁶ DCA = 1,1-Dichloroethane

⁷ TCA = 1,1,1-Trichloroethane

⁸ TCE = Trichloroethene

⁹ PCE = Tetrachloroethene

¹⁰ All other Method 8010 analytes (by 8021B)

¹¹ nd = not detected

* Chloroform detected in equipment blank at 1.6 $\mu\text{g/L}$

Table 3. Summary of Groundwater Monitoring Well Data
(results measured in µg/L)

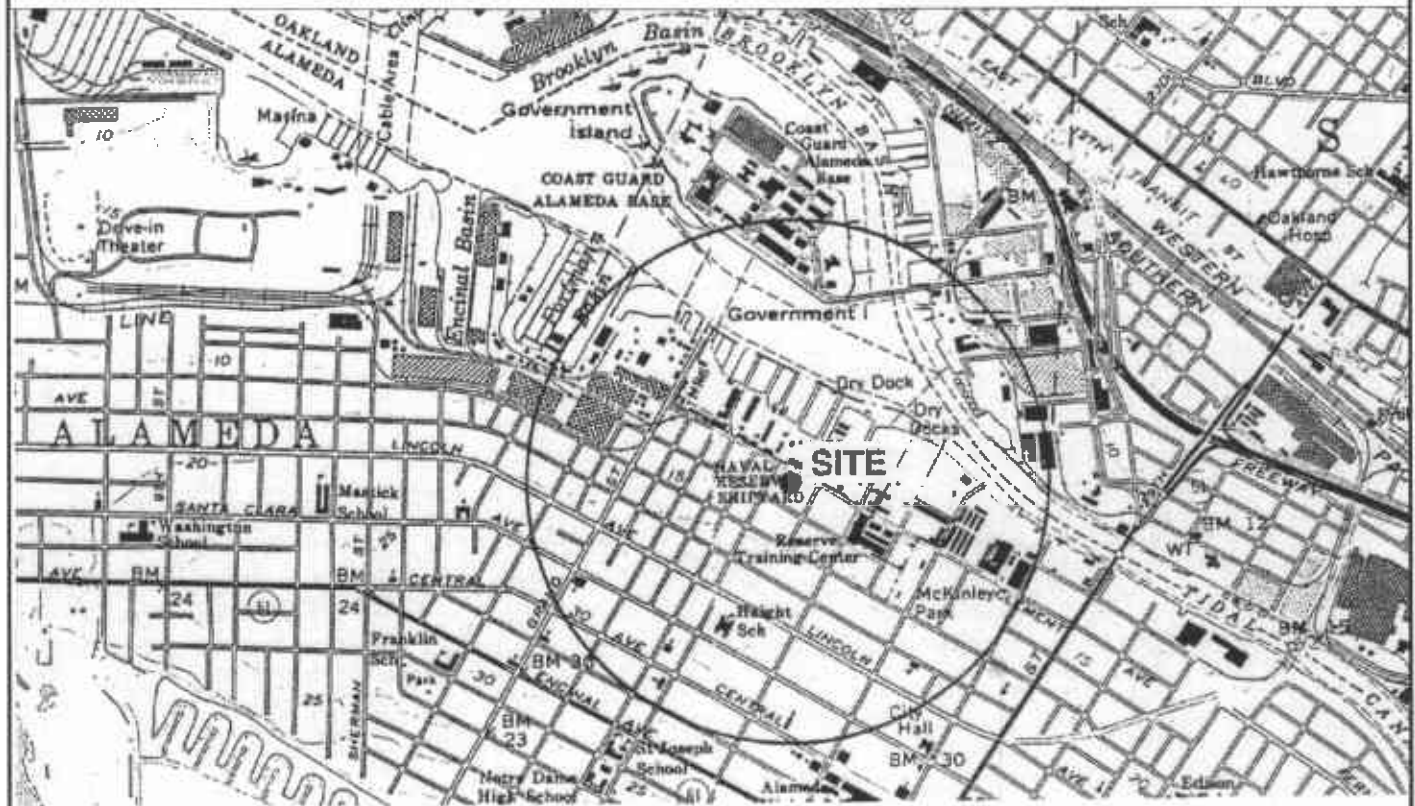
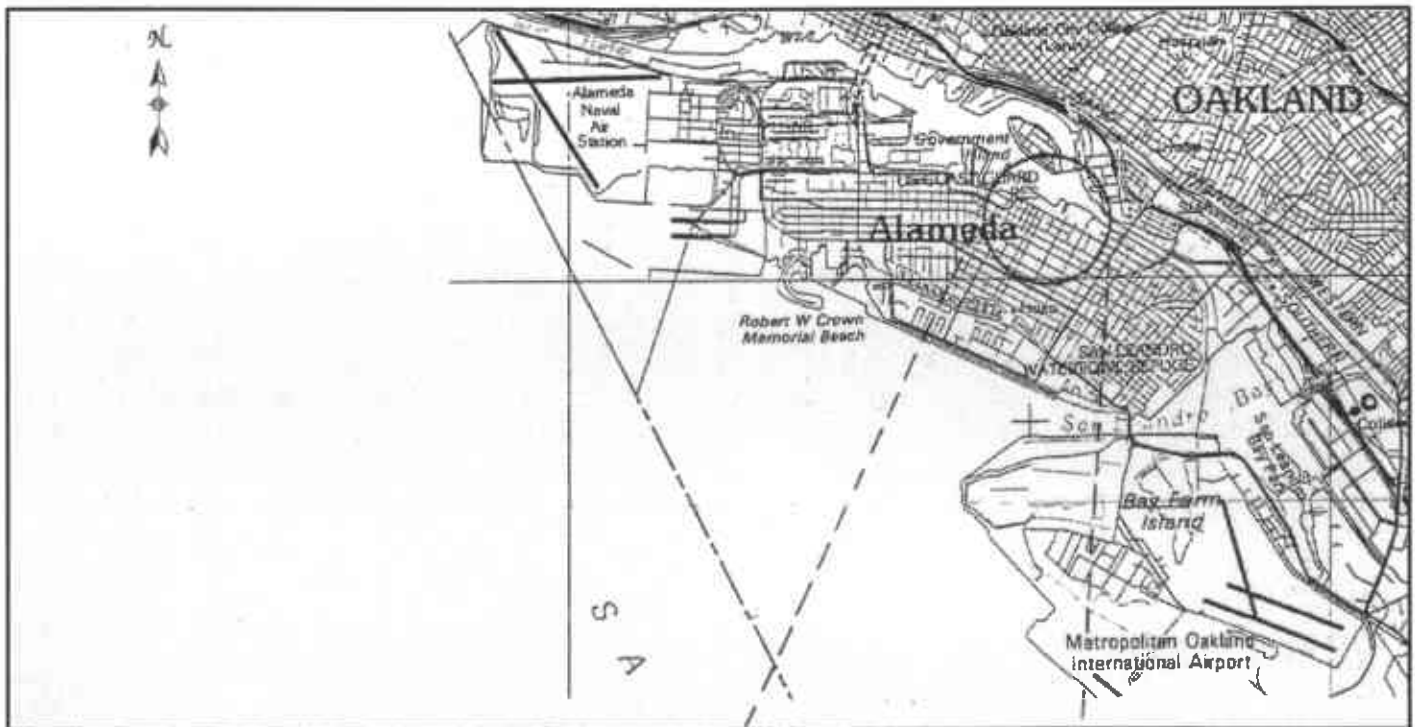
Well No. Field Date	MW-2																				MCL ¹	
	11/16/99	3/30/00	5/16/00	7/28/00	11/30/00	3/26/01	6/25/01	9/28/01	12/17/01	3/28/02	6/6/02	9/20/02	12/30/02	3/4/03	6/9/03	9/8/03	12/1/03	3/4/04	6/2/04	9/14/04		12/8/04
DCE ²	<50.0	<0.5	<25	<25	<8.3	<25	<25	<25	<25	<25	<25	<25	<25	<20	<20	<20	<20	<20	<25	<25	<20	6
CFC 113 ³	na	<0.5	<25	<25	<17	<100	<100	<100	<100	<25	<25	<25	<25	<20	<20	<20	<20	<20	<25	<25	<20	ne ⁵
DCA ⁶	<50.0	<0.5	<25	<25	<8.3	<25	<25	<25	<25	<25	<25	<25	<25	<20	<20	<20	<20	<20	<25	<25	<20	5
Chloroform	<50.0	<0.5	<25	<25	<17	<25	<25	<25	<25	<25	<25	<25	<25	<20	<20	<20	<20	<20	<25	<25	<20	ne
TCA ⁷	<50.0	5.0	<25	<25	<8.3	<25	<25	<25	<25	<25	<25	<25	<25	<20	<20	<20	<20	<20	<25	<25	<20	200
TCE ⁸	<50	29	53	<25	20	40	78	<25	<25	49	52	32	<25	58	41	28	25	39	49	37	30	5
PCE ⁹	840	3,600	3,200	3,300	1,700	2,200	4,400	1,700	1,700	3,500	3,800	2,100	1,800	3,900	3,800	2,500	2,500	3,000	4,100	3,800	2,800	5
Other analytes	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	--

Table 3. Summary of Groundwater Monitoring Well Data
(results measured in µg/L)

Well No. Field Date	MW-3																				MCL ¹	
	11/16/99	3/30/00	5/16/00	7/28/00	11/30/00	3/26/01	6/25/01	9/28/01	12/17/01	3/21/02	6/6/02	9/20/02	12/19/02	3/4/03	6/9/03	9/8/03	12/1/03	3/4/04	6/2/04	9/14/04		12/8/04
DCE ²	<0.500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.51	<0.5	0.81	<0.5	<0.5	6
CFC 113 ³	na	<0.5	<0.5	<0.5	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ne ⁵
DCA ⁶	<0.500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5
Chloroform	<0.500	<0.5	<0.5	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ne
TCA ⁷	<0.500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	200
TCE ⁸	<0.500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5
PCE ⁹	<0.500	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	0.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.90	<0.5	<0.5	5
Other analytes	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	--

Table 3. Summary of Groundwater Monitoring Well Data
(results measured in µg/L)

Well No. Field Date	MW-4													MCL ¹
	12/17/01	3/28/02	6/6/02	9/20/02	12/19/02	3/4/03	6/9/03	9/8/03	12/1/03	3/4/04	6/2/04	9/14/04	12/8/04	
DCE ²	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6
CFC 113 ³	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ne ⁵
DCA ⁶	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5
Chloroform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ne
TCA ⁷	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	200
TCE ⁸	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5
PCE ⁹	2.6	2.8	2.0	2.5	1.1	2.1	2.1	1.6	1.6	1.7	1.4	1.3	1.2	5
Other analytes	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	--



Base map (upper): U.S.G.S. 1:1,000,000-scale series (Topographic)
 San Francisco Quadrangle, California, 1978.
 Base map (lower): U.S.G.S. 7.5 minute series (Topographic)
 Oakland East and Oakland West Quadrangles, California,
 1959, Photorevised 1980.

0 2,000 4,000
 Scale in feet (lower map)

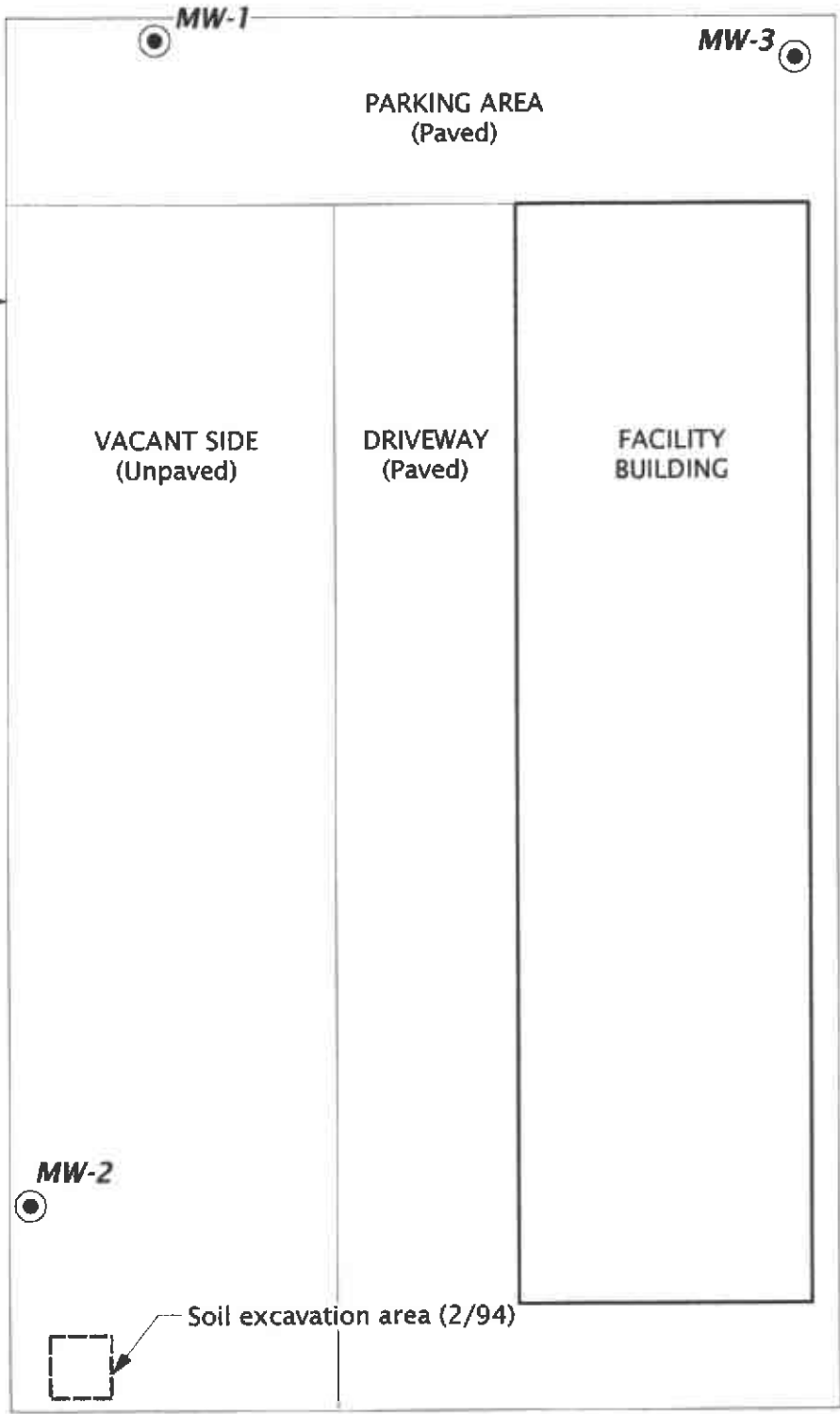


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 2016 Clement Avenue, Alameda, California
Figure 1. Site Location



← Clement Avenue →



EXPLANATION

● Groundwater monitoring well

Note: See Figure 4 for location of MW-4

SCALE: 0 20 40 FEET

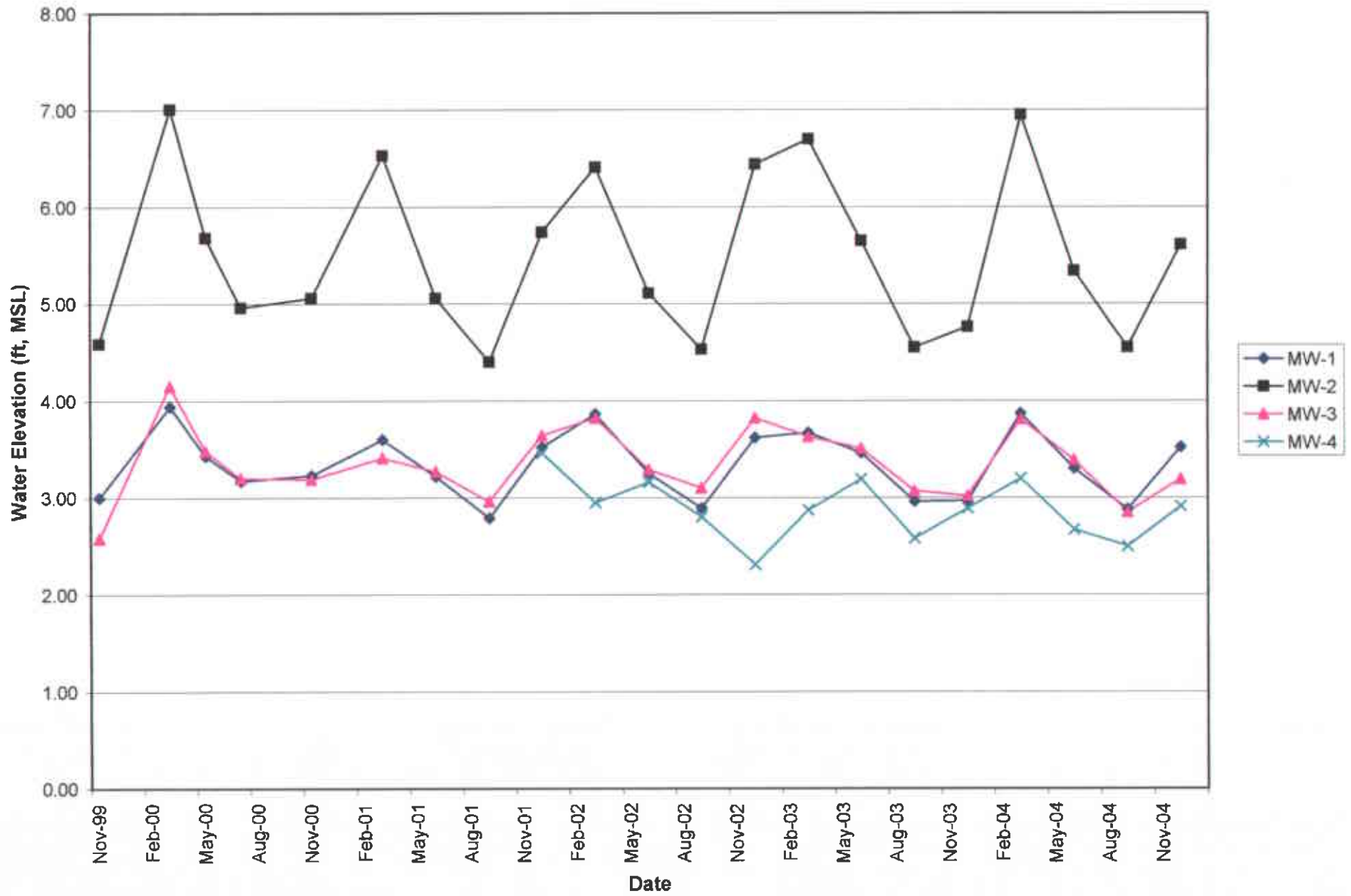


1605fig204.dsf 8/25/05



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Figure 2. Groundwater Monitoring Well Locations

Figure 3. Graphical Summary of Groundwater Elevations

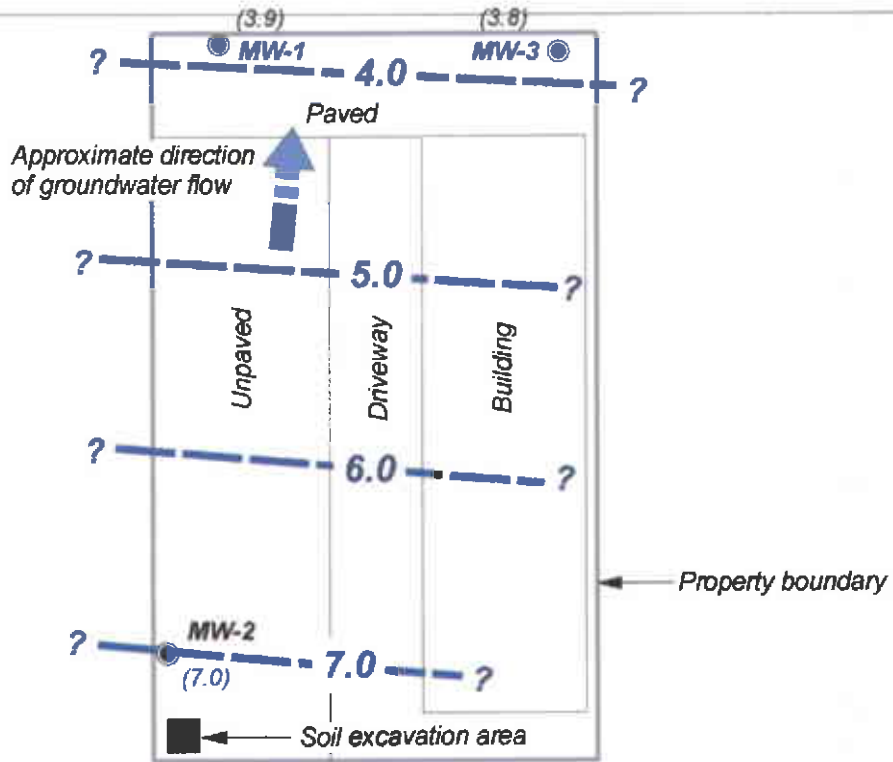




MW-4 (3.2)

Curb line (Typ.)

Clement Avenue

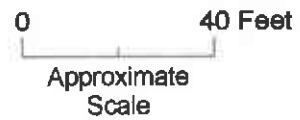


EXPLANATION

● Monitoring well

(3.8) Groundwater elevation (Ft.-MSL);
measured 3/4/04

? — 4.0 — Groundwater elevation contour
(Ft.-MSL)



Base map from Conor Pacific/EFW, Off-Site
Groundwater Characterization, August 21, 2002.

1605fig404.dst 11/7/05



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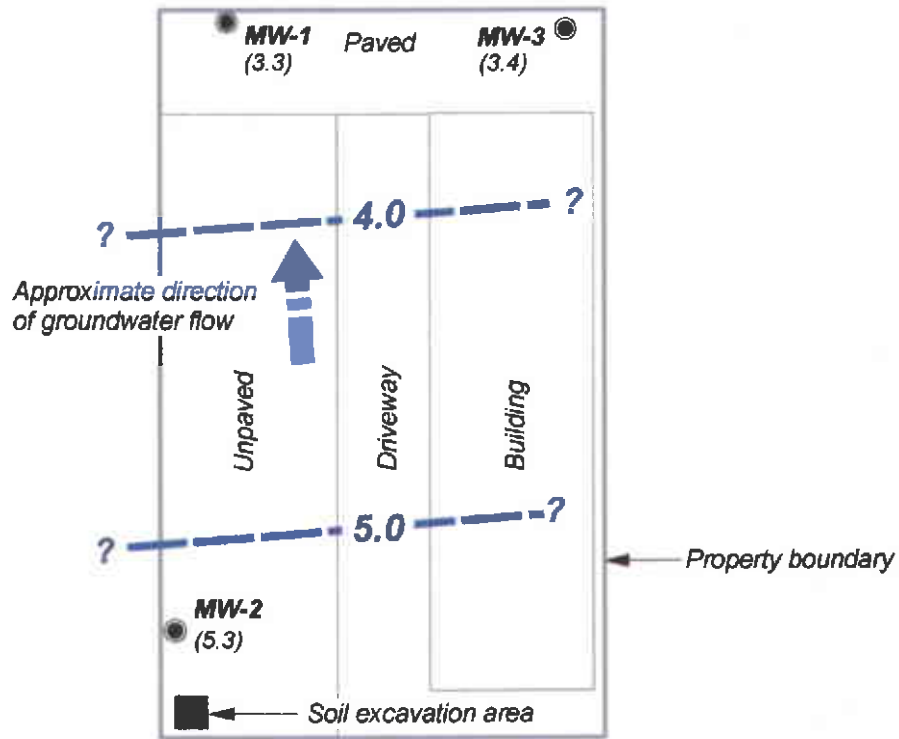
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Figure 4. Groundwater Elevation Contours - March 2004



Curb line (Typ.)

MW-4
(2.7)

Clement Avenue

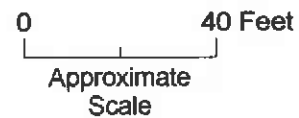


EXPLANATION

● Monitoring well

(3.4) Groundwater elevation (Ft.-MSL);
measured 6/2/04

? — 4.0 — Groundwater elevation contour
(Ft.-MSL)



1605fig504.dwg 11/7/05

Base map from Conor Pacific/EFW, Off-Site
Groundwater Characterization, August 21, 2002.



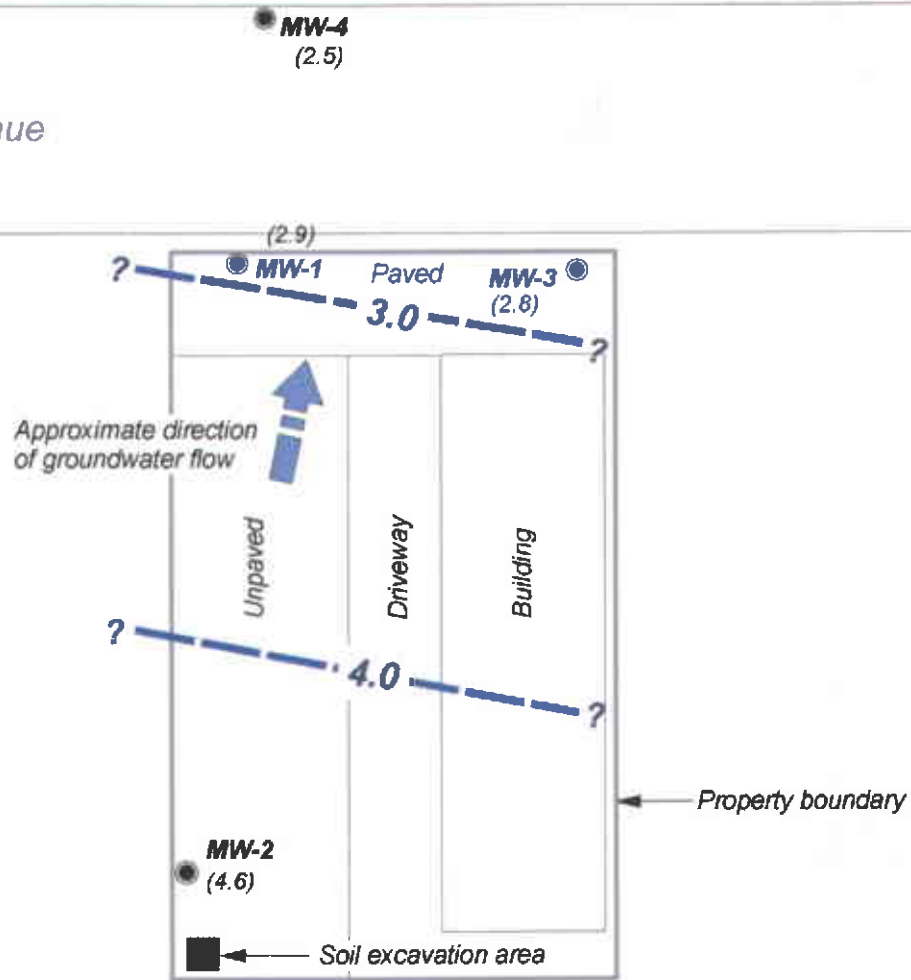
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Figure 5. Groundwater Elevation Contours - June 2004



Curb line (Typ.)

Clement Avenue



EXPLANATION

● Monitoring well

(2.8) Groundwater elevation (Ft.-MSL);
measured 9/14/04

? — 4.0 — Groundwater elevation contour
(Ft.-MSL)

0 40 Feet
Approximate
Scale

Base map from Conor Pacific/EFW, Off-Site
Groundwater Characterization, August 21, 2002.

1605fig604.dsf 11/7/05



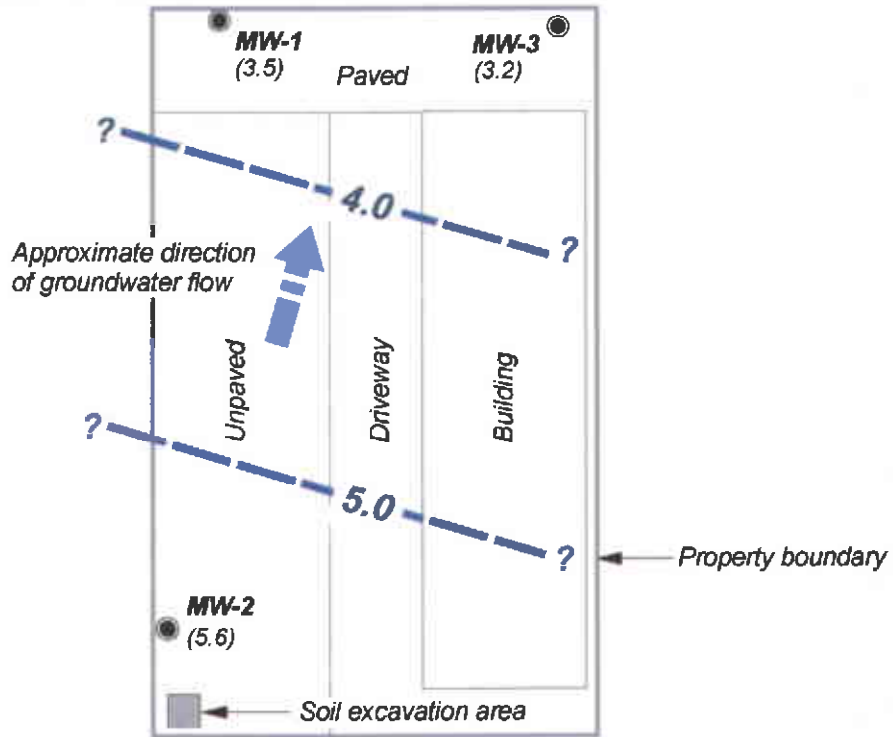
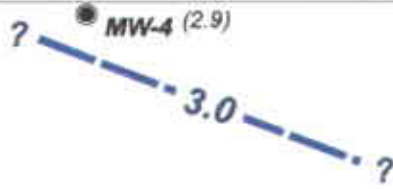
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Figure 6. Groundwater Elevation Contours - September 2004



Curb line (Typ.)

Clement Avenue

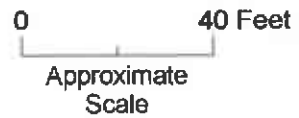


EXPLANATION

● Monitoring well

(3.2) Groundwater elevation (Ft.-MSL);
measured 12/8/04

? — 4.0 — Groundwater elevation contour
(Ft.-MSL)



Base map from Conor Pacific/EPW, Off-Site
Groundwater Characterization, August 21, 2002.

1605fg704.dxf 11/7/05



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Figure 7. Groundwater Elevation Contours - December 2004



Curb line (Typ.)

Clement Avenue

MW-4

Parameter	3/04	6/04	9/04	12/04
DCE	ND	ND	ND	ND
PCE	1.7	1.4	1.3	1.2
TCE	ND	ND	ND	ND

Parameter	3/04	6/04	9/04	12/04
DCE	ND	5.8	6.6	ND
PCE	370	490	620	380
TCE	53	72	81	39

Parameter	3/04	6/04	9/04	12/04
DCE	ND	0.81	ND	ND
PCE	ND	0.90	ND	ND
TCE	ND	ND	ND	ND

Parameter	3/04	6/04	9/04	12/04
DCE	ND	ND	ND	ND
PCE	3,000	4,100	3,800	2,800
TCE	39	49	37	30



EXPLANATION

● Groundwater monitoring well location

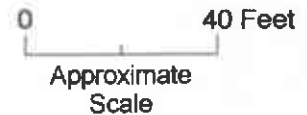
— Analyte concentration

DCE	ND
PCE	1.2
TCE	ND

— Analytical parameter

All concentrations reported in micrograms per liter (µg/L), in groundwater. All other 8010 constituents were below detection limits.

ND = Not detected
 DCE = 1,1-Dichloroethene
 PCE = Tetrachloroethene
 TCE = Trichloroethene
 VOCs = Volatile organic compounds



Base map from Conor Pacific/EFW, Off-Site Groundwater Characterization, August 21, 2002.

1605fig804.dsf 8/25/05



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 2016 Clement Avenue, Alameda, California
Figure 8. VOC Concentrations in Groundwater – March through December 2004

Figure 9. Graphical Summary of PCE Concentrations

