



August 14, 2002

AUG 16 2002

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

**RE: Groundwater Monitoring Results, First through Fourth Quarter 2001
Cargill Salt – Alameda Facility, Alameda, California**

Dear Ms. Chu,

The attached report presents the groundwater monitoring results for First through Fourth Quarter 2001 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, eight additional quarters of groundwater monitoring data have been collected. These data generally confirm the results of the transect sampling and initial sampling of the monitoring wells.

A workplan for off-site characterization was submitted to the Alameda County Department of Environmental Health on June 19, 2001. These 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 will be submitted to the ACEHS in a separate report.

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,

Teri Peterson
Environmental Manager

AUG 16 2002

**Groundwater Monitoring Results
First through Fourth Quarter 2001
Cargill Salt - Alameda Facility
Alameda, California**

Aug 2002

**Groundwater Monitoring Results
First through Fourth Quarter 2001
Cargill Salt - Alameda Facility
Alameda, California**

Prepared for:

**Cargill Salt
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Newark, California 94560**

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**Project No. CS1605
August 14, 2002**

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1 Introduction

Crawford Consulting, Inc. (CCI) 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 groundwater transect sampling and the monitoring wells installation and sampling were performed 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, eight additional quarters of groundwater monitoring data have been collected. The results of the first four additional quarters were reported in *Groundwater Monitoring Results, First through Fourth Quarter 2000, Cargill Salt - Alameda Facility, Alameda, California* (Crawford Consulting, Inc., April 11, 2001.)

A workplan for off-site characterization was prepared by Conor Pacific and submitted to the ACEHS on June 19, 2001. After approval of the workplan by the ACEHS, Cargill Salt conducted 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. The results of these activities will be submitted to the ACEHS in a separate report.

Background information and a summary of the reporting period activities for the first through fourth quarters of 2001 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). The results of the 2000 quarterly groundwater monitoring activities were submitted to the ACEHS in a report, *Groundwater Monitoring Results, First through Fourth Quarter 2000, Cargill Salt – Alameda Facility, Alameda, California* (Crawford Consulting, Inc., April 11, 2001).

A workplan for remedial investigation activities, *Workplan for Off-Site Characterization, Cargill Salt – Alameda Facility, Alameda, California*, 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 will be submitted to the ACEHS in a separate report.

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. Also, site personnel have reported that the residential neighbor to the northwest owns a dry cleaning business that could be a potential source for PCE.

1.2 Reporting Period Activities

Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were installed, sampled, and analyzed in November 1999 as part of a remedial investigation at the Site. A fourth groundwater monitoring well (MW-4) was installed, sampled, and analyzed in December 2001.

Since the initial sampling and analysis event in November 1999, eight quarters of groundwater monitoring data have been collected. This report presents the results of groundwater monitoring data collected during the first through fourth quarters of 2001. 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 is shown below.

Quarter of 2001	Field Date
First	March 26, 2001
Second	June 25, 2001
Third	September 28, 2001
Fourth	December 17, 2001

Supervision of the quarterly monitoring events were conducted for Cargill Salt by CCI. Groundwater level measurements and collection of groundwater samples were conducted by Field Solutions, Inc. The groundwater samples for the first through fourth quarters of 2001 were analyzed by STL Chromalab, Inc., a state-certified laboratory in Pleasanton, California.

2 Groundwater Flow Analysis

Groundwater levels were measured and groundwater contour maps were prepared for the first through fourth quarter 2001 reporting period.

2.1 Water-Level Measurement

Water levels in groundwater monitoring wells (MW-1, MW-2, and MW-3) were measured each quarter, before any of the groundwater monitoring wells were purged for sampling for the quarterly monitoring event. During the fourth quarter 2001, the water level in groundwater monitoring well MW-4 was measured in addition to the other previously existing wells. 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 2001 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 elevation data is shown in Figure 3.

Groundwater levels rose across the Site between the fourth quarter 2000 and first quarter 2001 measurements, reflecting winter-season recharge. Groundwater levels measured in the second and third quarters of 2001 fell relative to the previous quarter, reflecting dissipation of winter-season recharge. Groundwater levels rose between the third and fourth quarter 2001 measurements, reflecting recharge for the beginnings of the 2000/2001 winter season.

2.2 Groundwater Flow Direction and Gradient

Groundwater contour maps for the first through fourth quarters of 2001 based on the March, June, September and December 2001 water-level data are shown on Figures 4 through 7.

The groundwater flow direction determined for each quarter of 2001 was to the northeast, consistent with the groundwater flow direction determined in September 1994, November 1999 and the first through fourth quarters 2000.

The horizontal hydraulic gradients measured for the first, second, third, and fourth quarters of 2001 were 0.022, 0.015, 0.013, and 0.017, respectively.

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 26, June 25, September 28, and December 17, 2001 from groundwater monitoring wells MW-1, MW-2, and MW-3. A groundwater sample was collected December 17, 2001 from groundwater monitoring well MW-4. Prior to the first quarter 2000 sampling event, dedicated tubing was installed in wells MW-1, MW-2, and MW-3 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 2001 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 B.

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 2001 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) 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:

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

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 2001 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 2001 Field QC Results

One field duplicate (DUP-1) was analyzed as part of the first quarter 2001 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 (Trichloroethene and Tetrachloroethene) exhibit a low RPD value (i.e., less than 10%) indicative of good precision.

Second Quarter 2001 Field QC Results

One field duplicate (DUP-1) was analyzed as part of the second quarter 2001 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), one parameter (Trichloroethene) exhibits a high RPD value (i.e., > 25%) indicative of relatively poor precision, and one parameter (Tetrachloroethene) exhibits a low RPD value (i.e., less than 10%) indicative of good precision. The second quarter 2001 results for the parameters exhibiting relatively poor precision should be viewed with caution if they appear anomalous with respect to previous or subsequent monitoring results.

Third Quarter 2001 Field QC Results

One duplicate sample (DUP-1) was analyzed as part of the third quarter 2001 sampling event at the Site. The blank 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 three parameters for which RPDs could be calculated (see Table 2), three parameters (1,1-Dichloroethene, Trichloroethene, and Tetrachloroethene) exhibit low RPD values (i.e., less than 10%) indicative of good precision.

Fourth Quarter 2001 Field QC Results

One duplicate sample (DUP-1) was analyzed as part of the fourth quarter 2001 sampling event at the Site. The blank 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 three parameters for which RPDs could be calculated (see Table 2), one parameter (Trichloroethene) exhibits moderate RPD values (i.e., between 10% and 25%) indicative of fair precision, and two parameters (1,1-Dichloroethene and Tetrachloroethene) exhibit low RPD values (i.e., less than 10%) indicative of good precision.

First through Fourth Quarter 2001 Laboratory QC Results

A review of the first through fourth quarter 2001 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 through 2001 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 2001 monitoring events are also shown on Figure 8.

Similar to previous characterization and monitoring results, PCE and its breakdown product TCE were the predominant VOCs detected in groundwater at the Site during the first through fourth quarters of 2001. A third breakdown product of PCE, 1,1-DCE, was detected at low concentrations at well MW-1.

For the first through fourth quarters of 2001, the concentrations of PCE detected ranged from 1,000 to 1,400 $\mu\text{g/L}$ in monitoring well MW-1 and from 1,700 to 4,400 $\mu\text{g/L}$ in MW-2. PCE was only detected at MW-3 during one quarter, at a concentration of 0.81 $\mu\text{g/L}$. PCE was detected at MW-4 during the fourth quarter 2001 at a concentration of 2.6 $\mu\text{g/L}$.

The concentrations of TCE detected ranged from 180 to 250 $\mu\text{g/L}$ in monitoring well MW-1 and from 40 to 78 $\mu\text{g/L}$ in MW-2. TCE was not detected in MW-3 or MW-4.

The concentrations of 1,1-DCE detected ranged from 14 to 15 $\mu\text{g/L}$ in monitoring well MW-1. 1,1-DCE was not detected in MW-2, MW-3 or MW-4.

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. CCI 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 2001.

3.3 Discussion

The results for the year 2001 quarterly monitoring events are generally similar to the results reported for the year 2000 quarterly monitoring program (see Figures 8 and 9).

As noted in last year's quarterly monitoring summary report, variations in VOC concentrations correlate with variations in groundwater elevations at the site. An increase in VOC concentrations follows a rise in groundwater elevations, and a decrease in VOC concentration follows a fall in groundwater levels (compare Figures 3 and 9).

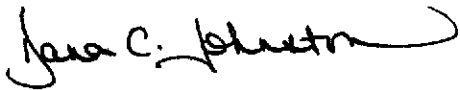
The concentrations of PCE detected in groundwater samples from MW-1 and MW-2 exceed California's primary drinking water standard for PCE, which is 5 $\mu\text{g}/\text{L}$. The concentrations of TCE detected in groundwater samples from MW-1 and MW-2 exceed California's primary drinking water standard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

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).

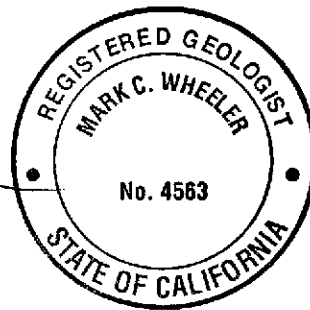
Professional Certification

Groundwater Monitoring Results
First through Fourth Quarter 2001
Cargill Salt - Alameda Facility
Alameda, California

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



Dana C. Johnston
Project Manager



Mark C. Wheeler
Principal Geologist
R.G. 4563

References

- Alameda County Environmental Health Services (ACEHS), 1999. Letter to Cargill Salt: "Groundwater Monitoring Well Installation at 2016 Clement Avenue, Alameda, CA", May 7, 1999.
- Crawford Consulting, Inc. (CCI), 1999. "Workplan for Groundwater Characterization and Monitoring Well Installation, 2016 Clement Avenue, Alameda, California", July 7, 1999.
- _____, 2001. "Groundwater Monitoring Results, First through Fourth Quarter 2000, Cargill Salt - Alameda Facility, Alameda, California", April 11, 2001
- Crawford Consulting, Inc. (CCI) and Conor Pacific/EFW, 2000. "Groundwater Characterization and Monitoring Well Installation, Cargill Salt - Alameda Facility, Alameda, California", January 31, 2000.
- Groundworks Environmental, Inc. (Groundworks), 1993. "Results of soil sampling and workplan for remedial activities, Alameda facility", October 19, 1993.
- _____, 1995. *Soil and Groundwater Investigations and Remedial Activities, July 1993 - September 1994, Cargill Salt - Alameda Facility, Alameda, California*, July 31, 1995.
- Hickenbottom, K. S., and Muir, K.S., 1988. *Geohydrology and Groundwater-Quality Overview of the East Bay Plain Area, Alameda County, California, 205 (j) Report*, prepared for the California Regional Water Quality Control Board, San Francisco Bay Region, by the Alameda County Flood Control and Water Conservation District, June 1988.

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
MW-1	11/16/99	09:56	6.75	3.75	3.00	NA
MW-1	3/30/00	10:09	6.75	2.81	3.94	0.94
MW-1	5/16/00	09:43	6.75	3.32	3.43	-0.51
MW-1	7/28/00	09:11	6.75	3.58	3.17	-0.26
MW-1	11/30/00	08:36	6.75	3.52	3.23	0.06
MW-1	3/26/01	08:47	6.75	3.15	3.60	0.37
MW-1	6/25/01	10:19	6.75	3.53	3.22	-0.38
MW-1	9/28/01	09:32	6.75	3.96	2.79	-0.43
MW-1	12/17/01	10:47	6.75	3.23	3.52	0.73
MW-2	11/16/99	11:15	9.81	5.22	4.59	NA
MW-2	3/30/00	10:05	9.81	2.80	7.01	2.42
MW-2	5/16/00	09:35	9.81	4.13	5.68	-1.33
MW-2	7/28/00	09:17	9.81	4.85	4.96	-0.72
MW-2	11/30/00	08:32	9.81	4.75	5.06	0.10
MW-2	3/26/01	08:40	9.81	3.28	6.53	1.47
MW-2	6/25/01	12:12	9.81	4.75	5.06	-1.47
MW-2	9/28/01	12:20	9.81	5.41	4.40	-0.66
MW-2	12/17/01	10:44	9.81	4.07	5.74	1.34
MW-3	11/16/99	15:43	6.92	4.34	2.58	NA
MW-3	3/30/00	10:01	6.92	2.77	4.15	1.57
MW-3	5/16/00	09:46	6.92	3.44	3.48	-0.67
MW-3	7/28/00	09:05	6.92	3.72	3.20	-0.28
MW-3	11/30/00	08:34	6.92	3.73	3.19	-0.01
MW-3	3/26/01	08:54	6.92	3.51	3.41	0.22
MW-3	6/25/01	10:21	6.92	3.65	3.27	-0.14
MW-3	9/28/01	09:30	6.92	3.96	2.96	-0.31
MW-3	12/17/01	10:38	6.92	3.28	3.64	0.68
MW-4	12/17/01	10:40	6.01	2.55	3.46	NA

Key:

NA = Not available

feet, MSL = feet, relative to Mean Sea Level

Table 2.
Relative Percent Difference Based on Duplicate Samples

Analysis	First Quarter 2001			Second Quarter 2001			Third Quarter 2001			Fourth Quarter 2001		
	Well MW-1 Results	DUP-1 Results	RPD ¹ (%)	Well MW-1 Results	DUP-1 Results	RPD ¹ (%)	Well MW-1 Results	DUP-1 Results	RPD ¹ (%)	Well MW-1 Results	DUP-1 Results	RPD ¹ (%)
Organic Compounds ($\mu\text{g/L}$)												
1,1-Dichloroethene (1,1-DCE)	ND ²	ND	NM ³	14	ND	NM	15	15	0	ND	ND	0
Trichloroethene (TCE)	180	190	5.4	250	150	50	210	210	0	190	210	10
Tetrachloroethene (PCE)	1,000	980	2.0	1,400	1,400	0	1,000	1,000	0	1,400	1,300	7.4
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 8021B/8010 analytes not detected.												

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	
DCE ²	<50.0	13	<10	15	14	<13	14	15	<13	6
CFC 113 ³	na ⁴	1.4	<10	<10	<8.3	<50	<50	<50	<50	ne ⁵
DCA ⁶	<50.0	0.8	<10	<10	<4.2	<13	<13	<13	<13	5
Chloroform	<50.0	0.6*	<10	<10	<8.3	<13	<13	<13	<13	ne
TCA ⁷	<50.0	1.6	<10	<10	<4.2	<13	<13	<13	<13	200
TCE ⁸	178	150	190	170	130	180	250	210	190	5
PCE ⁹	906	1,400	1,900	1,200	880	1,000	1,400	1,000	1,400	5
All other Method 8010/8021B analytes	nd ¹⁰	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 nd = not detected

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

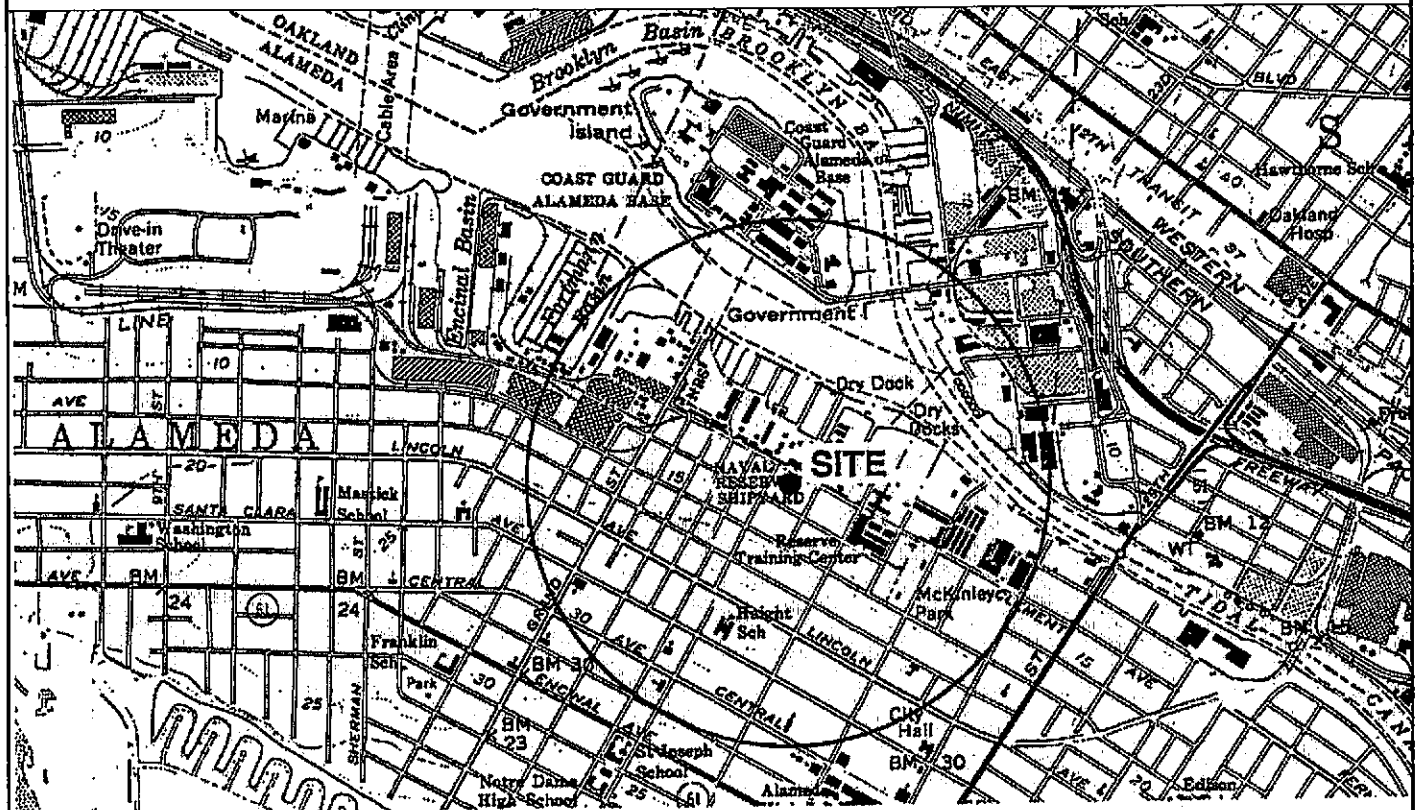
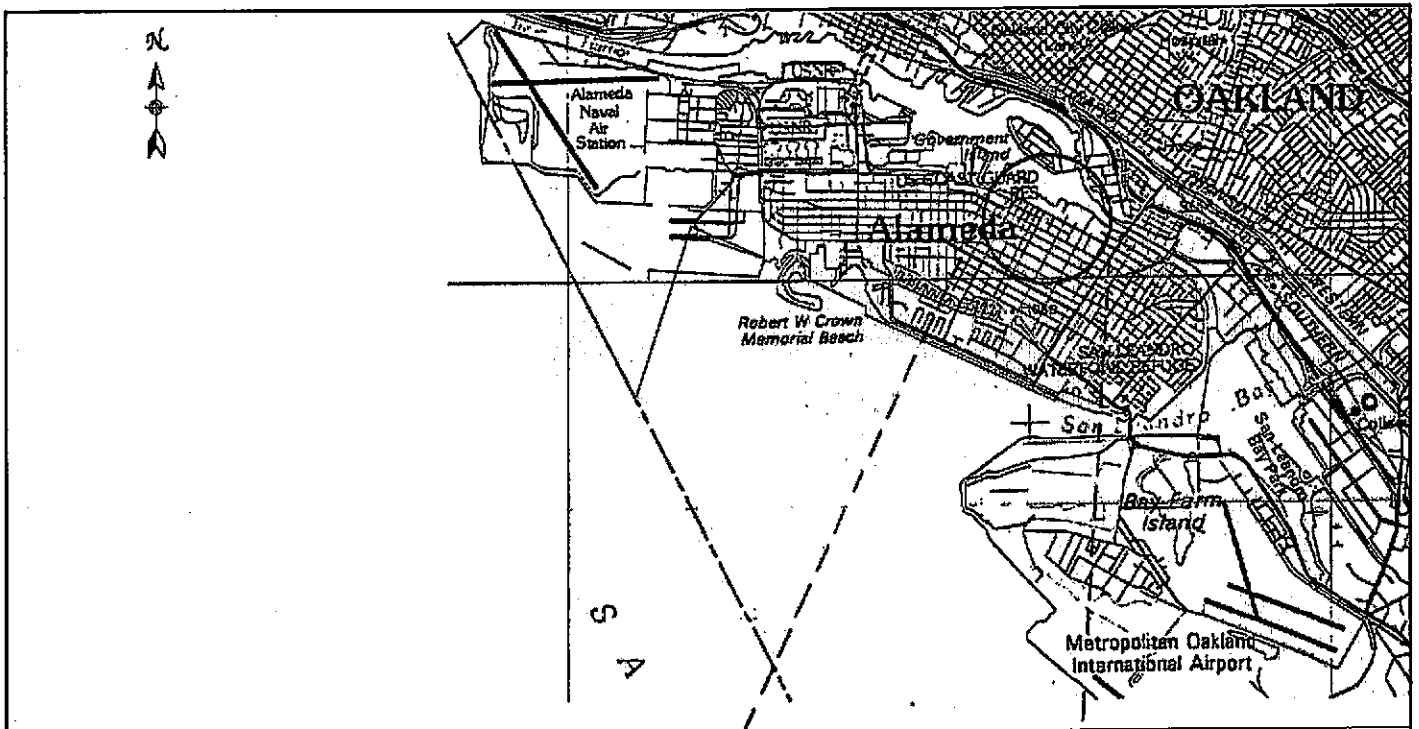
Although primary drinking water standards are exceeded in on-site groundwater, shallow groundwater in the vicinity of the site is not considered to be suitable as a source of drinking water (Groundworks, 1995; Hickenbottom and Muir, 1988).

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

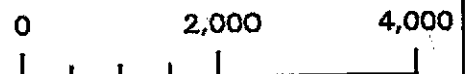
Well No. Field Date	MW-2									MCL ¹
	11/16/99	3/30/00	5/16/00	7/28/00	11/30/00	3/26/01	6/25/01	9/28/01	12/17/01	
DCE ²	<50.0	<0.5	<25	<25	<8.3	<25	<25	<25	<25	6
CFC 113 ³	na	<0.5	<25	<25	<17	<100	<100	<100	<100	ne ⁵
DCA ⁶	<50.0	<0.5	<25	<25	<8.3	<25	<25	<25	<25	5
Chloroform	<50.0	<0.5	<25	<25	<17	<25	<25	<25	<25	ne
TCA ⁷	<50.0	5.0	<25	<25	<8.3	<25	<25	<25	<25	200
TCE ⁸	<50	29	53	<25	20	40	78	<25	<25	5
PCE ⁹	840	3,600	3,200	3,300	1,700	2,200	4,400	1,700	1,700	5
All other Method 8010/8021B analytes	nd	nd	nd	nd	nd	nd	nd	nd	nd	--

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

Well No. Field Date	MW-3									MW-4	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	12/17/01		
DCE ²	<0.500	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<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	<2.0	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	5
Chloroform	<0.500	<0.5	<0.5	<0.5	<1.0	<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	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	5
PCE ⁹	<0.500	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	0.81	2.6	5
All other Method 8010/8021B analytes	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.



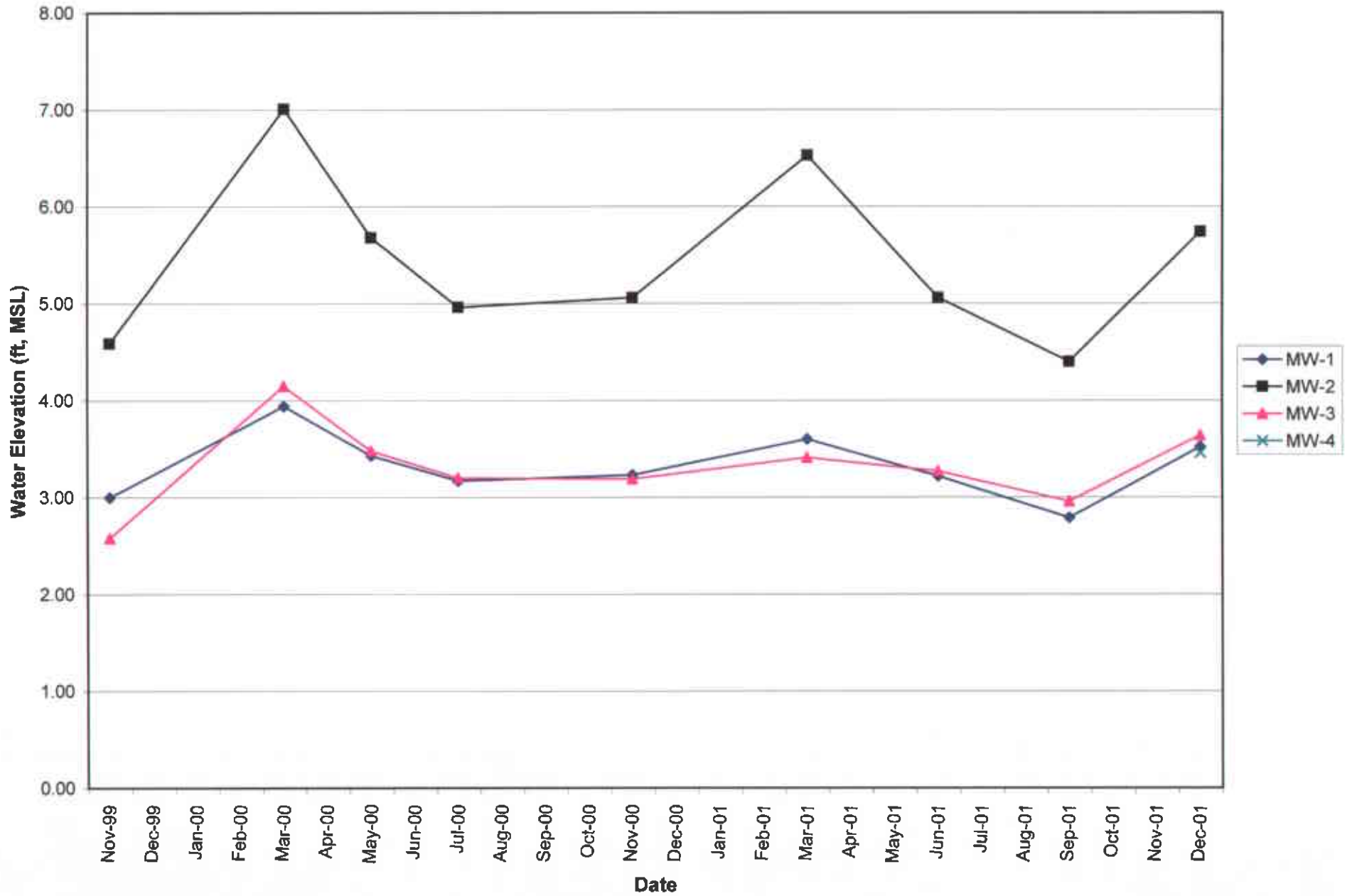
Scale in feet (lower map)

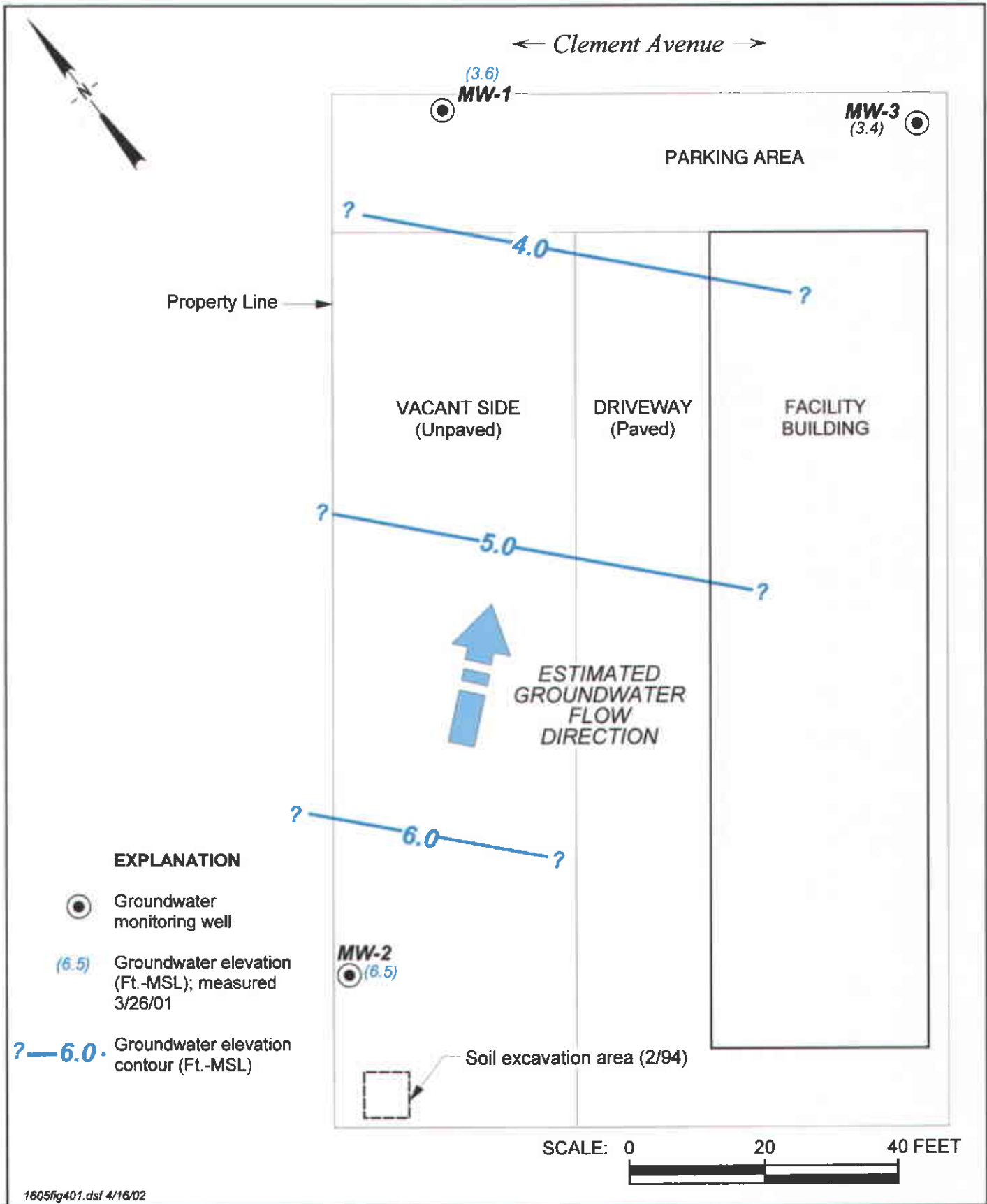


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Figure 1. Site Location

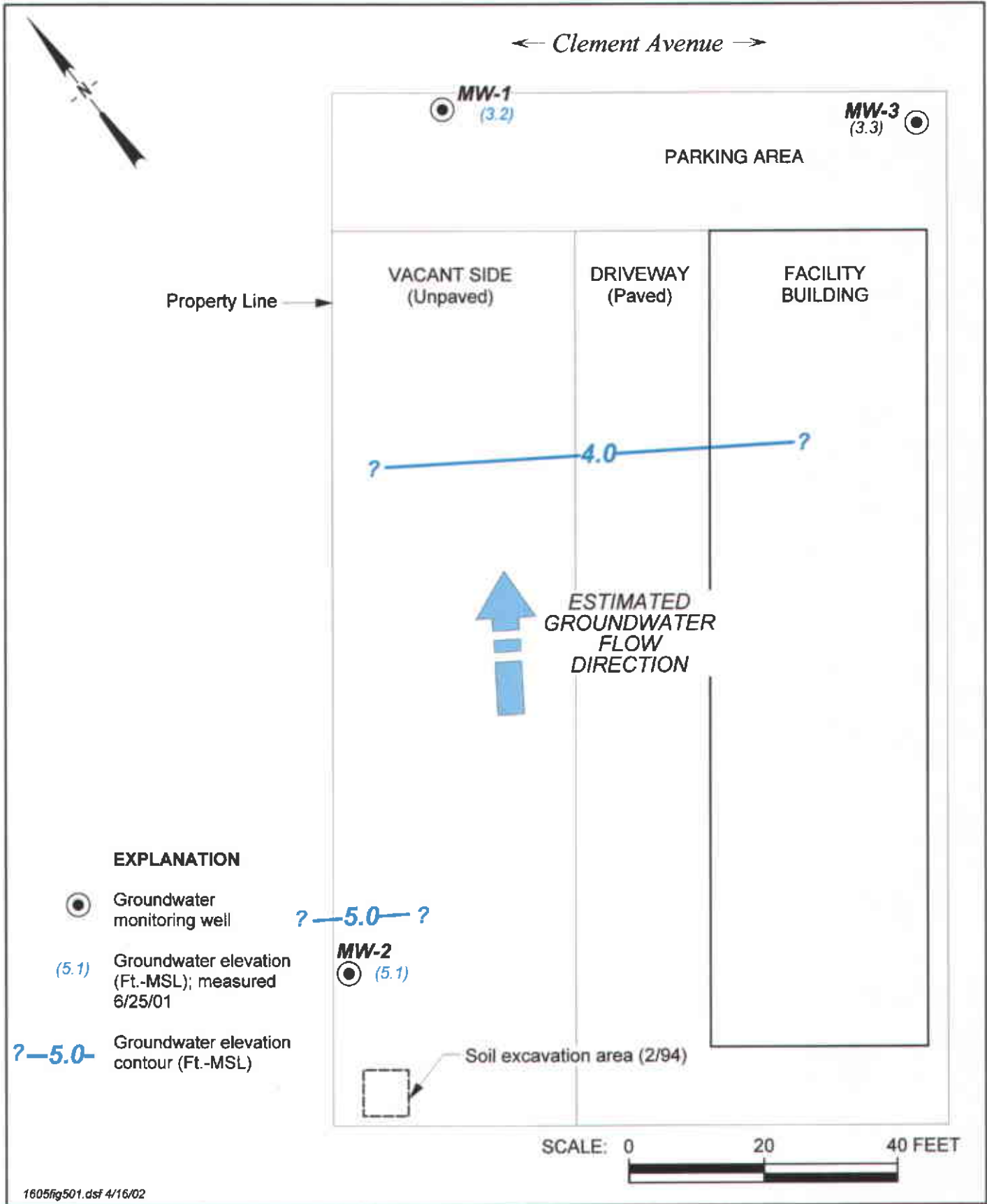
Figure 3. Graphical Summary of Groundwater Elevation Data





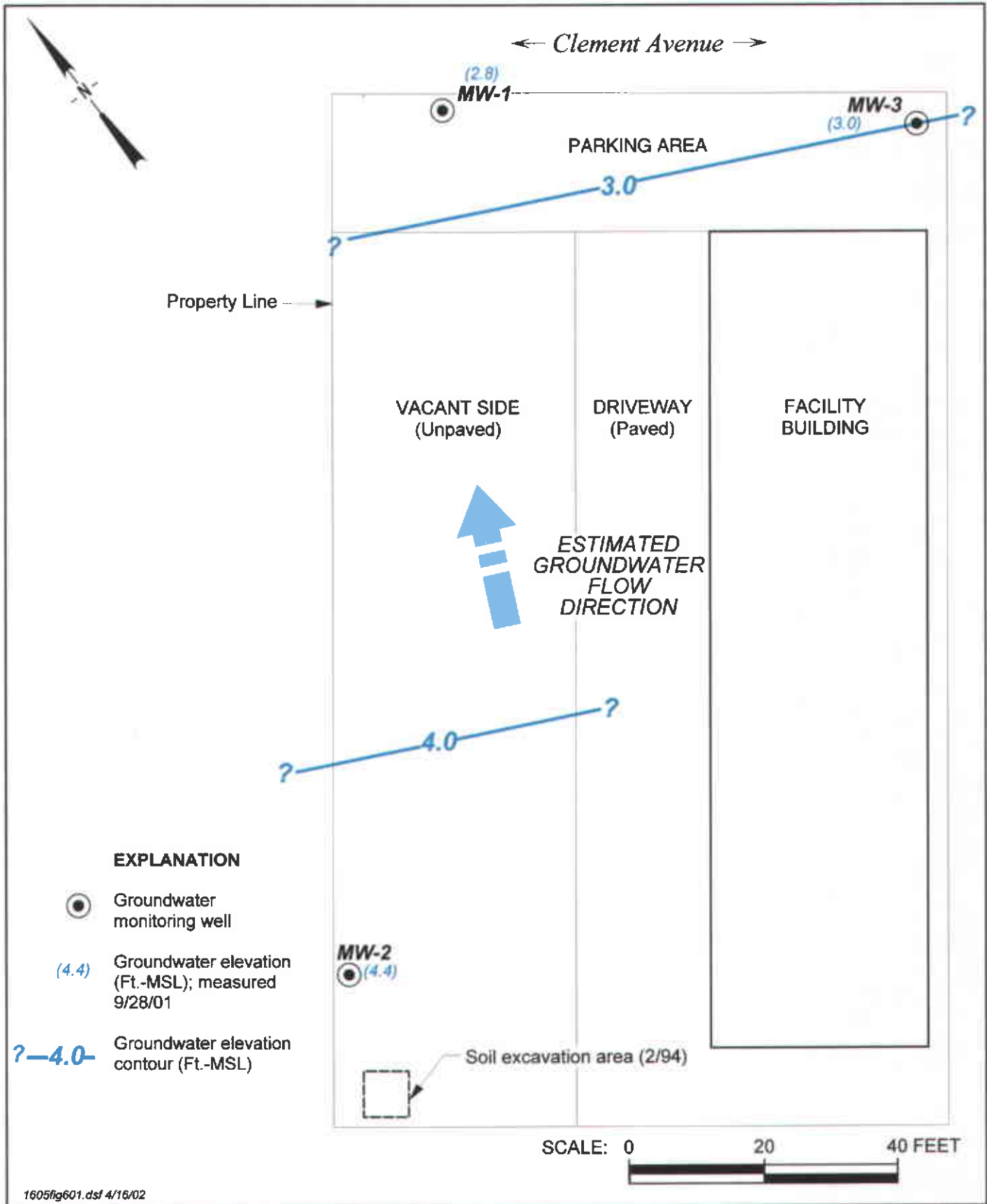
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Figure 4. Groundwater Elevation Contours - March 2001



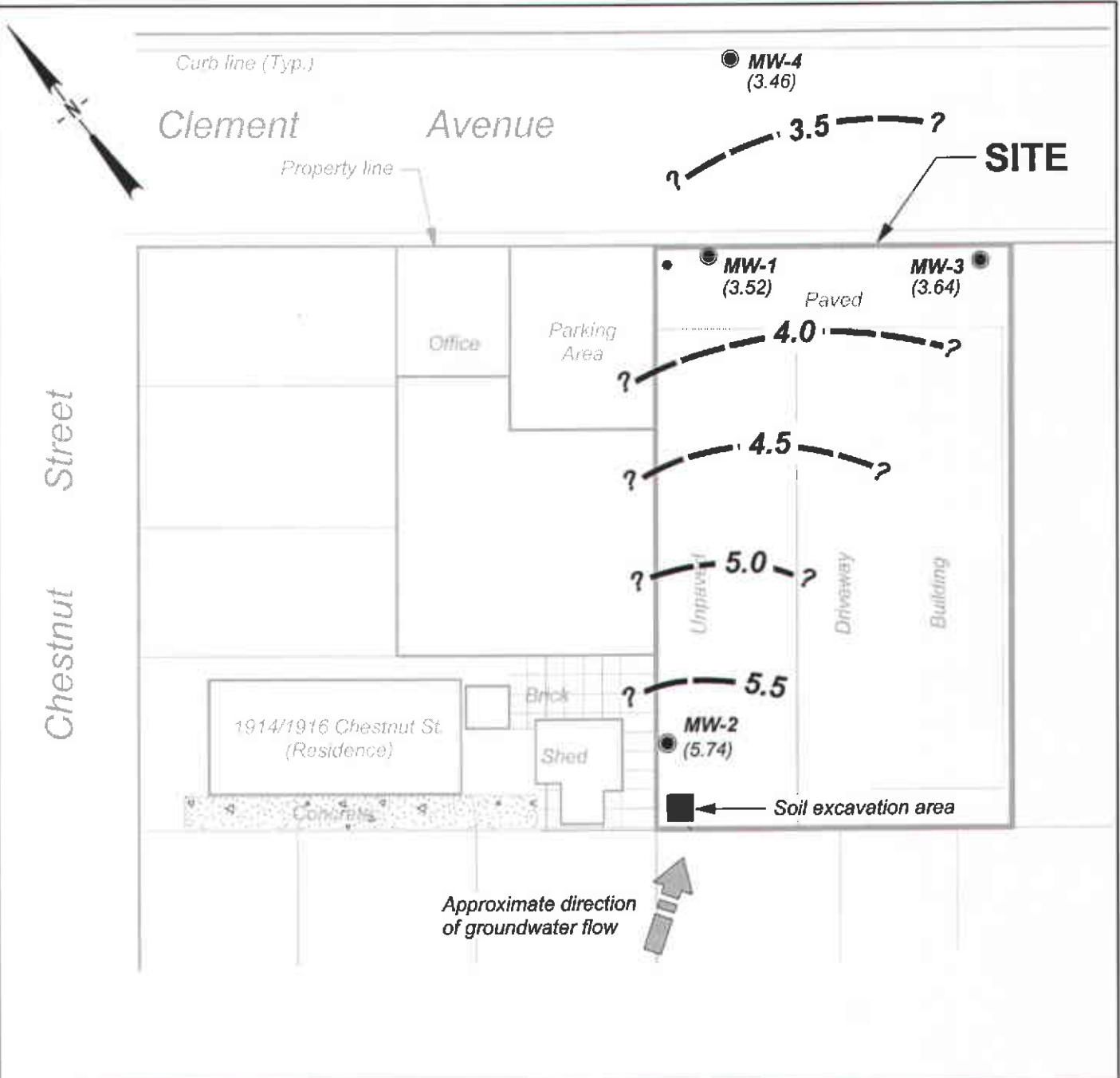
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Figure 5. Groundwater Elevation Contours – June 2001



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Figure 6. Groundwater Elevation Contours – September 2001



EXPLANATION



Monitoring well

(5.74) Groundwater elevation (Ft.-MSL);
measured 12/17/01



Groundwater elevation contour
(Ft.-MSL)

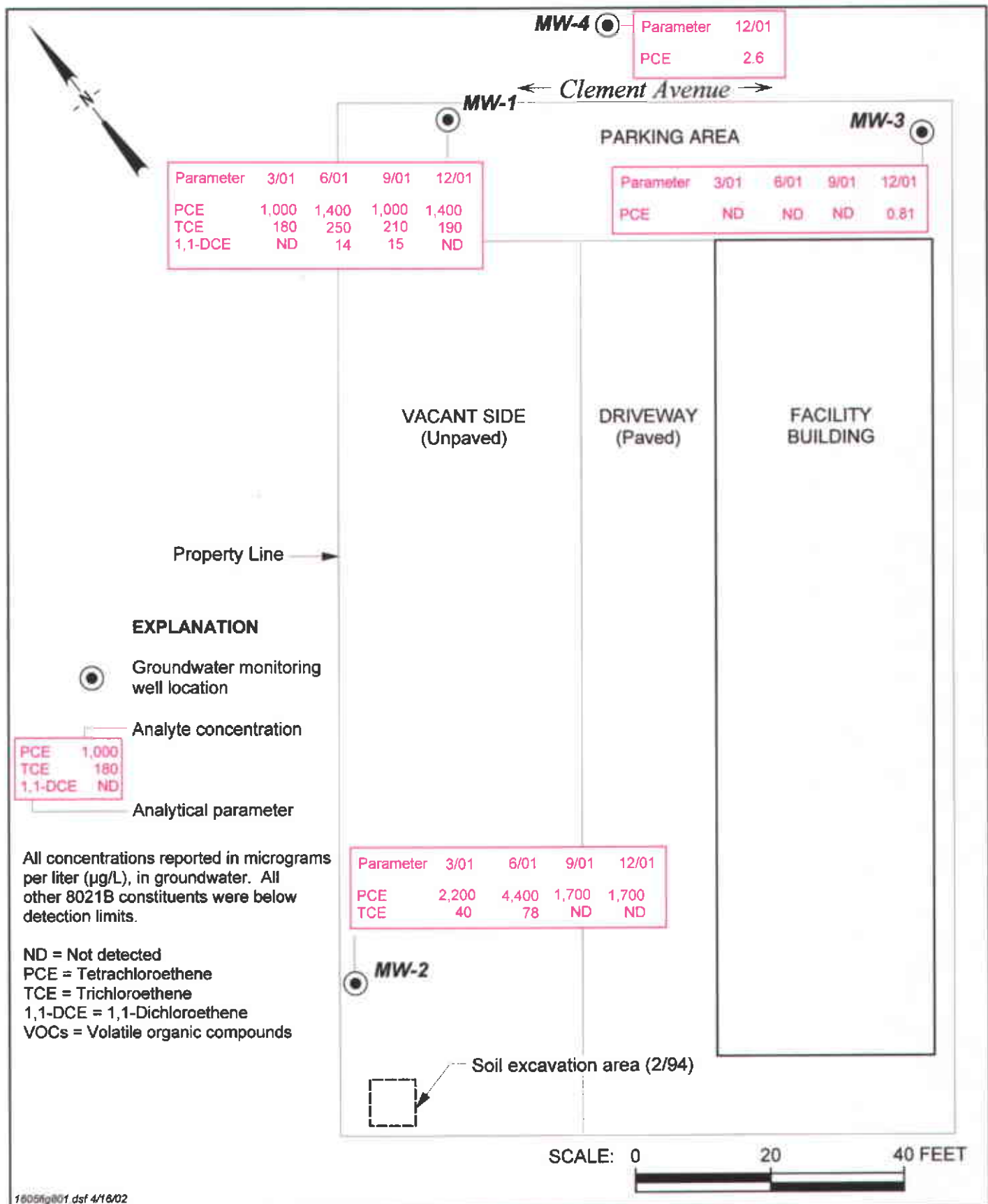


16059701 dsf 4/19/02

Map provided by Conor Pacific/EFW, Off-Site Groundwater Characterization and Remedial Evaluation, April XX, 2002.



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Figure 7. Groundwater Elevation Contours - December 2001



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**Figure 8. VOC Concentrations in Groundwater –
March through December 2001**

Figure 9. Graphical Summary of PCE Concentrations

