Final Supplemental Site Characterization Report
Beaumont Site No. 1
Beaumont, California

September 2002
TC 12376-01

Prepared for
Lockheed Martin Corporation
Burbank, California

Prepared by
Tetra Tech, Inc.



Brenda Meyer
Brenda Meyer, P.E.
Project Manager

Benjamin M. Weink
Benjamin M. Weink
Project Geologist

Thomas J. Villeneuve
Thomas J. Villeneuve, P.E.
Program Manager

Reviewer	General/ Specific	Comment	Response	Proposed Action	DTSC Approval
Tizita Bekele	General	The subject document presents results of the field investigation conducted to address concerns identified during the Five-Year review. The results of the investigation show that in addition to VOCs, perchlorate and 1,4-dioxane are extensively present in the groundwater which are not being removed by the existing air stripper designed to treat VOCs. Furthermore, after the VOCs are removed with the air stripper, the partially treated groundwater containing perchlorate and 1,4-dioxane is reinjected back into the aquifer.	The primary scope of the supplemental investigation was to fill perceived/potential data gaps and to collect some post cleanup vadose zone data from the BPA.	An evaluation of the remedial system is underway. In order to minimize the potential spreading of the new contaminants, LMC will request permission to temporarily disrupt operation of the RMPA pump and treat system.	
		The data also indicates while elevated levels of VOCs, perchlorate and 1,4-dioxane are detected at the burn pit and the rocket motor production area, the plume above MCLs or recommended action levels is wide spread.	Comment noted.	Tasks are currently underway to further evaluate groundwater quality and to develop a site wide cleanup strategy.	
		Based on the findings of the investigation, the existing groundwater treatment system is inadequate to remove the contaminants identified at the site. Therefore, appropriate treatment technologies to effectively remove perchlorate and 1,4-dioxane should be added to the groundwater treatment system.	The primary scope of the supplemental investigation was to fill perceived/potential data gaps and to collect some post cleanup vadose zone data from the BPA.	An evaluation of the treatment system is underway.	
		In addition, ESU recommends re-evaluating the reinjection of contaminants back to the groundwater, as well as, the effectiveness of the existing extraction wells located at the burn pit area to effectively contain the widely spread plume.	The primary scope of the supplemental investigation was to fill perceived/potential data gaps and to collect some post cleanup vadose zone data from the BPA.	An evaluation of the treatment system is underway, including reinjection, to assess the effectiveness of control for all groundwater contaminants being extracted. In order to minimize the potential spreading of the new contaminants, LMC will request permission to temporarily disrupt operation of the RMPA pump and treat system.	

Reviewer	General/ Specific	Comment	Response	Proposed Action	DTSC Approval
Ron Okuda	Specific	1. The Report should be signed and stamped by the P.E., C.H.g., or R.G. responsible for the geologic and hydrogeologic interpretations described in the Report.	The report will be revised as requested.	Two of the signatories listed on the document's signature page are registered engineers. The signature page was stamped by an engineer as requested.	
		2. Section 3.5.1 Soil and Soil Gas Sampling at Direct Push Boreholes, Page 3-14. The second sentence in the second paragraph should be revised as follows: "The soil matrix samples were preserved in the field following EPA method 5035 (using Encore™ samplers) and analyzed for VOCs by EPA method 8260."	The report will be revised as requested.	Section 3.5.1 page 3-14 was revised as requested.	
		3. Section 5.1.3.3 Spatial Distribution of Analytes. Page 5-20 The analyte concentration isopleth maps (Figure 5-5 through Figure 5-12) provide an indication of lateral distribution of the constituents of concern. The unusual iso-concentration lines shown in the vicinity of the BPA (Figures 5-5 through Figure 5-11) are the result of plotting analyte concentrations from groundwater samples collected from wells screened at different depths. For example, on Figure 5-8, 0.3 micrograms per liter of trichloroethene was detected in groundwater monitoring well MW-03 (well screen between 260 feet below ground surface [bgs] and 270 feet bgs). Adjacent well MW-02 (well screen between 73 feet bgs and 93 feet bgs) detected 167 micrograms per liter of trichloroethene. There is approximately 182 feet of separation between the well screen lengths in MW-02 and MW-03. GSU recommends that the figures be redrawn to depict analyte concentrations from wells screened at approximately the same depth. Multiple isopleth maps or cross sections showing the vertical distribution of specific analytes will provide a better presentation of the groundwater data.	Maps were prepared for comparison to previous studies which included wells at various depths.	Alternative criteria for how best to graphically present the analytical data will be evaluated as part of future deliverable.	

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Ron Okuda	Recommendation	1. The lateral extent of the VOC plume upgradient and downgradient of the BPA and RMPA is not fully defined. The data shows that groundwater contamination has migrated beyond the most distant downgradient monitoring wells (MW-15 and MW-18), at least 2,500 feet downgradient from the RMPA. GSU recommends that further investigation be conducted to define the lateral extent of the plume. Additionally, LMC should evaluate remedial alternatives to capture and prevent further groundwater migration of the contaminant plume downgradient of the BPA and RMPA.	The primary scope of the supplemental investigation was to fill perceived/potential data gaps and to collect some post cleanup vadose zone data from the BPA.	Tasks are currently underway to further evaluate both groundwater quality and remedial alternatives.	
		2. It appears that the distribution of 1,4-dioxane and perchlorate in the aquifer (Figures 5-5 and 5-6) northwest and southwest of the RMPA is the result of reinjection of groundwater from the RMPA P&T system. Since the current remediation system is not effective in removing 1,4-dioxane and perchlorate, remedial alternatives to remove these compounds from the groundwater should be incorporated in the current remediation design.	The primary scope of the supplemental investigation was to fill perceived/potential data gaps and to collect some post cleanup vadose zone data from the BPA.	An evaluation of the remedial system is underway. In order to minimize the potential spreading of the new contaminants, LMC will request permission to temporarily disrupt operation of the RMPA pump and treat system.	
Gerald A. Pollock	General	Overall, HERD notes that the report is well organized and presented in a reasonable format. The use of tables and figures is useful in understanding the sampling results.	Thank you	None required	

Reviewer	General/ Specific	Comment	Response	Proposed Action	DTSC Approval
		1. However, HERD does not agree with all the conclusions presented in the report regarding the chemicals of potential concern (COPCs). The report reviews the analytical results and concludes, "in conclusion, no other groundwater COPCs were identified during this sampling event and therefore only the previously identified COPCs will be discussed and evaluated further." (Page 5-20). Earlier, the report concludes that cis-1,2-DCE and vinyl chloride should not be further evaluated due to the low levels of detection and the low frequency of detection. HERD does not support this conclusion. Rather, it seems appropriate to continue to evaluate the presence of these compounds, because they are breakdown products and may change over time. In regards to potential human health impacts, their presence may be of health concern. HERD recommends including these compounds in the evaluation but, including a discussion in the uncertainty section that presents the rationale as to why they should be dismissed from consideration. Also, other compounds detected at low levels (e.g., BTEX, MTBE, TEC, etc.) should be carried through the future risk assessment process.	All of the test data presented in this report will be carried forward into future investigations and assessments. The COPCs analysis performed as part of this report is intended to focus the discussion on those contaminants that are of most concern. Future testing will continue to analyze for all VOCs via Method 8260B. A health risk assessment will be conducted when the characterization of the site is complete. The human health risk assessment will assess all detected compounds.	Conduct human health risk assessment after site characterization is complete. Continue testing for all VOCs by Method 8260B.	
		2. There is not sufficient information presented in the report to support the conclusion that, "...no significant residual analytes remain in the soil." This conclusion is based on a comparison with residential PRGs and HERD notes that PRGs are only screening values. HERD does not support using PRGs for determining potential human health concerns in a risk assessment. PRGs only address potential risk/hazard to a single chemical but, risk assessment should address the total risk/hazard from all contaminants at a site. In future risk assessment, HERD recommends calculating potential risks/hazards using appropriate exposure models.	The PRGs were used as a screening tool to focus the discussion in this report on the contaminants of most concern. The proposed human health risk assessment will assess all detected compounds.	Complete site characterization and conduct human health risk assessment per DTSC guidelines. Section 6.0 pages 6-1 and 6-2 were modified to be consistent with the proposed action.	

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		3. HERD also notes that the report (Section 5.1.3.2) notes that metals have not been identified as COPCs, and therefore, are not addressed in this report. It notes that metals will be included in a subsequent risk assessment. Still, the report lists the results of analyses for metals, anions, and cations. HERD comments that some of the maximum levels of metals appear quite high (e.g., cadmium, lead, etc.). It appears that there may be some level of contamination.	Until a background analysis is performed as part of the risk assessment, it is unknown if metals contamination exists at the site.	Metals will be included in the human health risk assessment as well as a background analysis. Section 5.1.3.2 page 5-20 was modified to be more consistent with the proposed action.	
		HERD notes it concurs with the conclusion that soil vapor concentrations show a marked decrease from levels detected in the 1990's. HERD also agrees with the conclusion that some areas of contamination have not been fully delineated (Page 6-1). Overall, the Supplemental Site Characterization shows significant contamination of soil, groundwater, and surface waters still exists and supports actions to reduce contaminant levels. HERD also notes that the use of the isopleth figures shows a fairly consistent pattern of contamination and HERD supports the use of these figures for presentation of the results.	While it would be fair to say that contamination has been detected, the significance of it has not been determined.	No action required.	
Gerald A Pollock	Specific	1. Page 2-7, Section 2.5.2. HERD recommends including a figure that shows the extent of contamination described in this section. Also, it is not clear whether the "concentrations of VOCs" refers to the total VOCs or the levels for each of the main COPCs/VOCs. This should be clarified.	This data was extracted from previous reports and will be clarified as requested. A figure is not available. The statement is an observation and/or interpretation made by the previous authors. A reference for the statement was provided.	Section 2.5.2 page 2-7 was modify as appropriate. No additional figures will be added.	

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		2. Page 4-5. Section 4.2.4 and Page 5-14. Section 5.1.3.1: HERD notes that some analyses (e.g., SW6010/metals, E160.1TDS, etc.) had high levels of qualified data. For instance, 40% of the metals data were qualified. This level of qualification seems high and raises concerns regarding data quality.	All water, even purified water, has detectable levels of metals in it. Also, the native concentrations of metals detected in the samples collected from wells at the site were very low as well, many of them were "J" qualified because they were detected at concentrations between the method detection limit and the quantitation limit. Unfortunately, because of the low native concentrations, the validation process has resulted in an unusually high number of metals data "B" qualified due to potential blank contamination. We resampled several of the wells using different blank water and came up with similar results.	Retesting did not improve the data quality because of continued low level detection of metals. No further action is proposed. Section 4.2.4 page 4-5 was modified to better explain the source of the "B" qualified inorganic data.	

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		Also, Page 5-14 notes. "Since only hard copies of the environmental sample results were provided, the data was not validated for quality assurance and therefore the validity of the results is unknown." HERD has concerns that the data are not of sufficient quality to support risk assessment. HERD recommends review of the data quality by DTSC technical staff (Hazardous Materials Lab chemist, geologist, or Project Manager) with a determination that the data are acceptable.	Some of the data was provided by another contractor and it was not validated prior to receipt. The contractor was contacted and they indicated that the data has since been validated and that the validation performed will be documented in the routine groundwater monitoring report. (*Semiannual Groundwater Monitoring Report May 2002 Beaumont Test Site Facility No. 1, Prepared by Earth Tech, Inc., Dated 26 June 2002*)	Only validated data will be used in the risk assessment.	
Gerald A. Pollock	Conclusions and Recommendations	Overall, HERD concurs with the general description of contamination at the Site and the description of changes in contaminant levels over time. However, in order for the report to be acceptable, it should address the comments noted above. HERD has concerns regarding the potential contamination with vinyl chloride and cis-1,2-DCE and recommends continued consideration/examination of these contaminants in future activities. HERD also has concerns regarding the high frequency of some qualified data. HERD recommends including all detected organic compounds in the future human health risk assessment and evaluation of possibly elevated levels of metals. If you have any questions regarding the above comments, please feel free to contact me at (916) 255-6648 or gpollock@dtsc.ca.gov.	See responses to previous Gerald A. Pollock comments (General comments 1 and 3 and Specific comment 2).	See previous proposed actions to Gerald A. Pollock comments (General comments 1 and 3 and Specific comment 2).	

TETRA TECH, INC.
348 West Hospitality Lane, Suite 100
San Bernardino, CA 92408
Telephone (909) 381-1674
FAX (909) 889-1391

18 August 2002

Ms. Linda Gertler
Lockheed Martin Corporation
2550 N. Hollywood Way, 3rd Floor
Burbank, CA 91505

Subject: Submittal of Final Supplemental Site Characterization Report for Beaumont Site No. 1

Dear Ms. Gertler:

Enclosed are three copies of the subject final document for your review. Four copies have also been included for submittal to the Department of Toxic Substances Control (DTSC) under a separate cover letter prepared by Lockheed Martin Corporation. If you have any questions please call the undersigned at (909) 381-1674 or Neil Shukla at (626) 351-4664.

Sincerely,

Brenda Meyer

Brenda Meyer, P.E.
Project Manager
Tetra Tech, Inc.

cc: G. Matshshita; Lockheed Martin
N. Shukla, Tt-Engineering
T. Villeneuve, Tt-Engineering
D. Batrack, Tt-Engineering
P. Jex, Tt Contracts

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1-1
1.1 SITE BACKGROUND 1-1
1.2 OBJECTIVES OF THE SUPPLEMENTAL SITE CHARACTERIZATION 1-1

2.0 SITE CONCEPTUAL MODEL 2-1
2.1 PREVIOUS INVESTIGATIONS 2-1
2.2 PHYSICAL SETTING 2-3
2.3 GEOLOGY 2-4
2.4 HYDROGEOLOGY 2-5
2.5 ANALYTE DISTRIBUTION 2-6
2.5.1 Vadose Zone Impacts 2-6
2.5.2 Affected Groundwater 2-7

3.0 SUMMARY OF FIELD INVESTIGATION 3-1
3.1 GROUNDWATER SAMPLING 3-1
3.2 HYDRAULIC TESTING 3-9
3.3 SURFACE WATER SAMPLING 3-9
3.4 QUALITY CONTROL FOR GROUNDWATER AND SURFACE WATER SAMPLES 3-9
3.5 VADOSE ZONE SAMPLING 3-10
3.5.1 Soil and Soil Gas Sampling at Direct Push Boreholes 3-13
3.5.2 Soil Gas Sampling at Wells 3-14

4.0 SUMMARY OF DATA QUALITY OBJECTIVES AND COMPLIANCE 4-1
4.1 COMPLIANCE WITH DQOS OF ACCURACY, PRECISION, COMPLETENESS, AND COMPARABILITY 4-1
4.1.1 Accuracy 4-1
4.1.2 Precision 4-2
4.1.3 Completeness 4-3
4.1.4 Comparability 4-4
4.2 LABORATORY QA/QC: ANALYSIS METHODOLOGIES, METHOD COMPLIANCE, AND CORRECTIVE ACTIONS 4-4
4.2.1 Analysis Methodologies 4-4
4.2.2 Method Compliance 4-4
4.2.3 Corrective Action 4-4
4.2.4 Other Qualified Data 4-4
4.3 APPROPRIATENESS OF DATA FOR RISK ASSESSMENTS 4-5

5.0 RESULTS OF FIELD INVESTIGATION 5-1
5.1 GROUNDWATER ANALYSIS 5-1
5.1.1 Groundwater Elevations and Flow Direction 5-1
5.1.2 Aquifer Testing 5-1
5.1.3 Groundwater Quality 5-14
5.2 SURFACE WATER ANALYSIS 5-38
5.2.1 Analytical Results 5-38
5.2.2 Interpretation of Results 5-40
5.3 SOIL AND GAS ANALYSIS 5-42
5.3.1 Analytical Results 5-42

5.3.2 Interpretation of Results 5-42
6.0 CONCLUSIONS 6-1
7.0 REFERENCES 7-2
8.0 ACRONYMS 8-1

TABLE OF FIGURES

Figure 1-1 Site Location Map 1-2
Figure 3-1 Sampling Locations, May 2002 3-2
Figure 3-2 Spring/Summer 2002 Soils and Soil Gas Sampling Locations 3-11
Figure 5-1 May 2002 Groundwater Contours – QA Wells 5-4
Figure 5-2 May 2002 Groundwater Contours – ME Wells 5-5
Figure 5-3 Hydraulic Conductivity Distribution-QA Wells 5-12
Figure 5-4 Hydraulic Conductivity Distribution-ME Wells 5-13
Figure 5-5 Perchlorate Concentration Isopleth Map, May 2002 5-24
Figure 5-6 1,4-dioxane Concentration Isopleth Map, May 2002 5-25
Figure 5-7 Total VOCs Concentration Isopleth Map, May 2002 5-27
Figure 5-8 Trichloroethene Concentration Isopleth Map, May 2002 5-28
Figure 5-9 1,1-Dichloroethene Concentration Isopleth Map, May 2002 5-30
Figure 5-10 1,2-Dichloroethane Concentration Isopleth Map, May 2002 5-31
Figure 5-11 1,1-Dichloroethane Concentration Isopleth Map, May 2002 5-33
Figure 5-12 1,1,1-Trichloroethane Concentration Isopleth Map, May 2002 5-34
Figure 5-13 Vertical Analyte Profile-Source Area (BPA) Depth Profile 5-35
Figure 5-14 Vertical Analyte Profile-Downgradient Source Area (BPA) and Near RMPA 5-37
Figure 5-15 Vertical Analyte Profile-Downgradient of the RMPA and BPA 5-39
Figure 5-16 Surface Water Sampling Locations, May 2002 5-41
Figure 5-17 Soil and Soil Gas Concentrations, May 2002 5-49
Figure 5-18 1,1-DCE Soil Gas Concentrations, May 2002 5-50
Figure 5-19 TCE Soil Gas Concentrations, May 2002 5-51
Figure 5-20 1,1,1-TCA Soil Gas Concentrations, May 2002 5-52
Figure 5-21 1,1,1-DCA Soil Gas Concentrations, May 2002 5-53
Figure 5-22 Perchlorate Soil Gas Concentrations, May 2002 (15' bgs) 5-54
Figure 5-23 1,4-dioxane Soil Concentrations, May 2002 (5' and 15' bgs) 5-57

LIST OF TABLES

Table 3-1 Sample Matrix Beaumont No. 1 Site Lockheed Martin Corporation 3-3
Table 3-2 Well Construction Data Beaumont No. 1 Site Lockheed Martin Corporation 3-7
Table 3-3 Sample Matrix and Analysis Schedule for Soil and Soil Gas Samples Beaumont No. 1 Site Lockheed Martin Corporation 3-12

Table 5-1 Groundwater Elevations-May 2002 Beaumont No. 1 Site Lockheed Martin Corporation 5-2
Table 5-2 Lockheed Propulsion Company Beaumont Test Facility 2002 Slug Test Results Hydraulic Conductivity Values 5-7
Table 5-3 Lockheed Propulsion Company Beaumont Test Facility 2002 Slug Test Results Transmissivity Values 5-8
Table 5-4 Aquifer Test Results - Hydraulic Conductivity Estimates Beaumont No. 1 Site Lockheed Martin Corporation 5-11
Table 5-5 Groundwater Analytical Data Summary – Chemicals of Potential Concern (COPCs) Beaumont No. 1 Site Lockheed Martin Corporation 5-15
Table 5-6 Groundwater Analytical Data Summary – Metals Beaumont No. 1 Site Lockheed Martin Corporation 5-18
Table 5-7 Groundwater Analytical Data Summary –Anions Analytes Beaumont No. 1 Site Lockheed Martin Corporation 5-19
Table 5-8 Summary of Detected COPCs Beaumont No. 1 Site Lockheed Martin Corporation 5-21
Table 5-9 Summary of Detected Inorganic Analytes-Metals, Anions, and Cations Beaumont No. 1 Site Lockheed Martin Corporation 5-22
Table 5-10 Frequency and Range of Detected Surface Water Analytes 5-40
Table 5-11 Comparison of Surface Water Results with Nearby Groundwater Results 5-40
Table 5-12 Soil and Soil Gas Analytes of Potential Concern Beaumont No. 1 Site Lockheed Martin Corporation 5-43
Table 5-13 Soil Analytical Data Summary-Metals Beaumont No. 1 Site Lockheed Martin Corporation 5-45
Table 5-14 Detected Inorganic Analytes-Metals Beaumont No. 1 Site Lockheed Martin Corporation (mg/kg unless otherwise noted) 5-47
Table 5-15 Frequency and Range of Detected Soil Gas Analytes 5-47
Table 5-16 Frequency and Range of Detected Environmental Soil Analytes 5-48
Table 5-17 Soil Vapor Concentration Comparisons in Individual Wells 5-55
Table 5-18 Comparison of Soil Gas Results with Previous Survey 5-59

LIST OF APPENDICES

Appendix A Validated Analytical Results by Method
Appendix B Field Data Sheets
Appendix C QA/QC Guidelines
Appendix D Laboratory Analytical Data Packages
- Tetra Tech Groundwater Data
- Earth Tech Groundwater Data
- Tetra Tech Soil Data
- Tetra Tech Soil Gas Data

Appendix E Slug Test Plots – Volume III
Appendix F Previous Investigation Data – Volume III

EXECUTIVE SUMMARY

At the request of Lockheed Martin Corporation, Tetra Tech performed a supplemental site characterization at Beaumont Site No. 1 (Site). The objectives of the investigation were to: 1) provide a current and more extensive picture of the extent of the Volatile Organic Compounds (VOCs), 1,4-dioxane, and perchlorate affected groundwater, particularly down gradient, 2) collect additional aquifer hydraulic conductivity data, 3) evaluate the potential affect of VOCs, 1,4-dioxane, and perchlorate on surface water at the Site, 4) collect additional soil/soil gas samples to evaluate the potential for residual VOC, 1,4-dioxane, and perchlorate impacted soils at the Site, and 5) evaluate potential data gaps.

The Site is a 9,100-acre parcel located south of Beaumont, California. Between 1950 to 1974, the Site was utilized for rocket motor production (mixing and curing solid rocket fuel motors and testing of solid rocket fuel motors) and ballistics testing by the Grand Central Rocket Company and the Lockheed Propulsion Company.

Rocket propellant was used in and around the area referred to as the Rocket Motor Production Area. Activities associated with rocket motor production may have affected soil and groundwater in this area.

Rocket propellant and a number of process chemicals were used at the Site. These chemicals and waste propellant were disposed of in open burn pits, in a location on site commonly referred to as the burn pit area (Burn Pit Area). Soil and groundwater beneath the burn pit area have been affected by VOCs and perchlorate from the disposal activities.

Groundwater Characterization

Groundwater level measurements were collected from 107 monitoring, injection, and extraction wells in May 2002. The groundwater within the Quaternary Alluvium (QA) and the Mount Eden (ME) Formation generally flows from the eastern portion of the valley towards the west-southwest into Masacre Canyon. Cones of depression are present around extraction wells EW-1 and EW-2 and a groundwater mound exists near injection wells IW-3 and IW-4. In general, the slope of the water table follows along the surface topography of the valley floor. Hydraulic conductivity at the Site is generally moderate to low.

A total of 52 monitoring wells were sampled and analyzed for VOCs, perchlorate and 1,4-dioxane. Primary chlorinated solvents and solvent degradation products including trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in groundwater. 1,4-Dioxane and perchlorate were also reported in groundwater wells. Based on the data collected, perchlorate appears to be more widespread than the solvents and 1,4-dioxane, extending further north, south and east of the Burn Pit Area and Rocket

Motor Production Area. The extent of groundwater affected by chlorinated solvents and perchlorate extends up gradient of the Burn Pit Area and down gradient of the Rocket Motor Production Area. The extent of the affected groundwater is defined in the area between the Burn Pit Area and Rocket Motor Production Area. The extent of solvents and perchlorate in groundwater is not well defined at the up gradient and down gradient plume margins and north of the Rocket Motor Production Area. The extent of 1,4-dioxane affected groundwater is not well defined down gradient, north of the Rocket Motor Production Area, and south of the Burn Pit Area.

The vertical extent of affected groundwater shows that the bulk of the analytes are confined to the upper portion of the water-bearing units and migration into the deeper units is limited. Based on the vertical distribution of the affected groundwater, it appears that the aquifer displays a much stronger horizontal gradient in comparison to the weaker vertical gradient. Concentrations in the deeper, less permeable units, are in many cases three to four orders of magnitude less than the concentrations detected at the water table.

Test results from groundwater samples collected at the Site indicate that the Burn Pit Area is a likely source of chlorinated solvent, 1,4-dioxane, and perchlorate observed in the groundwater. Source(s) of perchlorate may exist in the Rocket Motor Production Area. Soil data indicates elevated levels of perchlorate north of the monitoring wells in the Rocket Motor Production Area.

Groundwater quality data collected during this investigation was compared to data collected during the source and hydrogeologic investigation in 1989 (Radian, 1990). Overall, the only significant temporal trends identified were the notable decreases in VOCs in the area immediately down gradient of the Burn Pit Area and in the Rocket Motor Production Area. The concentration changes that were observed are most likely due to the remedial actions conducted between 1992 and 1999, as well as plume migration over time.

Surface Water Characterization

Three surface water samples were collected and analyzed for VOCs, 1,4-dioxane, and perchlorate. Two of the surface water locations are ponds fed by direct groundwater discharge and the third pond is fed by artesian flow from well MW-45. Analytes were detected in two of the three surface water locations at concentrations above the maximum contaminant level (MCL) or California Recommended Action Level (CRAL). The analytes detected include perchlorate, 1,4-dioxane, TCE, and 1,1-DCE. The analytes and concentrations detected at the locations fed by direct groundwater discharge are similar to those detected in nearby monitoring wells.

Surface water samples also indicate 1,4-dioxane impacted groundwater extends beyond the furthest down gradient well sampled during this investigation.

Soil and Soil Gas Characterization

A total of 40 soil and 40 soil gas samples were collected and analyzed from 20 locations at depths of 5 and 15 feet below ground surface (bgs). Ten of these locations were within the Rocket Motor Production Area and ten of these locations were within the Burn Pit Area. Seven of the locations sampled in the Burn Pit Area were replicates of historic sampling locations. In addition, soil gas was also collected from 3 extraction wells and 10 groundwater monitoring wells.

Soil gas samples were collected at ten probe locations and three vapor extraction wells at the Burn Pit Area. 1,1-DCE was the only analyte detected in the vapor probes at concentrations ranging from 0.4 to 0.6 µg/L at two locations. The samples from the three vapor wells had detectable concentrations of TCE, 1,1-DCE, 1,1-DCA and 1,1,1-TCA. Of the analytes detected in the samples from the Burn Pit Area vapor wells, 1,1-DCE had the highest concentrations of detected VOCs, ranging from 29 µg/L to 152 µg/L. TCE and 1,1,1-TCA were also detected in the three vapor monitoring wells at concentrations ranging from 1.6 to 16 µg/L and 1.4 to 16 µg/L, respectively. 1,1-DCA was detected in only one probe at a concentration of 0.7 µg/L. All detected VOCs in soil vapor were within 250 feet of VEW-11, which correlates to the area of highest VOC affected groundwater.

TCE, 1,1-DCE and fuel components were detected in soil gas samples at the Rocket Motor Production Area. TCE concentrations ranged from 0.6 to 2 µg/L and 1,1-DCE was detected at 0.15 µg/L. The chlorinated solvents were detected near the former motor casing washout area. The fuel components were detected at low concentrations at four locations in the northern portion of the Rocket Motor Production Area at both the 5 and 15 foot sampling depths. Methyl-tert-butyl ether (MTBE) was also detected indicating a relatively recent source.

Only one of the ten tested soil samples had detectable VOCs in the environmental samples in the Burn Pit Area and eight of ten samples in the Rocket Motor Production Area. 1,2,4-trimethylbenzene was detected at one location at 5 feet in depth at a concentration of 0.6 mg/kg in the Burn Pit Area. The sample result does not correlate with any detected soil vapor analytes and may be a result of laboratory blank contamination. In the Rocket Motor Production Area, 1,4-dioxane was detected in two samples at one location at low concentrations. Perchlorate was detected in three of the ten tested soil samples from 15 feet in depth at concentrations of 8.6 to 259 µg/kg at the Burn Pit Area and eight of 10 tested samples at the Rocket Motor Production Area at concentrations from 35.7 to 1,260 µg/kg. Perchlorate was detected

in samples along the northwest-southeast axis of the Burn Pit Area with the highest concentrations near the center of the Burn Pit Area and throughout the Rocket Motor Production Area. All concentrations of perchlorate detected were below the residential preliminary remediation goal (PRG) concentration for soil of 39,000 µg/kg.

Based on the soil and soil vapor results, no significant residual analytes remain in the soil in the areas tested. None of the soil samples tested show concentrations greater than residential PRGs and soil vapor concentrations show a marked decrease from levels detected in the 1990's.

1.0 INTRODUCTION

1.0 INTRODUCTION

The Lockheed Martin Corporation tasked Tetra Tech, Inc. to implement the supplemental characterization of Beaumont No. 1 (Site). This report documents the characterization activities performed, summarizes the results of the data collected, and provides an evaluation of the data. The purpose of this investigation was to collect additional data to further characterize the current extent of groundwater impacts, develop a clearer conceptual model for the site, and compare current conditions at the Burn Pit Area with conditions documented prior to the implementation of remedial action in that area. The field investigation was conducted in accordance with the Beaumont Site 1 Sampling and Analysis Plan (SAP), prepared by Earth Tech, dated June 2002.

1.1 SITE BACKGROUND

The Lockheed Martin Corporation's Beaumont No. 1 site is a 9,100-acre parcel located south of Beaumont, California (Figure 1-1). Beginning in the 1950's and continuing until 1974, the Site was used by the Grand Central Rocket Company and the Lockheed Propulsion Company. Activities at the Site included rocket motor production (mixing of solid rocket fuel, curing of solid rocket fuel, and testing of solid rocket fuel motors) and ballistics testing (Earth Tech, 2002).

Activities at the site also included the destruction of process chemicals and waste rocket propellants in open burn pits, commonly referred to as the burn pit area (Burn Pit Area). These burn pits have affected the soil and groundwater. Chlorinated solvents and rocket fuel have affected soil and groundwater in the Burn Pit Area. The affected groundwater from this area has migrated down gradient into the Rocket Motor Production Area. The primary chemical constituents detected include the volatile organic compounds (VOCs) trichloroethene, (TCE), trichloroethane (TCA), and their degradation compounds and the semi-volatile compound 1,4-dioxane. Perchlorate, derived from ammonium perchlorate used in solid rocket fuel, is present within the groundwater as well (Earth Tech, 2002).

1.2 OBJECTIVES OF THE SUPPLEMENTAL SITE CHARACTERIZATION

The objectives of this site characterization are to: 1) further define the current extent of the VOC and perchlorate affected groundwater, 2) evaluate if surface water has been affected, 3) collect additional aquifer hydraulic conductivity data, 4) further evaluation of potential sources of analytes in the Burn Pit Area and the Rocket Motor Production Area, and 5) identify any potential data gaps. The field investigation also incorporated additional requirements from the Department of Toxic Substances Control (DTSC) in a comment letters dated February 20, 2002 and May 24, 2002.

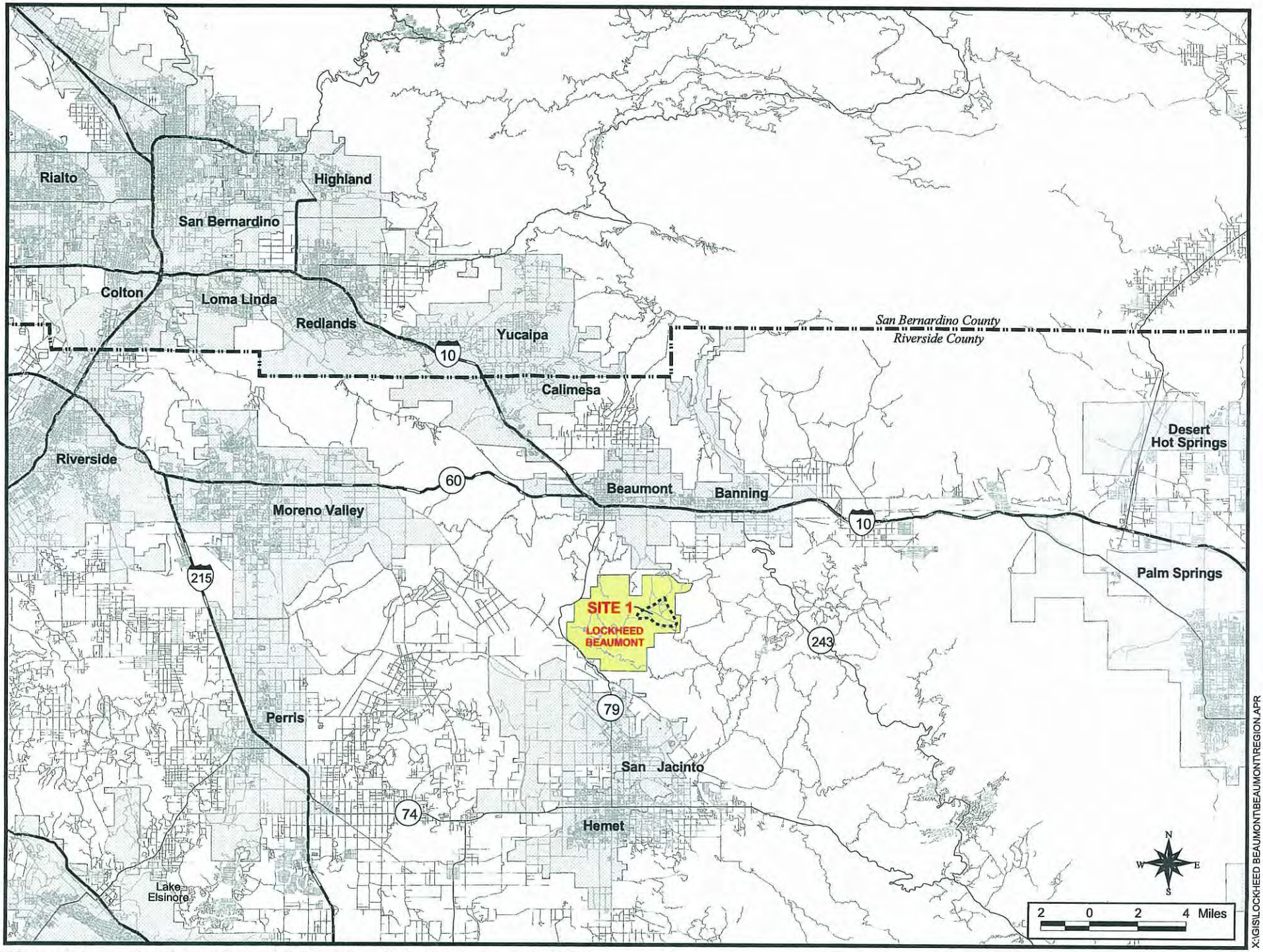


Figure 1-1 Regional Location of the Lockheed Martin Beaumont Site

2.0 SITE CONCEPTUAL MODEL

2.0 SITE CONCEPTUAL MODEL

The following sections summarize the site conceptual model for the Lockheed Martin Corporation's Beaumont No. 1 site based on previous investigations conducted at the Site. The discussion is divided into five main sections: previous investigations, physical setting, geology, hydrogeology, and analyte distribution.

2.1 PREVIOUS INVESTIGATIONS

The following section provides a brief discussion of previous investigations that have been conducted and brief regulatory history of the Site.

In September 1986, Radian Corporation (Radian) performed a detailed review of the site history at the Lockheed test facility, referred to as Beaumont No. 1, south of Beaumont, California. This investigation described the historical industrial activity at the Site, and proposed a method of scientific investigation to allow the nature and extent of environmental impacts to be defined. Much of the site history was obtained through interviews of employees of the Lockheed Martin Corporation, who formerly conducted work at the Site (Radian, 1986A).

In December 1986, Radian released a Preliminary Remedial Investigation report on the Beaumont No. 1 site. In October 1986, nine groundwater wells were sampled. Chlorinated hydrocarbons, including 1,1-DCE, 1,1-DCA, 1,1,1-TCA, and TCE had been detected in the groundwater, and comprise the major portion of the analytes found at the Site. It was determined at this time that the affected groundwater extended northwest of the burn pit and rocket motor production areas. The results of this preliminary groundwater study confirmed the conclusions of the site history investigation that identified these two areas as the primary potential sources of affected groundwater. The report recommended further characterization. During this investigation in October 1986, a geophysical investigation was conducted to better define the extent of the burn pit trenches.

In June 1989, the State of California Department of Health Services (DHS) issued a Consent Order directing a Remedial Investigation and Feasibility Study (RI/FS) of Beaumont No. 1.

Radian conducted a field investigation and produced a report titled "Lockheed Propulsion Company, Beaumont Test Facilities, Source and Hydrogeologic Investigation" in February 1990. This report summarized the field investigation performed in late 1989. Radian conducted a hydrogeologic investigation consisting of a soil vapor investigation and installation of 19 monitoring wells in order to identify the magnitude and extent of surface and subsurface impacts. This analysis indicated that there is a narrow, well-defined groundwater plume of volatile organic compounds limited to the upper alluvial

aquifer, originating in the burn pit and rocket motor production areas and extending approximately 2 miles downgradient. Trenching activities in the burn pit area were conducted in order to determine the location and alignments of the burn pits, characterize the burn pit waste, and collect samples of waste and surrounding soils for chemical analysis. This investigation resulted in the confirmation of 14 burn pit locations, and chemical analysis indicated that burn pit wastes contain volatile organic and semi-volatile organic compounds. Approximately 60 soil vapor samples were collected in and around the Burn Pit Area and the Rocket Motor Production Area. The soil vapor data indicate that there is a well-defined soil vapor plume originating from the burn pit and rocket motor production areas, and define the primary source for soil vapor and affected groundwater derives from the burn pit area with the rocket motor production area as a secondary source of analytes (Radian, 1990).

Surface water was also investigated by Radian., it was reported that a body of surface water referred to as the "upper pond" had VOC concentrations of 72 micrograms per liter (µg/L). During the same time period, well OW-2, located 500 feet east of the upper pond, had VOC concentrations of 170 µg/L. Also, during the same time period a "lower pond" was sampled and analyzed but the samples were non-detect for VOCs (Radian, 1990).

Radian submitted a Treatability Study to Lockheed Martin in February 1992, which presented the test results of the investigation conducted from March to May 1991 at the Beaumont No. 1 site. During this study, the hydrogeologic parameters of the aquifers were investigated, and five pilot-scale treatment technologies were tested to determine their ability to extract and treat the soil vapor and affected groundwater at the site. It was concluded that the clean-up strategy would comprise a dual phase VOC extraction within the Burn Pit Area, and included a catalytic oxidation unit with liquid phase granular activated carbon (LPGAC). Within the Rocket Motor Production Area a groundwater pump and treat system was constructed, and included two groundwater extraction wells connected to an air stripping column with vapor phase granular activated carbon (Radian, 1992b).

In August 1992, Radian submitted a Remedial Action Plan to Lockheed Martin summarizing the results of the remedial investigations at the Lockheed Beaumont No. 1 site. This plan also describes the remedial action strategy to mitigate and control soil and groundwater impacts at the Site. This document provided an overview of the recommended burn pit removal action, proposed soil and groundwater extraction and treatment systems (Radian, 1992a).

In June 1993, Radian prepared the Burn Pit Area Removal Action Report, which provides details of the removal action performed from November 1992 through February 1993 at the burn pit area. Using excavation equipment the soil and waste debris was removed from the burn pits and transported to an

appropriate approved off-site disposal facility. During the three-month removal action, 21 burn pits were excavated. Sixteen of these burn pits were known to exist from previous historical reports and previous trenching activities, and five additional burn pits were discovered during these excavation activities. At the completion of excavation and waste disposal activities, the site was restored to its near original condition (Radian, 1993).

In June of 1994, Lockheed Martin and the DTSC entered into a Final Operation and Maintenance (O&M) Agreement. This agreement implemented the remediation and O&M Plan, and allowed Lockheed Martin to operate and maintain the water and soil vapor treatment systems at Beaumont No. 1.

In September 1998, Radian submitted a report titled "Final Lockheed Martin Beaumont Burn Pit Area Remediation System Evaluation" which discussed the feasibility of shutting down the soil vapor extraction (SVE) system located in the burn pit area. This report concluded that each of the Regional Water Quality Control Board's (RWQCB's) performance criteria had been met, and soil vapor concentrations have been reduced by more than 99.6 percent, so continued vapor extraction was not considered efficient or necessary (Radian, 1998).

In March of 2000, Earth Tech prepared the Five Year Review Report. This report presented an evaluation of analytical and operational data collected during the previous five years of remedial activities at the Site, particularly the Rocket Motor Production Area and the Burn Pit Area (Earth Tech, 2000). The report concludes that the SVE system at the Burn Pit Area has gone asymptotic and has been effective in remediating VOC affected soil in the vadose zone; and that concentrations of VOCs in groundwater at the Burn Pit Area are still elevated. The groundwater extraction system installed and operated in the Rocket Motor Production Area has been effective in reducing the concentrations of VOCs in the area and appears to have reduced the migration of VOCs down gradient of the area as well (Earth Tech, 2002).

After comments to the Five Year Review Report were received from the DTSC in July 2001, it was determined that additional analyses needed to be conducted at the Site. The Lockheed Martin Corporation reviewed the comments from the DTSC, and responded in September 2001. Lockheed Martin Corporation's response included implementation of the Sampling and Analysis Plan (SAP), written by Earth Tech in June 2002 (Earth Tech, 2002). Among others, one of the main objectives of the SAP was to evaluate the extent and magnitude of the affected groundwater at the Site.

2.2 PHYSICAL SETTING

The Lockheed Beaumont No. 1 site is located at the northern end of the Peninsular Range Geomorphic Province. The province is, in general, a large block uplifted abruptly along its eastern edge and tilted

westward. The province has a subtle northwest trend expressed by its higher mountains and longer valleys (Sharp, 1975). More locally speaking, the Beaumont No. 1 site is located in a small valley in the northeastern foothills of the San Jacinto Mountains. This valley extends from the San Gorgonio Pass to the San Jacinto Valley and decreases approximately 1000 feet from north to south. A large portion of the Site is located in the wide part of the valley know as San Jacinto Nuevo Y Potrero. Southwest of San Jacinto Nuevo Y Potrero, the topographic gradient of the valley steepens toward Massacre Canyon, which drains to the San Jacinto Valley. To the west of the Site is an area that is commonly referred to as the "Badlands," an area of indurated sands and silts incised with canyons.

2.3 GEOLOGY

The regional stratigraphy in the vicinity of the Beaumont No. 1 site has been described by Dibblee (1981). The alluvium is divided into Older and Recent alluviums. Geologic units, from oldest to youngest, consist of: the basement complex of late Paleozoic to middle Mesozoic age metasedimentary rocks and Mesozoic granitic rocks; sedimentary deposits of the Pliocene to Pleistocene age Mount Eden Formation overlain by the sedimentary San Timoteo Formation; and Quaternary alluvium (Radian, 1990).

The basement complex is composed of metasedimentary and granitic rocks. The metasedimentary rocks chiefly consist of foliated, gray, micaceous schists and pink to gray gneiss. In the hills surrounding San Jacinto Nuevo Y Potrero, lenticular blocks of light gray to white marble occur within the schists and gneiss. Allen (1957) named similar basement rocks in the San Gorgonio Pass area as the San Gorgonio Igneous-Metamorphic Complex. The basement complex includes the intrusive rocks that underlie and flank San Jacinto Nuevo Y Potrero Valley. The intrusive rocks, described by Miller (1944) as the San Jacinto Granodiorite, are primarily granodiorite to quartz diorite. These granitic rocks crop out in the southern and western hills surrounding the San Jacinto Nuevo Y Potrero Valley, adjacent to metasedimentary rocks, or occur as boulders flanking intrusive outcrops.

Sedimentary rocks of continental origin, which overly the basement rocks, are divided into the Mount Eden Formation and the overlying San Timoteo Formation. The Mount Eden Formation is the most widespread unit outcropping and underlying the San Jacinto Nuevo Y Potrero Valley. Mapping performed by Dibblee (1981) indicates that the Mount Eden, as described by Fraser (1931), is early Pliocene age and is chiefly composed of red to dark brown arkosic sandstones and conglomerates with silty and clayey sand horizons. The unit is well indurated and, in outcrop, occurs as a deep red or gray, hard, resistant sandstone or conglomerate. South of the main San Jacinto Nuevo Y Potrero Valley, Dibblee (1981) mapped the Mount Eden grading into conglomeratic rocks of a cemented alluvial fan with beds dipping from 5 to 15 degrees to the north and northeast.

The San Timoteo Formation (Fraser, 1931), of Upper Pliocene or Pleistocene age (Dibblee, 1981), is primarily composed of poorly indurated, greenish gray interbedded sandstone, siltstone, shale, claystone, and minor conglomerates (Leighton and Associates, 1983). The San Timoteo Formation crops out at higher elevations north of the San Jacinto Nuevo Y Potrero Valley.

In the center of the San Jacinto Nuevo Y Potrero Valley, alluvial deposits overlie the Mount Eden Formation. Alluvial deposits mapped by Dibblee (1981) and others consist of Older Alluvium (Pleistocene age) and Recent age alluvium. The Older Alluvium is generally found flanking the southern part of Potrero Creek above the entrance to Massacre Canyon. The Older Alluvium is composed chiefly of interbedded sand and gravel deposits and is difficult to distinguish from the Recent age alluvium in the subsurface. Recent age alluvium fills the lower elevations of the San Jacinto Nuevo Y Potrero Valley. The alluvium consists of lenticular interbeds of sands, clayey sands, sandy clays, and conglomerates.

Several faults near the Site have been mapped by Dibblee (1981) and Leighton and Associates (1983). In particular, a northwest trending fault is located approximately one mile east of the Burn Pit Area. It is uncertain whether this fault has any influence on the groundwater beneath the Site.

2.4 HYDROGEOLOGY

A large portion of the Lockheed Martin Corporation's Beaumont No. 1 facilities were located in the broad valley known as San Jacinto Nuevo Y Potrero. The watershed area, including the valley itself, is approximately 35 square miles. The valley is roughly triangular in shape, and the valley floor covers approximately 800 acres. The valley is predominantly drained by Potrero Creek, an intermittent or seasonal stream which follows the valley from north to south before turning southwest to pass through Massacre Canyon toward its confluence with the San Jacinto River. Potrero Creek is fed by local tributary drainage and storm runoff from the city of Beaumont in the San Gorgonio Pass area and other ephemeral streams (Bedsprings Creek) located in the southeast area of the site.

Groundwater occurs in each of the major geologic units, however, this report primarily focuses on the waterbearing potential of the Recent Alluvium and the Mount Eden Formation. Data from previous studies indicates that groundwater in the alluvium generally flows from the southeast towards the west, with the slope of the water table generally parallel to the valley floor. Recharge to the groundwater aquifer in the alluvium occurs from direct infiltration of rainfall and loss from surface drainage through the sides and bottoms of stream channels. Recharge occurs primarily in the eastern portion of the valley where coarser, more permeable sediments are present at the surface. In the western and lower portions of the valley, direct recharge may be limited by the presence of fine grained, low permeability sediments in the upper portion of the alluvium. Groundwater recharge to the alluvial aquifer may also occur from

subsurface inflow from adjacent or underlying units. However, subsurface inflow is thought to be a relatively minor contributor to groundwater in the alluvium.

Within the Recent alluvium, the piezometric surface of the groundwater varies from the surface to approximately 80 feet below ground surface. Artesian flow has occurred from two monitoring wells located in the central-eastern portion of the valley. Near these wells, MW-45 and MW-47, and in wells to the west, groundwater in the alluvium may be under confined or semi-confined conditions. Fine grain sediments present in the upper portion of the alluvium may act as a confining layer for groundwater in underlying coarser deposits.

Groundwater in the upper 20 feet of the alluvial aquifer generally flows from the Burn Pit Area to the northwest, passing under the Rocket Motor Production Area where the direction of flow turns to the west and southwest parallel to the flow of Potrero Creek. Groundwater then flows out of the valley through Massacre Canyon.

Surface water at the Site consists of ephemeral flows due to seasonal rainfall, and artesian springs from confined groundwater aquifers. Two main creeks on Site, Potrero Creek and Bedspings Creek, convey seasonal runoff and spring flows. In addition, several artificial ponds have been constructed for stock watering holes, and appear to be recharged from shallow groundwater.

2.5 ANALYTE DISTRIBUTION

Based on the VOC and perchlorate contours provided in the Earth Tech SAP (Earth Tech, 2002), it appears that the extent of the VOC and perchlorate plume is not well defined. The previous sampling data for both VOCs and perchlorate did not define the lateral extent of the plume at the Site. The data from previous investigations was insufficient to determine the downgradient extent of impacts, or for depicting the extent of other known constituents in the groundwater, including 1,4-dioxane and perchlorate. In addition, there are no current data to determine the extent of vertical impacts in the Burn Pit Area (Earth Tech, 2002). The following is a list of analytes detected in prior sampling events in soil and/or groundwater at Beaumont No. 1: perchlorate, 1,4-dioxane, 1,1-dichloroethene (1,1-DCE), trichloroethene (TCE), and small quantities of 1,1-dichloroethane (1,1-DCA), 1,1,1-trichloroethane (TCA), and 1,2-dichloroethane (1,2-DCA).

2.5.1 Vadose Zone Impacts

A soil vapor survey conducted in 1990 by Radian indicated the presence of a vadose zone source in the Burn Pit Area, and suggested a secondary source may be present in the Rocket Motor Production Area. The soil vapor plume originating in the Burn Pit Area and Rocket Motor Production Area was identified

with maximum VOC detections of greater than 10,000 parts per billion (ppb), and the highest concentrations were located in the Burn Pit Area. The soil vapor plume extended from the Burn Pit Area towards the northwest for approximately 1 mile (Earth Tech, 2000).

2.5.2 Affected Groundwater

During the same Radian investigation reported above (Radian, 1990), it was determined that a narrow groundwater plume was located beneath the soil vapor plume. The L-shaped groundwater plume, flowing westerly from the Burn Pit Area and the Rocket Motor Production Area, was approximately 1,000 feet long and 500 to 1,700 feet wide. Concentrations of Total VOCs in the groundwater were detected in the range of 1 to 2 ppm in the high concentration areas, and perchlorate was detected in the 1 to 9 ppm range in these same areas (Earth Tech, 2002).

3.0 SUMMARY OF FIELD INVESTIGATION

3.0 SUMMARY OF FIELD INVESTIGATION

In accordance with the Beaumont Site 1 SAP, prepared by Earth Tech, dated June, 2002, the following field investigation was conducted by Tetra Tech. The following sections summarize the groundwater sampling, hydraulic testing, surface water sampling, soil sampling, and soil gas sampling conducted at the Lockheed Martin Corporation, Beaumont Site 1. The objectives of the SAP, and this field investigation are to: 1) better define the extent of the VOC, 1,4-Dioxane, and perchlorate affected groundwater, 2) determine if the surface water has been affected, 3) to evaluate the status of post-cleanup conditions at the Burn Pit Area, 4) an evaluation of potential sources of analytes in the Burn Pit Area and the Rocket Motor Production Area, and 5) identify any potential data gaps. The locations of the groundwater, surface water, soil, and soil gas sampling locations are shown in Figure 3-1. Table 3-1 shows a sample matrix identifying the analytical methods requested for each sample location for either soil, soil-gas, surface water, or groundwater. The field investigation also incorporated additional requirements from the DTSC in two comment letters dated February 20, 2002 and May 24, 2002. The results from these sampling events are discussed in Section 5.

3.1 GROUNDWATER SAMPLING

Groundwater level measurements were collected on May 14 and 15, 2002. Measurements were collected from 107 monitoring and extraction wells across the Site. The tabulated groundwater elevations from this event are presented in Section 5.

For this sampling event, 55 monitoring wells (23 groundwater wells from the Burn Pit Area, 15 groundwater wells from the Rocket Motor Production Area and 17 groundwater wells from the downgradient areas) were proposed. Obstructions in three (MW-16, MW-21, and MW-24) of the 55 wells prevented groundwater samples from being obtained. Therefore, a total of 52 monitoring wells were sampled during this event consisting of 22 wells from the Burn Pit Area, 14 wells from the Rocket Motor Production Area, and 16 wells from the downgradient areas. A summary of the well construction data for all the wells at the Site is presented in Table 3-2.

Several field quality assurance/quality control (QA/QC) procedures were instituted in an effort to ensure that all field measurements and samples were representative and collected in a manner that would provide adequate data for achieving the objectives of this program. These procedures are discussed below.

During well purging, water level, temperature, pH, electrical conductivity (EC), turbidity, dissolved oxygen, and color were measured and recorded on the field data sheet. Purging was considered complete when at least 3 wetted casing volumes had been removed and the above parameters had stabilized, or the well was purged dry (evacuated). Stabilization of water quality parameters was used as an indication that stagnant water in the well casing had been removed and that fresh formation water had entered the casing

Figure 3-1

Sampling Locations
May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well
- Soil Sampling Location
- Soil Gas Sampling Location
- Surface Water Sampling Location

NORTH

0 500 1000

Feet

POTRERO CREEK

BEDSPRINGS CREEK

Rocket Motor Production Area

Burn Pit Area

P-04, MW-11, P-03, IW-05, IW-04, IW-03, VP-9A, MW-12, MW-40, MW-44, MW-66, VP-8A, VP-9B, VP-8B, P-02, MW-29, VP-7A, VP-7B, MW-06, MW-05, MW-65, MW-64, MW-41, MW-39, MW-34, MW-13, MW-42, OW-02, S-2, EW-02, MW-62A, OW-03, MW-52, MW-56A, MW-56B, VP-6, VP-5, MW-57A, MW-57B, VP-4A, MW-19, MW-49, MW-51, MW-58D, EW-01, VP-4B, MW-54, MW-04, MW-30, MW-21, MW-45, MW-43, S-1, MW-48, MW-47, MW-46, MW-09, MW-08, MW-50, MW-63, MW-23, MW-02, MW-22, MW-60B, MW-10, MW-17, MW-53, MW-28, MW-20, MW-55, MW-03, EW-10, VP-3, VP-2, MW-60A, MW-27, EW-09, EW-08, EW-12, VEW-06, MW-59A, MW-59B, EW-14, MW-01, EW-11, EW-13, VEW-11, VEW-10, MW-32, MW-24, MW-61A, MW-61B, MW-26, MW-07, VP-1, BP-21, BP-25, BP-6, MW-31, MW-61C, MW-61D, EW-15, EW-18, BP-3, BP-8, BP-4, EW-16, MW-36, BP-5, OW-08, MW-38, MW-37, MW-14, MW-15, MW-18, IW-02, IW-01, MW-35, P-05, OW-01

S-3 LOCATED APPROXIMATELY 3000' SOUTHWEST

Table 3-1
Sample Matrix
Beaumont No. 1 Site
Lockheed Martin Corporation

Monitoring Well or Sample Location	Matrix	VOC's EPA 8260B	Perchlorate EPA 314.1/314.6	1,4-Dioxane EPA 8270 SIM	CCR Title 22 Metals (filtered)	Common Anions and Cations + TDS	VOCs GC/MS Soil-Gas	Comments and QA/QC Samples
BP21-5	Soil	X		X	X			
BP21-5	Soil-Gas						X	
BP21-15	Soil	X	X	X	X			
BP21-15	Soil-Gas						X	
BP25-5	Soil	X		X	X			
BP25-5	Soil-Gas						X	
BP25-15	Soil	X	X	X	X			
BP25-15	Soil-Gas						X	
BP3-5	Soil	X			X			
BP3-5	Soil-Gas						X	
BP3-15	Soil	X	X		X			
BP3-15	Soil-Gas						X	
BP4-5	Soil	X		X	X			
BP4-5	Soil-Gas						X	
BP4-15	Soil	X	X	X	X			
BP4-15	Soil-Gas						X	
BP5-5	Soil	X		X	X			
BP5-5	Soil-Gas						X	
BP5-15	Soil	X	X	X	X			
BP5-15	Soil-Gas						X	Duplicate BP5-15 dup collected
BP6-5	Soil	X		X	X			Duplicate BP6-5D collected
BP6-5	Soil-Gas						X	
BP6-15	Soil	X	X	X	X			Duplicate BP6-15D collected
BP6-15	Soil-Gas						X	Duplicate BP6-15 dup collected
BP8-5	Soil	X		X	X			
BP8-5	Soil-Gas						X	
BP8-15	Soil	X	X	X	X			
BP8-15	Soil-Gas						X	Duplicate BP8-15 dup collected
EW-15	Groundwater		X	X	X	X		
MW-01	Groundwater	X	X	X	X	X		
MW-02	Groundwater	X	X	X	X	X		
MW-03	Groundwater	X	X	X	X	X		
MW-04	Groundwater		X	X				
MW-05	Groundwater		X	X	X	X		Duplicate MW-05A collected. MS/MSD
MW-06	Groundwater	X	X	X	X	X		
MW-07	Groundwater		X	X	X	X		
MW-08	Soil-Gas						X	
MW-08	Groundwater	X	X	X				
MW-09	Groundwater	X	X	X				
MW-10	Groundwater		X	X				
MW-11	Groundwater		X	X				
MW-12	Groundwater	X	X	X	X	X		
MW-13	Soil-Gas						X	
MW-13	Groundwater	X	X	X				
MW-14	Soil-Gas						X	

MS/MSD - Matrix Spike/Matrix Spike Duplicate Sample
QA/QC - Quality Assurance/Quality Control

Table 3-1
Sample Matrix
Beaumont No. 1 Site
Lockheed Martin Corporation

Monitoring Well or Sample Location	Matrix	VOC's EPA 8260B	Perchlorate EPA 314.1/314.6	1,4-Dioxane EPA 8270 SIM	CCR Title 22 Metals (filtered)	Common Anions and Cations + TDS	VOCs GC/MS Soil-Gas	Comments and QA/QC Samples
MW-14	Groundwater	X	X	X				Duplicate of MW-14A collected. MS/MSD
MW-15	Groundwater	X	X	X	X	X		
MW-16	Groundwater	X	X	X	X	X		Not Sampled: well inaccessable
MW-17	Groundwater		X	X				
MW-18	Groundwater	X	X	X	X	X		
MW-19	Groundwater		X	X	X	X		
MW-21	Groundwater	X	X	X				Not Sampled: obstruction in well
MW-24	Groundwater	X	X	X	X	X		Not Sampled: obstruction in well
MW-26	Groundwater		X	X				
MW-27	Soil-Gas						X	
MW-29	Soil-Gas						X	
MW-30	Groundwater	X	X	X				
MW-31	Groundwater	X	X	X				
MW-32	Groundwater	X	X	X				Duplicate MW-32A collected. MS/MD
MW-34	Groundwater	X	X	X				
MW-35	Soil-Gas						X	
MW-35	Groundwater	X	X	X				
MW-36	Soil-Gas						X	
MW-36	Groundwater		X	X				
MW-37	Groundwater	X	X	X				
MW-38	Groundwater	X	X	X				
MW-39	Groundwater		X	X				
MW-40	Groundwater		X	X	X	X		
MW-42	Groundwater		X	X	X	X		
MW-43	Groundwater	X	X	X	X	X		
MW-45	Groundwater	X	X	X	X	X		
MW-46	Soil-Gas						X	
MW-46	Groundwater	X	X	X	X	X		
MW-47	Groundwater	X	X	X				
MW-50	Groundwater		X	X	X	X		
MW-56A	Groundwater		X	X	X	X		
MW-56B	Groundwater	X	X	X	X	X		
MW-57A	Groundwater		X	X	X	X		
MW-57B	Groundwater	X	X	X				
MW-58D	Groundwater		X	X	X	X		
MW-59A	Groundwater	X	X	X				
MW-59B	Groundwater		X	X	X	X		
MW-60A	Groundwater	X	X	X				
MW-60B	Groundwater	X	X	X				
MW-62A	Groundwater		X	X	X	X		
MW-63	Soil-Gas						X	
MW-63	Groundwater		X	X	X	X		
MW-64	Groundwater		X	X				Duplicate MW-64A collected. MS/MD
MW-65	Soil-Gas						X	
MW-66	Groundwater		X	X				

MS/MSD - Matrix Spike/Matrix Spike Duplicate Sample
QA/QC - Quality Assurance/Quality Control

Table 3-1
Sample Matrix
Beaumont No. 1 Site
Lockheed Martin Corporation

Monitoring Well or Sample Location	Matrix	VOC's EPA 8260B	Perchlorate EPA 314.1/314.6	1,4-Dioxane EPA 8270 SIM	CCR Title 22 Metals (filtered)	Common Anions and Cations + TDS	VOCs GC/MS Soil-Gas	Comments and QA/QC Samples
OW-02	Groundwater	X	X	X	X	X		
OW-03	Groundwater		X	X				Duplicate OW-03A collected.
P-05	Groundwater	X	X	X				
S-1 (MW-45 Area)	Surface Water	X	X	X				
S-2 (Upper Pond)	Surface Water	X	X	X				Duplicate S-2A Collected. MS/MD
S-3 (Potreo Creek)	Surface Water	X	X	X				
S-4 (Stream Reach)	Surface Water	X	X	X				Not Sampled: No surface water
VEW10	Soil-Gas						X	
VEW11	Soil-Gas						X	
VEW6	Soil-Gas						X	
VP1-5	Soil	X			X			Duplicate VP1-5D collected
VP1-5	Soil-Gas						X	
VP1-15	Soil	X	X	X	X			Duplicate VP1-15D collected
VP1-15	Soil-Gas						X	Duplicate VP1-15 dup collected
VP2-5	Soil	X			X			
VP2-5	Soil-Gas						X	
VP2-15	Soil	X	X		X			
VP2-15	Soil-Gas						X	Duplicate VP2-15 dup collected
VP3-5	Soil	X		X	X			
VP3-5	Soil-Gas						X	
VP3-15	Soil	X	X	X	X			
VP3-15	Soil-Gas						X	Duplicate VP3-15 dup collected
VP4A-5	Soil	X			X			
VP4A-5	Soil-Gas						X	
VP4A-15	Soil	X	X		X			
VP4A-15	Soil-Gas						X	
VP4B-5	Soil	X			X			
VP4B-5	Soil-Gas						X	
VP4B-15	Soil	X	X		X			
VP4B-15	Soil-Gas						X	
VP5-5	Soil	X			X			
VP5-5	Soil-Gas						X	
VP5-15	Soil	X	X		X			
VP5-15	Soil-Gas						X	
VP6-5	Soil	X			X			
VP6-5	Soil-Gas						X	
VP6-15	Soil	X	X		X			
VP6-15	Soil-Gas						X	Duplicate VP6-15 dup collected
VP7A-5	Soil	X		X	X			
VP7A-5	Soil-Gas						X	
VP7A-15	Soil	X	X	X	X			
VP7A-15	Soil-Gas						X	
VP7B-5	Soil	X		X	X			Duplicate VP7B-5D collected
VP7B-5	Soil-Gas						X	
VP7B-15	Soil	X	X	X	X			Duplicate VP7B-15D collected

MS/MSD - Matnx Spike/Matnx Spike Duplicate Sample
QA/QC - Quality Assurance/Quality Control

Table 3-1
Sample Matrix
Beaumont No. 1 Site
Lockheed Martin Corporation

Monitoring Well or Sample Location	Matrix	VOC's EPA 8260B	Perchlorate EPA 314.1/314.6	1,4-Dioxane EPA 8270 SIM	CCR Title 22 Metals (filtered)	Common Anions and Cations + TDS	VOCs GC/MS Soil-Gas	Comments and QA/QC Samples
VP7B-15	Soil-Gas						X	
VP8A-5	Soil	X			X			Duplicate VP8A-5D collected
VP8A-5	Soil-Gas						X	
VP8A-15	Soil	X	X		X			Duplicate VP8A-15D collected
VP8A-15	Soil-Gas						X	
VP8B-5	Soil	X			X			
VP8B-5	Soil-Gas						X	
VP8B-15	Soil	X	X		X			
VP8B-15	Soil-Gas						X	
VP9A-5	Soil	X		X	X			
VP9A-5	Soil-Gas						X	
VP9A-15	Soil	X	X	X	X			
VP9A-15	Soil-Gas						X	
VP9B-5	Soil	X			X			
VP9B-5	Soil-Gas						X	
VP9B-15	Soil	X	X		X			
VP9B-15	Soil-Gas						X	

MS/MSD - Matrix Spike/Matrix Spike Duplicate Sample
QA/QC - Quality Assurance/Quality Control

Table 3-2
Well Construction Data
Beaumont No. 1 Site
Lockheed Martin Corporation

Well ID	Hydrostratigraphic Unit Screened	Measuring Point Elevation (feet MSL)	Date Completed	Total Depth (feet bgs)	Screened Interval (feet bgs)		Depth to Mt. Eden (feet bgs)
EW-01	QA	2142.60	09/22/92	78.00	35.00	76.00	
EW-02	QA	2125.10	10/22/92	70.00	25.00	66.00	
EW-08	ME	2175.10	10/21/92	115.00	61.00	112.00	52.00
EW-09	ME	2176.40	09/23/92	122.00	70.00	120.00	27.00
EW-10	ME	2176.90	10/20/92	115.00	61.00	112.00	38.00
EW-11	ME	2178.70	10/07/92	105.00	60.00	111.00	30.00
EW-12	ME	2176.80	10/12/92	115.00	60.00	111.00	58.00
EW-13	ME	2179.90	09/17/92	117.00	74.00	114.00	41.00
EW-14	ME/QA	2181.40	10/08/92	106.00	60.00	101.00	70.00
EW-15	ME	2181.30	09/25/92	107.00	65.00	105.00	50.00
EW-16	ME	2182.30	09/28/92	107.00	65.00	105.00	48.00
EW-17	NA	NA	NA	NA	NA	NA	
EW-18	ME	2182.30	02/03/93	102.00	60.00	101.00	49.00
IW-01	QA	2158.30	08/12/92	95.00	6.00	90.00	
IW-02	QA	2152.50	08/13/92	100.00	10.00	95.00	
IW-03	QA	2129.90	09/29/92	65.00	22.00	63.00	
IW-04	QA	2132.00	10/01/92	65.00	22.00	63.00	
IW-05	QA	2134.10	10/02/92	65.00	21.00	62.00	
MW-01	ME	2174.30	12/07/92	128.00	116.00	126.00	93.00
MW-02	ME	2167.50	12/04/92	102.00	73.00	93.00	92.00
MW-03	ME	2166.40	12/19/92	272.00	260.00	270.00	82.17
MW-04	QA	2157.40	12/09/92	85.00	62.00	82.00	
MW-05	QA	2118.70	12/10/92	44.50	23.00	43.00	
MW-06	QA/ME	2119.10	12/10/92	119.00	104.00	114.00	112.62
MW-07	QA	2173.80	12/14/92	93.00	70.00	90.00	
MW-08	QA	2087.80	12/03/92	35.00	13.00	33.00	
MW-09	QA	2086.30	12/01/92	132.00	115.00	125.00	
MW-10	QA	2176.70	12/06/89	100.00	79.00	99.00	
MW-11	QA	2119.90	12/01/89	70.00	46.00	66.00	
MW-12	QA	2095.80	12/02/89	55.00	29.00	49.00	
MW-13	QA	2055.20	12/05/89	38.00	16.00	36.00	
MW-14	QA	2027.00	12/07/89	50.00	29.00	49.00	
MW-15	QA/ME	2007.10	12/21/89	93.00	81.00	91.00	91.00
MW-16	QA/ME	1818.00	12/09/89	15.00	8.00	13.00	12.50
MW-17	QA	2137.70	12/11/89	65.00	44.00	64.00	
MW-18	QA	2006.00	12/13/89	52.00	30.00	50.00	
MW-19	QA	2115.80	12/13/89	50.00	25.00	45.00	
MW-20	QA	2156.90	01/21/91	135.00	65.00	95.00	
MW-21	QA	2158.10	01/24/91	165.00	70.00	100.00	155.00
MW-22	QA	2168.20	01/28/91	120.00	74.00	114.00	
MW-23	QA	2159.60	08/13/92	119.00	85.00	115.00	
MW-24	ME	2180.60	09/29/92	105.00	85.00	105.00	53.00
MW-26	ME	2179.90	01/03/91	129.00	88.00	128.00	54.00
MW-27	QA	2178.00	02/08/91	92.20	29.30	91.40	
MW-28	QA	2158.30	12/03/91	134.00	120.00	130.00	133.00
MW-29	ME	2112.40	12/03/91	50.00	23.70	48.70	22.00
MW-30	QA	2159.00	02/13/91	125.00	90.00	124.50	
MW-31	ME	2183.30	02/09/91	195.00	180.00	190.00	62.00
MW-32	ME	2173.40	02/11/91	223.00	210.00	220.00	88.48
MW-34	QA	2151.40	02/18/91	85.00	62.00	82.00	
MW-35	QA	2168.30	03/07/91	140.00	60.00	80.00	138.00
MW-36	QA	2202.50	03/14/91	105.00	85.00	105.00	
MW-37	QA/ME	2038.30	02/27/91	62.00	40.00	60.00	50.00
MW-38	ME	2027.60	02/25/91	82.00	60.00	80.00	38.50
MW-39	QA	2141.50	03/11/91	86.00	60.00	80.00	82.00
MW-40	ME	2123.70	02/19/91	67.00	46.00	66.00	38.00
MW-41	QA/ME	2131.30	12/10/91	55.00	35.00	55.00	49.50
MW-42	QA	2089.90	12/04/91	36.00	13.20	34.70	
MW-43	QA	2065.80	12/06/91	115.50	8.40	23.40	

Table 3-2
Well Construction Data
Beaumont No. 1 Site
Lockheed Martin Corporation

Well ID	Hydrostratigraphic Unit Screened	Measuring Point Elevation (feet MSL)	Date Completed	Total Depth (feet bgs)	Screened Interval (feet bgs)		Depth to Mt. Eden (feet bgs)
MW-44	QA	2124.40	12/11/91	59.00	34.00	54.00	
MW-45	QA	2068.90	12/10/91	55.00	42.70	52.70	
MW-46	QA	2069.40	09/28/92	55.00	42.70	61.50	
MW-47	QA	2077.10	02/03/93	54.00	43.30	53.30	
MW-48	QA	2173.70	08/12/92	25.00	8.70	23.70	
MW-49	QA	2128.20	12/20/91	113.50	30.50	52.00	110.50
MW-50	QA	2148.80	12/19/91	74.30	54.30	74.30	
MW-51	QA	2135.70	08/14/92	67.00	39.00	59.00	
MW-52	QA	2133.50	08/17/92	65.00	37.00	57.00	
MW-53	QA	2150.60	08/20/92	78.00	53.00	73.00	
MW-54	QA	2150.80	08/19/92	80.00	53.00	73.00	
MW-55	QA	2153.50	08/19/92	93.00	67.00	87.00	
MW-56A	ME	2140.40	08/23/92	183.00	176.00	180.00	100.00
MW-56B	QA	2139.90	08/27/92	95.50	89.00	91.00	
MW-56C	QA	2140.00	08/31/92	63.80	48.00	58.00	
MW-56D	QA	2140.10	09/11/92	75.00	72.00	74.00	
MW-57A	QA	2139.90	09/08/92	75.00	59.00	69.00	
MW-57B	QA	2143.30	09/09/92	98.00	94.00	96.00	98.00
MW-57C	QA	2143.40	09/10/92	85.00	81.50	83.50	
MW-57D	QA	2143.50	09/10/92	57.00	46.00	56.00	
MW-58A	QA	2138.10	09/14/92	88.50	79.00	81.00	
MW-58B	QA	2138.10	09/14/92	50.00	40.00	50.00	
MW-58C	QA	2138.40	09/14/92	60.00	57.50	59.50	
MW-58D	QA	2138.30	09/15/92	70.00	68.00	70.00	
MW-59A	ME	2177.00	08/26/92	144.00	138.00	140.00	48.00
MW-59B	ME	2177.20	09/04/92	110.00	97.00	107.00	49.00
MW-59C	ME	2176.70	09/10/92	135.50	134.00	134.00	53.00
MW-59D	ME	2177.30	09/10/92	125.00	118.00	120.00	53.00
MW-60A	ME	2179.50	09/02/92	149.00	132.00	134.00	69.00
MW-60B	ME	2179.50	09/02/92	119.00	112.00	114.00	69.00
MW-61A	ME	2183.70	09/01/92	155.00	148.00	150.00	50.00
MW-61B	ME	2183.60	09/02/92	105.00	92.00	102.00	50.00
MW-61C	ME	2183.70	09/08/92	135.00	128.00	130.00	50.00
MW-61D	ME	2183.70	09/09/92	120.00	114.00	116.00	53.00
MW-62A	QA	2128.80	10/20/92	45.00	39.00	41.00	
MW-62B	QA	2128.90	10/20/92	65.00	62.00	64.00	
MW-63	QA	2156.40	02/04/93	64.00	21.00	63.00	
MW-64	QA	2125.80	02/05/93	41.00	29.00	40.00	
MW-65	QA	2126.30	02/09/93	47.00	23.00	45.00	
MW-66	QA	2127.90	02/10/93	50.00	37.00	48.00	
OW-01	QA	2202.30	05/25/83	70.00	60.00	70.00	
OW-02	QA	2076.60	05/26/83	50.00	56.00	66.00	44.00
OW-03	QA	2141.00	05/26/83	70.00	46.00	56.00	
OW-08	QA	2033.00	05/27/83	64.00	51.00	61.00	
P-02	NA	2078.60	12/05/91	36.00	24.50	34.70	
P-03	QA	2137.60	12/04/91	58.00	47.70	57.70	
P-04	QA	2109.00	12/07/91	49.00	38.70	48.70	
P-05	QA	2159.50	12/08/91	120.00	61.40	71.40	

Notes: All elevations in feet relative to MSL; all depth measurements in feet below top of casing

TOC = Top of Casing
MSL = Mean Sea Level
OW = Observation Well
MW = Monitoring Well
EW = Extraction NA = Not Available
QA = Quaternary Alluvium
ME = Mount Eden Formation
IW = Injection Well

and was being purged. The criterion for stabilization of these parameters is as follows: temperature +/- 1 degree Centigrade; pH +/- 0.1 unit; and EC +/- 5%. To insure accurate and reproducible field measurements, all instruments and equipment were maintained, calibrated, and operated in accordance with the manufacturer's specifications, guidelines, and recommendations.

3.2 HYDRAULIC TESTING

On June 4 and June 5, 2002, aquifer slug tests were performed on nine wells across the Site. Rising and falling-head slug tests were performed on wells MW-31, MW-26 and MW-1, located within the Burn Pit Area, to obtain hydraulic conductivity data on the Mount Eden Formation, and in wells MW-55, MW-7 and MW-22 within the alluvial aquifer located downgradient of the Burn Pit Area. Slug tests were also conducted on wells MW-44, MW-50 and MW-51, screened in the alluvium, and located within the Rocket Motor Production Area. The results for the hydraulic testing are presented in Section 5.1.2.

3.3 SURFACE WATER SAMPLING

Four surface water samples were proposed to be collected to determine if the affected groundwater has affected surface water. Surface water samples were collected, in standing water, near the upstream ends of the ponds. The samples were collected on May 20, 2002, during base flow conditions. One surface water sample could not be collected at the proposed sampling location, S-4, because no water was available to sample. Three samples were collected by placing a disposable bailer into the ponded water then transferring the water into the appropriate sample containers. Appropriate locations were selected based on the stream flow direction and the absence of floating debris, bubbles, insects and surface films. Samples for VOC analysis were collected first, followed by 1,4-dioxane, and perchlorate.

3.4 QUALITY CONTROL FOR GROUNDWATER AND SURFACE WATER SAMPLES

All water samples, including groundwater monitoring well samples and surface water samples, were placed in the appropriate containers in order of decreasing volatilization. The samples were chilled and transported to the laboratory via courier, thus maintaining proper temperatures and sample integrity. Equipment blanks (EB) were collected on a daily basis to assess contamination of the environmental samples while in transit and/or via sampling equipment. One trip blank (TB) was collected per day per crew for a total of 9 TBs and 10 EBs. Results of field blanks were reviewed for the presence of contaminants. If contaminants were detected in any of the field blanks, the results were compared to the associated environmental samples. The environmental sample results were then qualified as appropriate. Field duplicate samples were collected to assess sampling and analytical precision. Duplicates are collected at a minimum rate of 10 percent of the environmental samples. A total of 55 environmental samples, including 52 groundwater monitoring well samples and 3 surface water samples were collected.

In addition, 6 field duplicate samples were collected which equates to 10.9%. Environmental sample validation based on relative percent difference (RPD) values calculated from field duplicate and parent sample results are discussed in Section 4.

All sampling equipment was decontaminated as required in the SAP. Equipment was decontaminated after use in each well. All decontamination fluids and purge water were temporarily stored in portable tanks, and subsequently transferred to the onsite water treatment plant.

3.5 VADOSE ZONE SAMPLING

A total of 40 soil and 40 soil gas samples were collected and analyzed from 20 locations at depths of 5 and 15 feet bgs. Ten of these locations were within the Rocket Motor Production Area and ten of these locations were within the Burn Pit Area as per the SAP. Of the ten locations within the Burn Pit Area, seven locations (BP-3, BP-4, BP-5, BP-6, BP-8, BP-21, and BP-25) were chosen to replicate soil gas data collected during a previous investigation conducted by Radian in December 1989. These formerly sampled locations are designated as "BP" on Figure 3-2, and all new soil gas sampling locations are designated "VP." Five processing stations within the former Rocket Motor Production Area were selected for testing, two borings at each processing station (chemical storage quonset, fuel slurry station, propellant mixing station, motor casing washout, and the cast and cure station). In addition, soil gas was also collected from 3 extraction wells and 10 groundwater monitoring wells. Table 3-3 correlates the soil and soil gas samples with the operational area that the samples were collected in, it also indicates what tests were performed in each location.

Locating the historic soil gas sampling locations in the Burn Pit Area proved difficult. None of the historic soil gas sampling locations were land surveyed. The locations of the points were approximated in the field. These locations were then transferred onto site maps for inclusion in Radian's reports. Locating the former rocket motor production processing stations was difficult as well. All of the stations have been demolished. The concrete slabs from three of the stations were still present and provided a point of reference for choosing testing locations but no physical sign of the motor casing washout or the cast and cure station were present. Site maps from the older Radian reports and georeferenced aerial photographs from 1967 and 1996 were used to determine the coordinates of the locations to be sampled. A hand held GPS unit was then used to navigate to the locations in the field.

The following section describes the sampling procedures for collection of soil and soil gas from the 20 direct push probe locations, and the soil gas collection from the 13 wells.

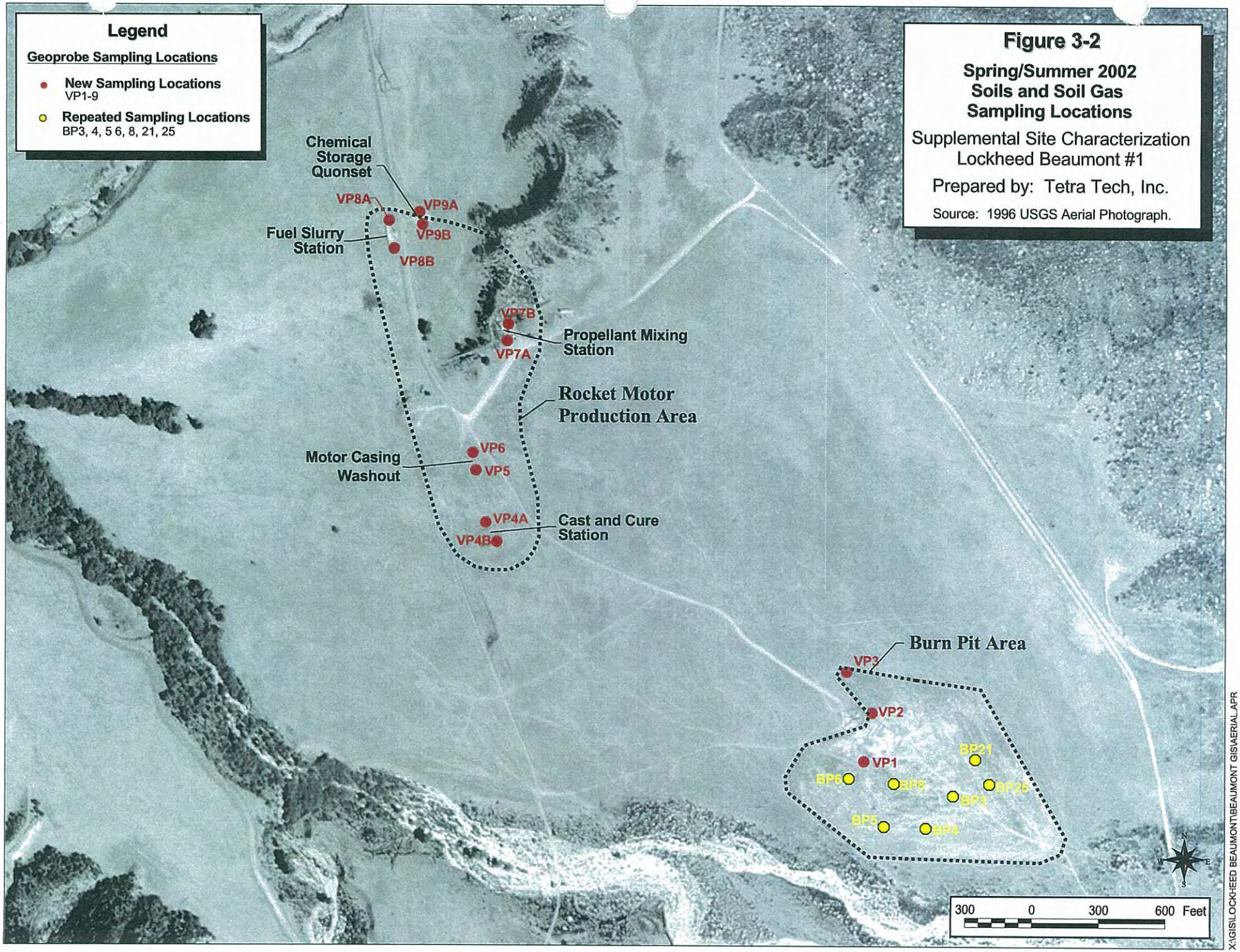

Legend
Geoprobe Sampling Locations
New Sampling Locations
VP1-9
Repeated Sampling Locations
BP3, 4, 5 6, 8, 21, 25
Figure 3-2
Spring/Summer 2002
Soils and Soil Gas
Sampling Locations
Supplemental Site Characterization
Lockheed Beaumont #1
Prepared by: Tetra Tech, Inc.
Source: 1996 USGS Aerial Photograph.
Chemical Storage Quonset
VP8A
VP9A
VP9B
Fuel Slurry Station
VP8B
VP7B
VP7A
Propellant Mixing Station
Rocket Motor Production Area
VP6
Motor Casing Washout
VP5
VP4A
VP4B
Cast and Cure Station
Burn Pit Area
VP3
VP2
VP1
BP21
BP6
BP8
BP25
BP3
BP5
BP4
300 0 300 600 Feet
X:\GIS\LOCKHEED BEAUMONT\BEAUMONT GIS\AERIAL.APR

Table 3-3
Sample Matrix and Analysis Schedule for Soil and Soil Gas Samples
Beaumont No. 1 Site
Lockheed Martin Corporation

Sample Location	Boring Number	Depth Feet bgs	Soil Gas Sample	Soil Sample	Equipment Blank	Duplicate***	MS/MSD*
Chemical Storage Quonset	VP-9A	5	VOCs	Metals			
	VP-9A	15	VOCs	Metals, Perchlorate**			
	VP-9B	5	VOCs	Metals			
	VP-9B	15	VOCs	Metals, Perchlorate**			
Fuel Slurry Station	VP-8A	5	VOCs	Metals			
	VP-8A	15	VOCs	Metals, Perchlorate**		VOCs	
	VP-8B	5	VOCs	Metals			
	VP-8B	15	VOCs	Metals, Perchlorate**			
Propellant Mixing Station	VP-7A	5	VOCs	Metals			
	VP-7A	15	VOCs	Metals, Perchlorate**			
	VP-7B	5	VOCs	Metals			
	VP-7B	15	VOCs	Metals, Perchlorate**			
Motor Casing Washout (Boring 1)	VP-6	5	VOCs	Metals			
	VP-6	15	VOCs	Metals, Perchlorate**		VOCs; Metals	
Motor Casing Washout (Boring 2)	VP-5	5	VOCs	Metals	VOCs; Metals		VOCs; Metals
	VP-5	15	VOCs	Metals, Perchlorate**			
Cast and Cure Station	VP-4A	5	VOCs	Metals		VOCs; Metals	
	VP-4A	15	VOCs	Metals, Perchlorate**			
	VP-4B	5	VOCs	Metals			
	VP-4B	15	VOCs	Metals, Perchlorate**			
Burn Pit Area (Boring 1)	VP-1	5	VOCs	Metals	VOCs		VOCs; Metals
	VP-1	15	VOCs	Metals, Perchlorate**			
Burn Pit Area (Boring 2)	VP-2	5	VOCs	Metals			
	VP-2	15	VOCs	Metals, Perchlorate**		VOCs; Metals; Perchlorate	
Burn Pit Area (Boring 3)	VP-3	5	VOCs	Metals			
	VP-3	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-3 Location	BP-3A	5	VOCs	Metals		VOCs, metals	
	BP-3A	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-4 Location	BP-4A	10	VOCs	Metals			
	BP-4A	15	VOCs	Metals, Perchlorate**			

Table 3-3
Sample Matrix and Analysis Schedule for Soil and Soil Gas Samples
Beaumont No. 1 Site
Lockheed Martin Corporation

Sample Location	Boring Number	Depth Feet bgs	Soil Gas Sample	Soil Sample	Equipment Blank	Duplicate***	MS/MSD*
Burn Pit Area Previous BP-5 Location	BP-5	10	VOCs	Metals			
	BP-5	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-6 Location	BP-6	10	VOCs	Metals			
	BP-6	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-8 Location	BP-8A	5	VOCs	Metals	VOCs	VOCs; Metals	VOCs; Metals
	BP-8A	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-21 Location	BP-21A	10	VOCs	Metals			
	BP-21A	15	VOCs	Metals, Perchlorate**			
Burn Pit Area Previous BP-25 Location	BP-25A	10	VOCs	Metals			
	BP-25A	15	VOCs	Metals, Perchlorate**			
Existing Vapor Extraction Wells	VEW-6	N/A	VOCs				
	VEW-10	N/A	VOCs			VOCs	VOCs
	VEW-11	N/A	VOCs				
Existing Groundwater Monitoring Wells	MW-08	N/A	VOCs				
	MW-13	N/A	VOCs				
	MW-14	N/A	VOCs				
	MW-27	N/A	VOCs				
	MW-29	N/A	VOCs			VOCs	
	MW-35	N/A	VOCs				
	MW-36	N/A	VOCs				
	MW-46	N/A	VOCs				
	MW-63	N/A	VOCs				
	MW-65	N/A	VOCs				

Notes: bgs = below ground surface
*MS/MSD = Matrix Spike/ Matrix Spike Duplicate
** Perchlorate analysis (by EPA Method 314.6) will be performed on samples that have the highest VOC detections. If a particular sample location has higher VOC detections at multiple depths than another sample location, then perchlorate analysis may be eliminated from the second sample location and multiple perchlorate analyses performed at the first location.
***Soil gas duplicate samples will be collected with summa cans and taken to a fixed site laboratory for analysis.
VOCs = Volatile Organic Compounds analyzed by EPA Method 8260B
Metals = CAM 17 metals analyzed by EPA Method 6010A

3.5.1 Soil and Soil Gas Sampling at Direct Push Boreholes

On May 21, 2002 direct push technology was used to advance boreholes at 20 locations. Soil was sampled and logged for lithology at 0, 5, 10, and 15 feet bgs. No backfill material was noted at any of the 10 locations at the Burn Pit Area.

Soil samples from the 5 and 15 foot depth were retained for laboratory analysis. The soil matrix samples were preserved in the field following EPA Method 5035 (using Encore™ samplers) and analyzed for VOCs by EPA Method 8260. Select samples were also analyzed for 1,4-dioxane by EPA Method 8270, perchlorate by EPA Method 314.6, and CAM 17 Metals by EPA Method 6010B/7000.

Following collection of the soil samples, nested temporary gas probes were installed in each direct push borehole. Nested probes were installed at depths of 5 and 15 feet bgs within the 1.25-inch direct push borehole, and a sample tip connected to the ¼ inch polyethylene tubing was extended down the boring to the appropriate depth. Each probe was set with a sand filter pack that extended approximately nine inches above and below the sample tip. Bentonite was used to seal the annulus of the borehole between each of the probe depths. As required by California Regional Water Quality Control Board, Los Angeles Division, CRWQCB-LA WIP, soil gas samples were not collected for 30 days, allowing soil gas sufficient time to equilibrate.

On June 24, 2002, after the soil gas had equilibrated for a minimum of 30 days, each of the 40 soil gas sampling probes were purged and sampled. The polyethylene tubing was connected to the sampling train, and soil vapor sampling was initiated. The tubing exiting the surface of the ground was connected to a glass sampling bulb fitted with Teflon® stopcocks and a Viton® rubber sampling port. This bulb was connected in turn to a vacuum gauge, calibrated flow-meter, and portable sampling pump. Vacuum integrity of the sampling system was tested prior to and after the vapor sampling. The probes are purged at a rate of 150-200 ml/min, and were maintained for seven to ten purge volumes. During the sampling, a leak check compound, isobutane, was placed around the sample train. Any trace of this compound detected in the sample would indicate the intrusion of ambient air into the sampling train, invalidating the results of the sample. No leaks were detected in any of the samples collected. Successive purge tests were conducted at VP-7B to determine if variations in purge amounts would affect the integrity of the soil gas sample. The purge test consisted of extracting 1, 2, 4, 6, 8, and 10 times the volume of the ¼ inch polyethylene tubing. Analytical results associated with the purge volume were plotted, and it was determined that the variation in purge volumes did not affect the integrity of the soil gas sample.

3.5.2 Soil Gas Sampling at Wells

In addition to the soil gas samples collected from the direct push borehole, 13 additional soil gas samples were collected: three from existing vapor extraction wells at the Burn Pit Area, and ten from groundwater monitoring wells around the Site, as specified in the SAP. The three existing vapor extraction wells (VEW-6, VEW-10, and VEW-11) sampled are part of the Burn Pit Area catalytic oxidation remediation system, and were sampled on June 24, 2002. The vapor wells were purged of approximately 3 well volumes. Once purging was completed, vapor samples were extracted from these wells using a sample port fitted with polyethylene tubing connected to a glass sampling bulb fitted with Teflon® stopcocks and a Viton® rubber sampling port. This bulb was connected in turn to a vacuum gauge, calibrated flow-meter, and portable sampling pump. Vacuum integrity of the sampling system was tested prior to, and after the vapor sampling.

On July 1, 2002, vapor samples were collected from inside the casings of 10 existing groundwater monitoring wells around the Site. These 10 groundwater monitoring wells include: MW-8, MW-13, MW-14, MW-27, MW-29, MW-35, MW-36, MW-46, MW-63, and MW-65. These wells were previously chosen by Earth Tech because of their location on the site, and because the water level in each of these wells is below the top of the well's screened interval, allowing the migration of vapors from the vadose zone into the casing. Soil vapor samples were extracted using a PVC slip cap with a hose barb connected by polyethylene tubing connected to a glass sampling bulb fitted with Teflon® stopcocks and a Viton® rubber sampling port. This bulb was connected in turn to a vacuum gauge, calibrated flow-meter, and portable sampling pump. Vacuum integrity of the sampling system was tested prior to, and after the vapor sampling.

The glass bulbs were shipped by courier to HydroGeoSpectrum located in the City of Industry, California. The glass bulbs were received and prepared within 6 hours of the initial sampling time. Soil gas samples were analyzed for VOCs by Gas Chromatography / Mass Spectrometry (GC/MS) method. A total of nine QA/QC soil vapor samples were collected, including seven duplicates and two ambient air blanks. The ambient air blanks served as equipment blanks to verify the laboratory decontamination procedures for the glass tubes were sufficient. These blanks were collected at the beginning of each field sampling day. A stopcock was opened on one end of the glass bulb, and ambient air was allowed inside the glass tube. The stopcock was then closed, and the sample was later analyzed for VOCs.

4.0 ANALYSIS OF DATA QUALITY

4.0 SUMMARY OF DATA QUALITY OBJECTIVES AND COMPLIANCE

Data quality objectives (DQOs) are qualitative and quantitative statements developed by data users to specify the quality of data collected from field and laboratory activities to support specific decisions or regulatory actions. The DQOs describe what data is needed, the quality of data needed, and how the data will be used to address the problem being investigated. DQOs also establish numeric limits for the data to allow the user (or reviewers) to determine whether the data collected are of sufficient quality for use in their intended application. The data validation criteria are described in the Quality Assurance/Quality Control Guidelines included in Appendix E.

The usability of the data collected depends on its quality. A number of factors relate to the quality of data, and sample collection methods are as important to consider as methods used for sample analysis. Following standard operating procedures for both sample collection and analysis reduces sampling and analytical error. Complete chain-of-custody documentation and adherence to required sample preservation techniques, holding times and proper shipment methods help ensure sample integrity. Obtaining valid and comparable data also requires adequate QA/QC procedures and documentation, as well as established detection and control limits.

Quantitation limits are based on the extent to which the equipment, laboratory or field, or analytical process can provide measurements within known precision and accuracy parameters for specific constituents in field samples. The quantitation limit for a given analysis will vary depending on instrument sensitivity and matrix effects.

4.1 COMPLIANCE WITH DQOS OF ACCURACY, PRECISION, COMPLETENESS, AND COMPARABILITY

The effectiveness of a QA program is measured by the quality of data generated by the laboratory. Data quality is judged in terms of its precision, accuracy, completeness and comparability. These terms are described below. Discussions of any errors which may have impacted the data quality and an evaluation of the percent DQO compliance are presented under each data quality section.

4.1.1 Accuracy

Accuracy is the degree of agreement of a measurement, or average of measurements, with an accepted reference or "true" value, and is a measure of bias in a system. The DQO for accuracy is 90 percent. The accuracy of a measurement system is impacted by any factor which breeches the samples integrity (sampling protocol errors) or degrades the analytical process (instrument or method QC errors).

For this project, laboratory accuracy of the measurement data will be assessed and controlled. Results for blanks, laboratory spikes (LCS), and surrogates are the primary indicators of accuracy. These results will be used to control accuracy by requiring that they meet specified criteria. As spiked samples are analyzed, recoveries will be calculated and compared to pre-established acceptance limits.

Acceptance limits are based upon previously established laboratory performance for similar samples. In this approach, the control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established limits indicate a possible need for corrective action. This includes recalibration of the instrument, reanalysis of the QC sample, reanalysis of the samples in the batch, or flagging the data as suspect if the problems cannot be resolved. For contaminated samples, recovery of matrix spikes may depend on sample homogeneity, matrix interference, and dilution requirements for quantification.

Percent Compliance with Accuracy DQO

Data results flagged with the "J" qualifier are by definition, an estimated value. Qualified data results impact the Data Quality Objective by virtue of a QC error. Listed below are the results of the data evaluation (by method) which impact the accuracy DQO.

Methods not listed were 100% compliant with the DQO.

Method	Matrix	Total Analytes	Analytes Qualified	Cause	% Qualified
SW6010B	Soil	768	2	Low Spike Recovery	0.3
SW8270SIM	Water	61	12	Holding Times	20

Data Usability

The DQO for accuracy was met for all methods except for method SW8270C SIM that is used for low level 1,4-dioxane determinations. The holding time violation that caused the qualification was due to extracting the sample one day past the seven day holding time criterion. The qualified data are useable for their intended purpose.

4.1.2 Precision

Precision is a measure of agreement among individual measurements of the same property under prescribed similar conditions. When control limits are established for accuracy, it automatically defines the precision of the method. In the analysis of samples in a preparation batch, if the recoveries of analytes in the LCS are within the control limits, then the precision is also within limits.

Precision is also determined from duplicate field sample analyses and MS/MSD analyses. The precision is quantified by the RPD value calculated from the duplicate results. The RPD control limit is 30 percent.

Percent Compliance with Precision DQO.

Some results were qualified "J" due to the precision criteria. Methods not listed were 100% compliant with the DQO.

Method	Matrix	Total Analytes	Analytes Qualified	Cause	% Qualified
D2216	Soil	48	8	Field Duplicate RPD	17
SW6010B	Soil	768	38	Field Duplicate RPD	5

Data Usability

Method D2216 soil samples were heterogeneous in nature. With no preparation or digestion protocols to homogenize the sample matrix, duplicate sample percent moisture results gave RPD values above criteria. However, the percent moisture results were less than 20% for all soil samples and did not cause the dry weight results reporting to be in error. The data are useable for their intended purpose.

4.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct, normal conditions. The DQO for completeness is at least 90 percent complete.

Successful analyses are defined as those where the samples arrived at the laboratory intact, properly preserved, in sufficient quantity to perform the requested analyses, and accompanied by a completed chain of custody. Furthermore, the sample must be analyzed in such a manner such that the results are not rejected by any method criteria.

Percent Compliance with Completeness DQO.

The DQO for completeness was 100%

Data Usability

The data are useable for their intended purpose.

4.1.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured through the use of established and approved sample collection techniques and analytical methods, consistency in the basis of analysis (detection limits, volume, etc.), consistency in reporting units, and analysis of standard reference materials.

Percent Compliance with Comparability DQO.

Comparability usually cannot be quantified; however, the samples were analyzed according to lab-specific Standard Operating Procedures (SOPs) which are a reflection of federally-established guidelines.

Data Usability

By analyzing the samples in accordance with established guidelines, the comparability objective was met. The data are useable for their intended purpose.

4.2 LABORATORY QA/QC: ANALYSIS METHODOLOGIES, METHOD COMPLIANCE, AND CORRECTIVE ACTIONS

Oversight of laboratory QA/QC should be as proactive as possible in order to ensure valid data are produced during the sampling round. The systematic use of SOPs which detail QA/QC guidelines usually indicates the level of laboratory QA/QC one can expect to see in the final analysis of the data. However, no system is fail safe, and a few QA/QC anomalies generally expose themselves and give evidence of their existence once all the data are examined.

4.2.1 Analysis Methodologies

The analytical methods used for the Beaumont project are covered in Section 3.2 of this report.

4.2.2 Method Compliance

The laboratory was in compliance with all analytical methods employed.

4.2.3 Corrective Action

When necessary, the laboratory performed the appropriate corrective action as required by the QAPP

4.2.4 Other Qualified Data

Blank contamination

Method/Parameter	Matrix	Total Analytes	Analytes Qualified	% Qualified
SW6010B/Metals	Soil	768	138	18
SW6010B/Metals	Water	520	206	40
SW8260B/VOC	Soil	3216	31	1
SW8260B/VOC	Water	2345	36	1.5
E160.1/TDS	Water	26	6	23
E300.0/Chloride	Water	26	10	38
E300.0/Nitrate	Water	24	1	4
E300.0/Sulfate	Water	26	12	46
SM2320/Bicarbonate	Water	26	6	23
SW7470/Mercury	Water	26	23	88

The contamination detected in the equipment blanks caused the "B" qualified data listed above. The organic data "B" flag amounts were low while the inorganic data "B" flag amounts were higher. The metals "B" flag amounts for water were the highest.

At current detection levels it is unreasonable to produce inorganic analyte free water. Trace levels of several inorganic analytes were detected in the field blanks. Unfortunately, because the native concentrations of inorganic analytes found at this site are low, there was unusually high number of "B" qualified data. Selected water matrix metals samples were resampled and reanalyzed. The data results from the reanalyzed samples gave similar "B" flagged amounts as the first data set. However, most of the "B" flagged data were also trace level detections that were below the regulatory action levels. The effect on the data usability is minimized since the DQO was developed to address the regulatory action level compliance.

4.3 APPROPRIATENESS OF DATA FOR RISK ASSESSMENTS

The soil and water data collected by Tetra Tech for this investigation was validated per EPA guidelines. Therefore, all data not rejected are appropriate for use in risk assessments. No data were rejected, but some data was qualified for blank contamination from laboratory or field blanks. These data show low concentrations of common laboratory contaminants or metals commonly found in water. Data qualified for common laboratory contaminants should not be considered as environmental contaminants. Additionally, it is expected that any low-level metals associated with blank contamination will be well within the range of background concentrations found at the site. If used in risk assessments, the data qualified for blank contamination should be considered as the maximum possible concentrations, but treated as less reliable than data not qualified for blank contamination.

5.0 RESULTS OF FIELD INVESTIGATION

5.0 RESULTS OF FIELD INVESTIGATION

The results of the groundwater sampling, surface water sampling, aquifer tests, and soil/soil gas sampling are presented in the following sections. These sections include a discussion of the slug tests, which were conducted to determine the hydraulic conductivity at various depths and various locations within the Burn Pit Area and the Rocket Motor Production Area. The following sections also discuss the groundwater and surface water analytical data, and the spatial and vertical distribution of chemicals of potential concern (COPC). The section also presents the results of the soil and soil gas sampling, including the analytical data and the distribution of COPCs.

5.1 GROUNDWATER ANALYSIS

The results and interpretations of the groundwater investigation conducted as part of the supplemental site characterization are presented in the following sections. These sections include tabulated summaries of the data collected, groundwater contour maps, hydraulic conductivity distribution maps, concentration isopleth maps for the COPCs, and vertical analyte impact profile plots.

5.1.1 Groundwater Elevations and Flow Direction

Groundwater level measurements were collected on May 14 and 15, 2002. A total of 107 water level measurements were collected from groundwater monitoring, injection, and extraction wells at the Site. The measured depths to groundwater and calculated groundwater elevations are presented in Table 5-1.

The groundwater within the Quaternary Alluvium (QA) and the Mount Eden (ME) Formation generally flows from canyons located east of the Burn Pit Area. The groundwater flow gradient is approximately 2.6% as it flows towards the Burn Pit Area beneath Bedsprings Creek. Beneath the Burn Pit Area, the groundwater flow gradient becomes approximately 0.2% (relatively horizontal) with an anomalous depression surrounding groundwater monitoring well MW-55. From this point, the groundwater begins to flow towards the west, away from the Rocket Motor Production Area, for approximately 3000 feet with a gradient of 1.3%. At this point the gradient increases to approximately 4%, and the groundwater flows towards the west-southwest. This direction continues for approximately 2000 feet, but the gradient begins to decrease to 1% as the groundwater flows towards Massacre Canyon. Refer to Figure 5-1 and Figure 5-2 for groundwater contour maps.

5.1.2 Aquifer Testing

Slug tests were conducted on various groundwater monitoring wells within the Burn Pit Area and Rocket Motor Production Area. These tests were conducted in order to more accurately determine the hydraulic conductivity of the groundwater within the Quaternary Alluvium and the Mount Eden Formation. The

Table 5-1
Groundwater Elevations - May 2002
Beaumont No. 1 Site
Lockheed Martin Corporation

Well ID	HSU	Date Measured	Measuring Point Elevation (feet MSL)	May 2002 Depth to Water (feet)	May 2002 Groundwater Elevation (feet MSL)
EW-01	QA	05/14/02	2142.60	48.62	2093.98
EW-02	QA	05/14/02	2125.10	40.45	2084.65
EW-08	ME	05/15/02	2175.10	70.65	2104.45
EW-09	ME	05/14/02	2176.40	72.22	2104.18
EW-10	ME	05/15/02	2176.90	72.39	2104.51
EW-11	ME	05/15/02	2178.70	72.68	2106.02
EW-12	ME	05/15/02	2176.80	73.90	2102.90
EW-13	ME	05/15/02	2179.90	73.60	2106.30
EW-14	ME/QA	05/15/02	2181.40	76.54	2104.86
EW-15	ME	05/15/02	2181.30	75.31	2105.99
EW-16	ME	05/15/02	2182.30	75.37	2106.93
EW-17	NA	05/14/02	NA	73.26	NA
EW-18	ME	05/15/02	2182.30	74.38	2107.92
IW-01	QA	05/14/02	2158.30	56.53	2101.77
IW-02	QA	05/14/02	2152.50	50.87	2101.63
IW-03	QA	05/14/02	2129.90	4.64	2125.26
IW-04	QA	05/14/02	2132.00	2.81	2129.19
IW-05	QA	05/14/02	2134.10	35.00	2099.10
MW-01	ME	05/14/02	2174.30	72.49	2101.81
MW-02	QA	05/14/02	2167.50	64.86	2102.64
MW-03	ME	05/14/02	2166.40	125.34	2041.06
MW-04	QA	05/14/02	2157.40	54.77	2102.63
MW-05	QA	05/14/02	2118.70	19.74	2098.96
MW-06	QA/ME	05/14/02	2119.10	21.62	2097.48
MW-07	QA	05/14/02	2173.80	71.96	2101.84
MW-08	QA	05/14/02	2087.80	14.32	2073.48
MW-09	QA	05/14/02	2086.30	1.45	2084.85
MW-10	QA	05/14/02	2176.70	71.74	2104.96
MW-11	QA	05/14/02	2119.90	41.19	2078.71
MW-12	QA	05/14/02	2095.80	26.97	2068.83
MW-13	QA	05/14/02	2055.20	16.91	2038.29
MW-14	QA	05/15/02	2027.00	35.57	1991.43
MW-15	QA/ME	05/14/02	2007.10	29.32	1977.78
MW-16	QA/ME	05/15/02	1818.00	NA	NA
MW-17	QA	05/14/02	2137.70	36.89	2100.81
MW-18	QA	05/14/02	2006.00	28.95	1977.05
MW-19	QA	05/14/02	2115.80	18.54	2097.26
MW-20	QA	05/14/02	2156.90	57.52	2099.38
MW-21	QA	05/14/02	2158.10	55.85	2102.25
MW-22	QA	05/14/02	2168.20	64.70	2103.50
MW-23	QA	05/14/02	2159.60	57.17	2102.43
MW-24	ME	05/15/02	2180.60	78.60	2102.00
MW-26	ME	05/15/02	2179.90	76.75	2103.15
MW-27	QA	05/14/02	2178.00	75.03	2102.97
MW-28	QA	05/14/02	2158.30	56.41	2101.89
MW-29	ME	05/14/02	2112.40	24.70	2087.70
MW-30	QA	05/14/02	2159.00	55.65	2103.35
MW-31	ME	05/15/02	2183.30	92.21	2091.09
MW-32	ME	05/14/02	2173.40	84.70	2088.70
MW-34	QA	05/14/02	2151.40	46.90	2104.50
MW-35	QA	05/14/02	2168.30	66.54	2101.76
MW-36	QA	05/14/02	2202.50	96.19	2106.31
MW-37	QA/ME	05/14/02	2038.30	38.12	2000.18
MW-38	ME	05/14/02	2027.60	46.90	1980.70
MW-39	QA	05/14/02	2141.50	39.82	2101.68
MW-40	ME	05/14/02	2123.70	37.81	2085.89
MW-41	QA/ME	05/14/02	2131.30	31.09	2100.21
MW-42	QA	05/14/02	2089.90	7.86	2082.04
MW-43	QA	05/14/02	2065.80	5.28	2060.52

Table 5-1
Groundwater Elevations - May 2002
Beaumont No. 1 Site
Lockheed Martin Corporation

Well ID	HSU	Date Measured	Measuring Point Elevation (feet MSL)	May 2002 Depth to Water (feet)	May 2002 Groundwater Elevation (feet MSL)
MW-44	QA	05/14/02	2124.40	27.21	2097.19
MW-45	QA	05/14/02	2068.90	Artesian	Artesian
MW-46	QA	05/14/02	2069.40	51.65	2017.75
MW-47	QA	05/14/02	2077.10	Artesian	Artesian
MW-48	QA	05/15/02	2073.70	8.44	2065.26
MW-49	QA	05/14/02	2128.20	27.69	2100.51
MW-50	QA	05/14/02	2148.80	47.31	2101.49
MW-51	QA	05/14/02	2135.70	34.17	2101.53
MW-52	QA	05/14/02	2133.50	32.73	2100.77
MW-53	QA	05/14/02	2150.60	49.18	2101.42
MW-54	QA	05/14/02	2150.80	49.11	2101.69
MW-55	QA	05/14/02	2153.50	62.02	2091.48
MW-56A	ME	05/14/02	2140.40	50.98	2089.42
MW-56B	QA	05/14/02	2139.90	38.58	2101.32
MW-56C	QA	05/14/02	2140.00	39.14	2100.86
MW-56D	QA	05/14/02	2140.10	38.76	2101.34
MW-57A	QA	05/14/02	2139.90	41.92	2097.98
MW-57B	QA	05/14/02	2143.30	42.05	2101.25
MW-57C	QA	05/14/02	2143.40	41.88	2101.52
MW-57D	QA	05/14/02	2143.50	42.09	2101.41
MW-58A	QA	05/14/02	2138.10	37.13	2100.97
MW-58B	QA	05/14/02	2138.10	37.03	2101.07
MW-58C	QA	05/14/02	2138.40	37.41	2100.99
MW-58D	QA	05/14/02	2138.30	37.34	2100.96
MW-59A	ME	05/14/02	2177.00	78.05	2098.95
MW-59B	ME	05/14/02	2177.20	73.34	2103.86
MW-59C	ME	05/14/02	2176.70	75.19	2101.51
MW-59D	ME	05/14/02	2177.30	74.63	2102.67
MW-60A	ME	05/14/02	2179.50	77.59	2101.91
MW-60B	ME	05/14/02	2179.50	75.79	2103.71
MW-61A	ME	05/15/02	2183.70	79.26	2104.44
MW-61B	ME	05/15/02	2183.60	77.75	2105.85
MW-61C	ME	05/15/02	2183.70	83.46	2100.24
MW-61D	ME	05/15/02	2183.70	80.95	2102.75
MW-62A	QA	05/14/02	2128.80	28.01	2100.79
MW-62B	QA	05/14/02	2128.90	28.82	2100.08
MW-63	QA	05/14/02	2156.40	51.79	2104.61
MW-64	QA	05/14/02	2125.80	26.20	2099.60
MW-65	QA	05/14/02	2126.30	27.08	2099.22
MW-66	QA	05/14/02	2127.90	28.11	2099.79
OW-01	QA	05/14/02	2202.30	55.67	2146.63
OW-02	QA	05/14/02	2076.60	2.96	2073.64
OW-03	QA	05/14/02	2141.00	39.94	2101.06
OW-08	QA	05/14/02	2033.00	50.99	1982.01
P-02	NA	05/14/02	2078.60	20.62	2057.98
P-03	QA	05/14/02	2137.60	41.35	2096.25
P-04	QA	05/14/02	2109.00	33.20	2075.80
P-05	QA	05/14/02	2159.50	58.18	2101.32

Notes: NA - Not available
(-) HSU Not Defined

Figure 5-1
May 2002 Groundwater Contours QA Wells

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

NORTH

0 500 1000

Feet

Legend

- Groundwater Contour (feet MSL)
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Monitoring/Injection/Extraction Well (Screened in QA Unit)

POTRERO CREEK

BEDSPRINGS CREEK

Rocket Motor Production Area

Burn Pit Area

P-4, MW-11, P-3, IW-5, IW-4, IW-3, MW-44, MW-66, MW-12, P-2, MW-13, OW-2, MW-42, MW-19, MW-5, MW-65, MW-64, EW-2, MW-62B, MW-62A, MW-39, MW-34, MW-52, MW-56B, MW-56C, MW-56D, MW-49, MW-51, MW-57A, MW-57R, MW-57C, MW-57D, MW-4, MW-58D, MW-58C, MW-58B, MW-58A, EW-1, OW-3, MW-54, MW-23, MW-30, MW-21, MW-43, MW-48, MW-46, MW-8, OW-8, MW-50, MW-63, MW-22, MW-10, MW-17, MW-53, MW-28, MW-20, MW-55, MW-2, MW-27, IW-2, IW-1, MW-7, MW-14, MW-35, MW-18, P-5, MW-36, OW-1

2,100 2,105 2,110 2,115 2,120 2,125 2,095 2,090 2,085 2,080 2,075 2,070 2,065 2,060 2,055 2,050 2,045 2,040 2,035 2,030 2,025 2,020 2,015 2,010 2,005 2,000 1,995 1,990 1,985 1,980 2,130 2,135 2,140 2,145

Figure 5-2

May 2002 Groundwater Contours ME Wells

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

NORTH

0 500 1000

Feet

Legend

- Groundwater Contour (feet MSL)
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Monitoring/Injection/Extraction Well (Screened in ME Unit)

POTRERO CREEK

BEDSPRINGS CREEK

Rocket Motor Production Area

Burn Pit Area

MW-38 MW-40 MW-29 MW-61D MW-61A MW-56A MW-61B MW-1

EW-8 MW-60B EW-10 EW-12 MW-59D EW-11 EW-13 MW-24 EW-16 EW-18 EW-15

1,985 1,990 1,995 2,000 2,005 2,010 2,015 2,020 2,025 2,030 2,035 2,040 2,045 2,050 2,055 2,060 2,065 2,070 2,075 2,080 2,085 2,090 2,095 2,100 2,105

slug tests included both rising and falling head tests which were analyzed using two different methods, following the Method of Bouwer and Rice, and the Method of Cooper et al (Dawson and Istok, 1991). In addition to the slug tests, a comparison was conducted between the hydraulic conductivity estimates from the slug tests and conductivity estimates calculated using specific capacity data collected during groundwater sampling. If a strong correlation exists between the two methods then the spatial distribution of hydraulic conductivity would be better understood because of the much larger specific capacity data set. The results of this analysis are presented in Section 5.1.2.2.

5.1.2.1 Slug Test Results

The slug test response data for Lockheed Beaumont Wells MW-1, MW-22, MW-26, MW-31, MW-44, MW-50, MW-51, MW-55, and MW-7 are given in Figures ST-1 through ST-10 in Appendix E. The results of two tests for MW-7 are given in Figures ST-9 (Test 2) and ST-10 (Test 3). Data for MW-7 (Test 2) displayed considerable noise that prohibited interpretation due to frequent negative drawdown values, so only MW-7 (Test 3) was interpreted. All other test results generally display behavior that is typical for slug tests. Due to the slow equilibration observed in MW-26 and MW-31, the rising head started before the falling head had stabilized, so the rising head interpretation results are subject to uncertainty. The tests at MW-50, MW-55, and MW-7 also exhibit noise in the test response, which may introduce uncertainty in the interpretation at these wells.

Figures ST-11 through ST-46 in Appendix E show the slug test interpretation results for Wells MW-1, MW-22, MW-26, MW-31, MW-44, MW-50, MW-51, MW-55, and MW-7 (Test 3). There are four interpretation plots for each well, with two plots each for the Falling Head and Rising Head portions of each test. The falling and rising head data were analyzed using two different methods, following the Method of Bouwer and Rice, and the Method of Cooper et al (Dawson and Istok, 1991). The test data was interpreted using the AQTESOLV software package (Geraghty and Miller, 1991), which is designed to analyze aquifer pump test and slug test data. Values for transmissivity and hydraulic conductivity were estimated for each of the wells tested.

Table 5-2 shows four hydraulic conductivity values estimated for each well, one for the Falling Head Test interpreted with the Bouwer-Rice Method; one for the Falling Head Test interpreted with the Cooper et al Method; one for the Rising Head Test interpreted with the Bouwer-Rice Method; and one for the Rising Head Test interpreted with the Cooper et al Method. Hydraulic conductivity values for the Copper et al method were obtained by dividing the transmissivity value (feet^2 per day) from the test result by the well screen length (feet). There is generally good correlation between the results of the rising and falling head tests, and the results of the two interpretation methods. The table also shows hydraulic conductivity values estimated from prior pump test results for wells MW-1 and MW-7 (Radian, 1990), and from recent specific capacity tests in MW-26, MW-31, and MW-50. There is fair correlation between the prior hydraulic conductivity estimates and the slug test results.

Table 5-2
Lockheed Propulsion Company
Beaumont Test Facility 2002 Slug Test Results
Hydraulic Conductivity Values

Well	Falling Head Values (feet per day)		Rising Head Values (feet per day)		Comments
	Bouwer-Rice	Cooper et al	Bouwer-Rice	Cooper et al	
MW-1	0.319	0.257	0.263	0.322	Pump test 0.20 (Radian, 1990)
MW-22	1.090	0.785	1.296	0.897	
MW-26[1]	0.0906	0.0994	0.0997	0.1999	0.4 from specific capacity
MW-31[1]	0.0465	0.0258	0.0313	0.2791	0.7 from specific capacity
MW-44	6.193	5.196	6.343	6.939	
MW-50	51.34	59.36	42.72	61.37	125 from specific capacity
MW-51	1.758	2.003	2.271	2.416	
MW-55	24.41	89.50	28.25	35.44	
MW-7	15.67	48.60	45.92	70.25	Pump test 25.5 (Radian, 1990)
Geomean-All	1.89	2.24	2.12	3.26	
Geomean-QA	7.84	11.33	10.06	11.49	
Geomean-ME	0.1103	0.0871	0.0936	0.2620	

Notes [1]Falling head did not stabilize at MW-26 and MW-31 before rising test began - rising head results uncertain
GEOMEAN = geometric mean, the appropriate method for averaging transmissivity and hydraulic conductivity values in a heterogeneous aquifer (Bear, 1979) since the data are log-normally distributed

Table 5-2 shows the geometric mean hydraulic conductivity value for all wells ranges from 2 to 3 feet per day. The geometric mean hydraulic conductivity value for the Mount Eden Formation wells ranges from 0.1 to 0.3 feet per day. The geometric mean hydraulic conductivity value for the Quaternary Alluvium wells ranges from 8 to 11 feet per day. These results are consistent with the site conceptual model (Radian, 1990) where the Mount Eden Formation is far less permeable than the overlying alluvium. The slug test results are also consistent with published values for sandstone and sand/gravel formations (Bear, 1979).

Table 5-3 summarizes the transmissivity values from the test results using the format of Table 5-2. Transmissivity values for the Bouwer-Rice method were obtained by multiplying the hydraulic conductivity value (feet per day) from the test result by the netted well screen length (feet). Table 5-3 shows the geometric mean transmissivity value for all wells ranges from 38 to 65 feet^2 per day. The geometric mean transmissivity value for the Mount Eden Formation wells ranges from 1 to 4 feet^2 per day. The geometric mean transmissivity value for the Quaternary Alluvium wells ranges from 176 to 258 feet^2 per day.

Table 5-3
Lockheed Propulsion Company
Beaumont Test Facility 2002 Slug Test Results
Transmissivity Values

Well	Falling Head Values (feet^2 per day)		Rising Head Values (feet^2 per day)	
	Bouwer-Rice	Cooper et al	Bouwer-Rice	Cooper et al
MW-1	3.191	2.569	2.629	3.224
MW-22	43.61	31.41	51.82	35.87
MW-26[1]	3.625	3.974	3.987	7.998
MW-31[1]	0.4646	0.2585	0.3127	2.7907
MW-44	123.9	103.9	126.9	138.8
MW-50	1027	1187	854	1227
MW-51	35.16	40.06	45.42	48.33
MW-55	488.2	1789.9	565.1	708.8
MW-7	313.3	972.0	918.4	1405.0
Geomean-All	37.87	44.70	42.31	65.15
Geomean-QA	176.1	254.2	225.8	257.9
Geomean-ME	1.752	1.382	1.486	4.159

Notes [1]Falling head did not stabilize at MW-26 and MW-31 before rising test began - rising head results uncertain
GEOMEAN = geometric mean, the appropriate method for averaging transmissivity and hydraulic conductivity values in a heterogeneous aquifer (Bear, 1979) since the data are log-normally distributed

5.1.2.2 Slug Test and Specific Capacity Comparison

The hydraulic conductivity values calculated from the slug tests were compared to hydraulic conductivity estimates using specific capacity data collected during groundwater sampling. Specific capacity estimates calculated from the purging data were used in the equations from Driscoll (1986), derived from Cooper and Jacob's (1946) approximation of the Theis solution, to estimate the hydraulic conductivity of the screened interval;

$$T = 200Q/s$$

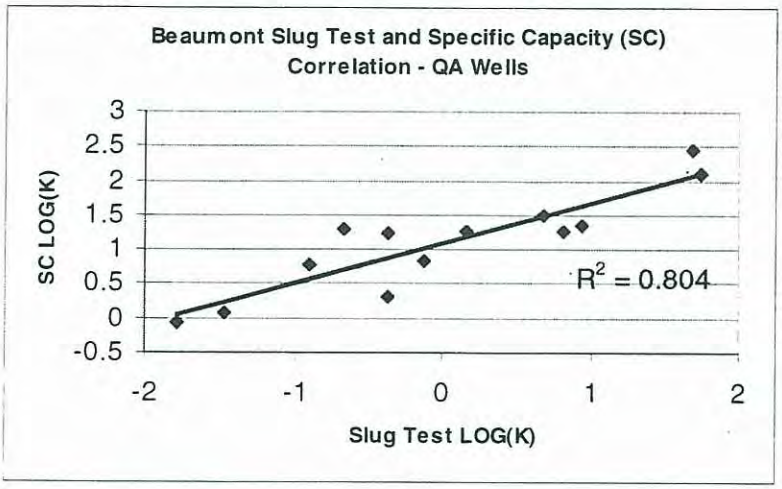
where

T = well transmissivity (feet^2/day)
Q = discharge (gallons/minute)
s = drawdown (feet)

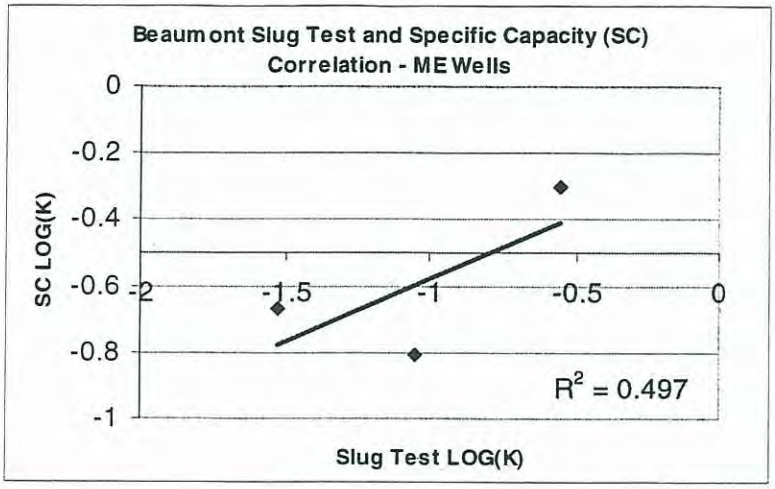
The average hydraulic conductivity (K) in the screened interval is then calculated by dividing the well transmissivity by the wetted screen length (feet);

$K = T/b$
K = hydraulic conductivity (feet/day)
T = well transmissivity ($feet^2$/day)
b = wetted screen length of the well (feet).

The hydraulic conductivity was calculated for each of the wells where slug tests were performed including the previous slug tests conducted in 1990 (Radian, 1990). Since the hydraulic conductivity estimates are closer to a lognormal distribution than a Gaussian or normal distribution, a log-log plot was used to determine the correlation of the two methods. The correlation plot below shows that there is a relatively strong relationship between the two methods in the QA wells. The coefficient of determination, R^2, for this relationship is 0.80.



The correlation in the ME wells was not very good due to the very limited number of wells that could be compared. However, although the correlation is relatively low, the specific capacity method still provides qualitative results of hydraulic conductivity to show areas of low conductivity versus areas of higher conductivity. Therefore, the calculated specific capacity values for the ME wells were used to better display the spatial distribution of hydraulic conductivity. These values should not be used for any quantitative analysis including groundwater modeling and contaminant fate and transport.



Based on the relatively good correlation of these two methods, hydraulic conductivity estimates were calculated for all wells where specific capacity data was available. The calculated conductivity values were used along with the slug test values to map the spatial distribution of hydraulic conductivity in both the QA and ME hydrostratigraphic units. The hydraulic conductivity values, including the log-transformed values, for both the slug tests and the specific capacity tests are presented in Table 5-4.

5.1.2.3 Hydraulic Conductivity Distribution

The hydraulic conductivity values calculated for the site range over four orders of magnitude which is reasonable for alluvial sedimentary bedrock aquifer systems. Since the hydraulic conductivity values are lognormally distributed, the values were log transformed before plotting the spatial distribution at the site. Figures 5-3 and 5-4 show the spatial distribution of hydraulic conductivity at the site for the QA and ME wells, respectively.

The hydraulic conductivity, for wells screened within the QA, range from 0.24 feet/day to 318 feet/day (Figure 5-3). The highest levels of conductivity are present near MW-7, MW-50, MW-15, and MW-18. The Burn Pit Area encompasses a broad range of conductivity values, with the lowest conductivity in the southeast corner, and the highest conductivity values in the northwest corner near MW-7. The Rocket Motor Production Area also encompasses a broad range of conductivity values, but a much larger area of the Rocket Motor Production Area has low conductivities in the range of 0.24 to 2.5 feet/day. The highest conductivity values near the Rocket Motor Production Area are located on the southwest corner near MW-50. Surprisingly, the majority of the monitoring wells near Bedsprings Creek and Potrero Creek downstream of the Rocket Motor Production Area have fairly low hydraulic conductivity values. However, the conductivity values begin to increase dramatically approximately 4,500 feet downgradient of the Rocket Motor Production Area. Hydraulic conductivity values reach another peak surrounding monitoring wells MW-15 and MW-18.

Figure 5-4

Hydraulic Conductivity Distribution
ME Wells

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

NORTH

0 500 1000

Feet

Legend

(feet/day)

67.8

9.27

5.5

1.7

0.08

Monitoring Well

MW-40

MW-06

Rocket Motor
Production Area

MW-56A

MW-03

MW-02

MW-60B

MW-60A

MW-59B

MW-59A

MW-32

Burn Pit Area

MW-26

MW-01

MW-31

EW-15

MW-38

Figure 5-3

Hydraulic Conductivity Distribution QA Wells

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

NORTH

0 500 1000

Feet

Legend

(feet/day)

318

15.5

5.9

2.5

0.24

Monitoring Well

MW-11
MW-12
MW-66
MW-05
MW-64
Rocket Motor Production Area
MW-42
MW-39
MW-13
OW-02
MW-62A
MW-34
MW-56B
MW-57A
MW-19
MW-57B
MW-04
MW-43
MW-58D
OW-03
MW-30
MW-46
MW-08
MW-10
MW-37
MW-09
MW-50
MW-63
MW-17
Burn Pit Area
MW-15
MW-14
MW-07
MW-35
MW-18
P-05
MW-36

Table 5-4
Aquifer Test Results - Hydraulic Conductivity Estimates
Beaumont No. 1 Site
Lockheed Martin Corporation

Well ID	Hydrostatigraphic Unit Screened	Hydraulic Conductivity (K) (feet/day)	LOG (K)
EW-15	ME	0.38	-0.416548896
MW-01	ME	1.00	0.001413756
MW-02	ME	67.80	1.83120798
MW-03	ME	0.69	-0.162415036
MW-26	ME	0.31	-0.508843824
MW-31	ME	0.11	-0.968202668
MW-32	ME	0.08	-1.10994958
MW-38	ME	0.79	-0.101747074
MW-40	ME	7.60	0.881074247
MW-56A	ME	6.01	0.778846678
MW-59A	ME	0.80	-0.094471129
MW-59B	ME	0.33	-0.481729197
MW-60A	ME	1.03	0.01188716
MW-60B	ME	9.63	0.983802646
MW-06	ME	14.52	1.161938388
MW-04	QA	6.01	0.778585762
MW-05	QA	2.12	0.326979093
MW-07	QA	318.88	2.503623946
MW-08	QA	21.22	1.326826978
MW-09	QA	2.14	0.330334522
MW-10	QA	19.61	1.292429824
MW-11	QA	6.67	0.823908741
MW-12	QA	4.75	0.6767479
MW-13	QA	23.58	1.372572691
MW-14	QA	46.40	1.666512422
MW-17	QA	0.77	-0.113776284
MW-18	QA	18.52	1.26760624
MW-19	QA	0.88	-0.05422991
MW-30	QA	28.28	1.45145704
MW-34	QA	6.99	0.844663963
MW-35	QA	10.19	1.008231395
MW-36	QA	1.94	0.287666034
MW-39	QA	2.38	0.377009295
MW-42	QA	2.31	0.363825651
MW-43	QA	1.15	0.059732609
MW-46	QA	3.14	0.496447632
MW-50	QA	125.00	2.096910013
MW-56B	QA	19.12	1.281498311
MW-57A	QA	45.45	1.657577319
MW-57B	QA	2.45	0.388701638
MW-58D	QA	1.97	0.294649537
MW-62A	QA	5.85	0.76700389
MW-63	QA	1.32	0.119288136
MW-64	QA	2.07	0.316142795
MW-66	QA	1.81	0.258336377
OW-02	QA	0.76	-0.116607744
OW-03	QA	0.66	-0.183554534
P-05	QA	2.00	0.301899454
MW-15	QA	102.56	2.010995384
MW-37	QA	0.24	-0.620136055
MW-22	QA	1.01	0.004321374
MW-44	QA	6.17	0.790285164
MW-51	QA	2.11	0.324282455
MW-55	QA	44.40	1.64738297

The hydraulic conductivity, for wells screened within the Mount Eden Formation, range from 0.08 feet/day to 202 feet/day (Figure 5-4). The highest levels of conductivity are present to the north of the Burn Pit Area. However, the validity of this high conductivity value is uncertain, as there are no monitoring wells in the general vicinity to validate this data. The Mount Eden Formation beneath the Burn Pit Area has a low conductivity value, which stretches to the southeast terminus of the Rocket Motor Production Area. The conductivity begins to increase steadily to a value of approximately 9.0 feet/day within the Rocket Motor Production Area. The conductivity values downgradient of the Rocket Motor Production Area remain within the 5.5 to 9.27 feet/day range until approximately 3,200 feet downgradient. The conductivity values begin to decrease to the range of 0.08 to 1.7 feet/day towards MW-38.

5.1.3 Groundwater Quality

The primary objective of this site characterization is to better define the extent of the VOC and perchlorate affected groundwater. In selected monitoring wells within and downgradient of the Burn Pit Area and the Rocket Motor Production Area, and within the alluvium and Mount Eden Formation, additional constituents were analyzed to provide updated information on inorganic analytes. The constituents include nitrate, sulfate, common anions and cations, dissolved oxygen, and CCR metals. Analytical data of these constituents will aid in the characterization of water quality, and will be needed to determine if natural degradation is a viable solution to meet clean-up goals (Earth Tech, 2002).

5.1.3.1 Analytical Data Summary

A summary of the validated laboratory analytical results for the supplemental groundwater investigation is presented in Tables 5-5 through 5-7. Analytical data from the semi-annual monitoring was provided by Earth Tech. Since only hard copies of the environmental sample results were provided, the data was not validated for quality assurance and therefore the validity of the results is unknown. Table 5-5 presents the COPCs positively detected during this investigation which include VOCs including 1,4-dioxane, and perchlorate. Table 5-6 shows the metals and Table 5-7 presents the cations and anions detected in the groundwater during this investigation. Sample results detected above the published primary maximum contaminant level (MCL) (federal or state, whichever is lowest) or California Recommended Action Levels are shaded in Tables 5-5 through 5-7. A complete list of the analytes tested along with the validated analytical results by method is provided in Appendix A. The laboratory analytical data packages which include all environmental, field QC, and laboratory QC results are included in Appendix D (Volume II of this report).

Table 5-5
Groundwater Analytical Data Summary - Chemicals of Potential Concern
Beaumont No. 1 Site
Lockheed Martin Corporation

Well	1,4-Dioxane EPA Method 8270SIM	Perchlorate EPA Method 314.1	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,2,4-Trimethylbenzene	1,2-Dichloroethane	Carbon tetrachloride	Chloroform	cis-1,2-Dichloroethene	Methylene Chloride	o-Xylene	Tetrachloroethene	Toluene	Trichloroethene	Vinyl Chloride
MCL	3*	4**	200	5	5	6	-	0.5	5	100	6	5	1750	5	150	5	0.5
MDL	0.5	1.8	0.33	0.34	0.28	0.56	0.20	0.38	0.25	0.30	0.30	1.1	0.088	0.21	0.16	0.18	0.44
Maximum Contaminant Levels (MCL), Method Detection Limit (MDL), and analyte concentrations ug/L unless otherwise noted																	
EW-15	590 g	141000 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-01	3 g	1220 g	20 g	2 Jq	13 g	228 g	ND	12 g	ND	1 Jq	2 Jq	ND	ND	1 Jq	ND	332 g	ND
MW-02	120 g	2520 g	5 g	1 Jq	3 Jq	302 g	ND	4 Jq	ND	1 Jq	1 Jq	ND	ND	ND	ND	167 g	ND
MW-03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 BJakq	ND	0.5 Jq	ND	0.3 Jq	ND
MW-04	14 g	861 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-05	26 g	4230 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-06	ND	3.9 Jq	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 BJkq	ND	ND	ND	0.9 Jq	ND
MW-07	ND	8.1 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5 Bak	ND	ND	ND	ND	ND
MW-09	5 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4 BJakq	ND	ND	ND	ND	ND
MW-10	ND	4.9 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-11	ND	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-12	ND	ND	ND	ND	ND	ND	0.4 BJkq	ND	ND	ND	ND	5 Bak	ND	ND	ND	ND	ND
MW-13	ND	ND	0.5 Jq	ND	0.4 Jq	73 g	ND	ND	ND	ND	ND	ND	ND	0.4 Jq	ND	63 g	ND
MW-14	3 g	11.1 g	ND	ND	ND	ND	0.4 BJkq	ND	ND	ND	ND	3 BJakq	0.3 Jq	ND	0.3 BJkq	ND	ND
MW-15	9.7 g	ND	ND	ND	0.4 Jq	ND	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	0.8 Jq	ND
MW-17	44 g	927 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-18	12 Je	7.8 g	ND	ND	0.4 Jq	3 Jq	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 Jq	ND
MW-19	75 Je	37.9 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-26	430 g	9970 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-30	ND	ND	ND	ND	ND	2 BJkq	ND	ND	ND	ND	ND	0.7 BJakq	ND	ND	ND	1 BJkq	ND
MW-31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 BJkq	ND	0.4 Jq	ND	ND	ND
MW-32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 BJakq	ND	0.5 Jq	ND	0.4 Jq	ND
MW-34	ND	32.3 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 BJakq	ND	ND	ND	0.4 Jq	ND
MW-35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND
MW-36	ND	36.7 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-37	11 g	ND	ND	ND	ND	3 Jq	ND	ND	ND	ND	ND	2 BJakq	ND	ND	ND	3 Jq	ND
MW-38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND
MW-39	10 g	808 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-40	31 Je	1250 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-42	34 g	37.4 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-43	16 g	89.6 g	ND	ND	0.6 Jq	8 g	ND	ND	ND	ND	ND	ND	ND	0.8 Jq	ND	5 Bk	ND
MW-45	17 g	336 g	ND	ND	0.5 Jq	9 g	ND	ND	ND	ND	ND	5 Bak	ND	ND	ND	9 g	ND
MW-46	9.3 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 BJkq	ND	ND	ND	0.5 Jq	ND
MW-47	ND	12.5 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	4 BJakq	ND	ND	ND	ND	ND
MW-50	10 g	272 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-56A	ND	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-56B	11 g	469 g	2 Jq	ND	2 Jq	61 g	ND	1 Jq	ND	0.9 Jq	ND	0.8 BJakq	ND	ND	ND	77 g	ND
MW-57A	39 g	1250 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-57B	22 g	608 g	3 Jq	ND	2 Jq	75 g	ND	1 Jq	ND	0.7 Jq	ND	0.9 BJakq	ND	ND	ND	84 g	ND
MW-58D	26 g	798 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS

Table 5-5
Groundwater Analytical Data Summary - Chemicals of Potential Concern
Beaumont No. 1 Site
Lockheed Martin Corporation

Well	1,4-Dioxane EPA Method 8270SIM	Perchlorate EPA Method 314.1	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,2,4-Trimethylbenzene	1,2-Dichloroethane	Carbon tetrachloride	Chloroform	cis-1,2-Dichloroethene	Methylene Chloride	o-Xylene	Tetrachloroethene	Toluene	Trichloroethene	Vinyl Chloride
MCL	3*	4**	200	5	5	6	-	0.5	5	100	6	5	1750	5	150	5	0.5
MDL	0.5	1.8	0.33	0.34	0.28	0.56	0.20	0.38	0.25	0.30	0.30	1.1	0.088	0.21	0.16	0.18	0.44
Maximum Contaminant Levels (MCL), Method Detection Limit (MDL), and analyte concentrations ug/L unless otherwise noted																	
MW-59A	ND	9.8 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	6 Bk	ND	0.9 Jq	ND	0.9 Jq	ND
MW-59B	60 g	5400 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-60A	35 Je	ND	2 Jq	0.5 Jq	2 Jq	228 g	ND	2 Jq	ND	1 Jq	0.7 Jq	ND	ND	ND	ND	111 g	ND
MW-60B	ND	2710 g	ND	ND	0.4 Jq	86 g	ND	ND	ND	1 Jq	ND	3 BJakq	ND	ND	ND	8 g	ND
MW-62A	36 Je	1940 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-63	25 Je	1520 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-64	46 g	1720 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-66	23 g	1680 g	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
OW-02	22 g	452 g	ND	ND	ND	8 g	ND	ND	ND	ND	ND	1 BJkq	ND	ND	ND	9 g	ND
OW-03	45 Je	ND	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS
P-05	ND	7.1 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND
S-1	ND	ND	ND	ND	ND	ND	0.4 Jq	ND	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND
S-2	19 g	256 g	ND	ND	0.6 Jq	11 g	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	12 g	ND
S-3	4.2 g	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND
Earth Tech's Environmental Results‡																	
EW-11	NS	NS	ND	ND	ND	800	ND	7.5	ND	ND	ND	ND	ND	ND	ND	410	ND
EW-12	NS	NS	47	ND	48	2900	ND	120	ND	ND	ND	ND	ND	ND	ND	1400	ND
EW-13	NS	NS	ND	200	480	26000	ND	1000	ND	ND	390	ND	ND	ND	ND	8300	ND
EW-15	NS	NS	ND	ND	340	12000	ND	280	ND	ND	ND	ND	ND	ND	ND	3600	ND
EW-16	NS	NS	ND	ND	ND	2600	ND	ND	ND	47	ND	ND	ND	ND	ND	1600	ND
EW-18	NS	NS	ND	ND	230	8800	ND	190	ND	ND	ND	ND	ND	ND	ND	2100	ND
MW-02	NS	NS	7.4	ND	4.4	340	ND	5	ND	ND	ND	ND	ND	ND	ND	220	ND
MW-04	NS	NS	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	40	ND
MW-05	NS	NS	3.2	ND	4.2	120	ND	0.59	ND	4.4	ND	ND	ND	ND	ND	83	ND
MW-07	NS	NS	ND	ND	ND	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND
MW-10	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-11	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-19	NS	NS	2.9	ND	3.6	32	ND	0.54	ND	ND	ND	ND	ND	ND	ND	20	ND
MW-20	NS	NS	2	ND	ND	53	ND	0.6	ND	ND	ND	ND	ND	ND	ND	49	ND
MW-26	NS	NS	ND	ND	110	4100	ND	160	ND	ND	ND	ND	ND	ND	ND	3200	ND
MW-29	NS	NS	ND	ND	7	31	ND	ND	ND	ND	2.3	ND	ND	ND	ND	60	ND
MW-36	NS	NS	ND	ND	ND	4.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	ND
MW-39	NS	NS	1.1	ND	2	86	ND	0.51	ND	3.6	ND	ND	ND	ND	ND	93	ND
MW-40	NS	NS	ND	ND	1.2	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	32	ND
MW-41	NS	NS	1	ND	2.3	52	ND	ND	ND	3.2	ND	ND	ND	ND	ND	95	ND
MW-42	NS	NS	ND	ND	7	120	ND	1	1.2	ND	1.4	ND	ND	ND	ND	87	1.2
MW-44	NS	NS	3	ND	3.3	85	ND	1	ND	2.2	ND	ND	ND	ND	ND	110	ND
MW-49	NS	NS	2.1	ND	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	ND
MW-51	NS	NS	2.2	ND	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	ND
MW-52	NS	NS	2.5	ND	1.3	44	ND	ND	ND	1	ND	ND	ND	ND	ND	64	ND

Table 5-5
Groundwater Analytical Data Summary - Chemicals of Potential Concern
Beaumont No. 1 Site
Lockheed Martin Corporation

Well	1,4-Dioxane EPA Method 8270SIM	Perchlorate EPA Method 314.1	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,2,4-Trimethylbenzene	1,2-Dichloroethane	Carbon tetrachloride	Chloroform	cis-1,2-Dichloroethene	Methylene Chloride	o-Xylene	Tetrachloroethene	Toluene	Trichloroethene	Vinyl Chloride
MCL	3*	4**	200	5	5	6	-	0.5	5	100	6	5	1750	5	150	5	0.5
MDL	0.5	1.8	0.33	0.34	0.28	0.56	0.20	0.38	0.25	0.30	0.30	1.1	0.088	0.21	0.16	0.18	0.44
Maximum Contaminant Levels (MCL), Method Detection Limit (MDL), and analyte concentrations ug/L unless otherwise noted																	
MW-55	NS	NS	3.1	ND	1.5	**120**	ND	**1.4**	ND	ND	ND	ND	ND	ND	ND	**92**	ND
MW-56A	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-56C	NS	NS	3.4	ND	3	**65**	ND	**1.8**	ND	1.4	ND	ND	ND	ND	ND	**100**	ND
MW-57A	NS	NS	3.6	ND	2.5	**100**	ND	**2.1**	ND	1.1	ND	ND	ND	ND	ND	**100**	ND
MW-58D	NS	NS	2.5	ND	2.1	**67**	ND	**1.6**	ND	ND	ND	ND	ND	ND	ND	**67**	ND
MW-59B	NS	NS	ND	ND	**16**	**330**	ND	**26**	ND	ND	ND	ND	ND	ND	ND	**290**	ND
MW-62A	NS	NS	2.4	ND	1.5	**53**	ND	**0.58**	ND	1.3	ND	ND	ND	ND	ND	**64**	ND
MW-66	NS	NS	1.6	ND	**5.4**	**120**	ND	**0.78**	ND	3.4	ND	ND	ND	ND	ND	**120**	ND

Validation Qualifiers

B: The sample result is less than 5 times the blank contamination. The result qualified for blank contamination is considered not to have originated from the environmental sample, since cross-contamination is suspected.

J: The analyte was positively identified, but the analyte concentration is an estimated value.

Qualifiers Descriptors -

a: The analyte was found in the method blank.

g: The datum met prescribed method criteria.

k: The analyte was found in a field blank.

q: The analyte detection was below the Practical Quantitation Limit (PQL).

MCL=Maximum Contaminant Level

MDL=Method Detection Limit

(-)=No MCL listed

EPA Method SW8260B unless otherwise noted

* California Department of Health Services Recommended Action Level

** California Department of Health Services unregulated chemicals for which monitoring is required, Recommended Action Level Listed

‡ Earth Tech data is not validated.

ND = Non-detect

NS = Not Sampled

Bolded analyte detected at a level exceeding the Maximum Contaminant level

Table 5-6
Groundwater Analytical Data Summary- Metals
Beaumont No. 1 Site
Lockheed Martin, Corporation

Well	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Lead	Magnesium	Molybdenum	Mercury EPA Method 7470A	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
MCL	6	50	1000	4	5	-	50		1300	15			2	100		50	100*	-	2	-	5000*
MDL	1.8	1.4	0.48	0.05	0.095	40	0.25	0.18	0.72	0.66	5.5	0.39	0.039	0.38	16	2.6	0.25	97	0.75	0.49	1.1
Maximum Contaminant Levels (MCL), Method Detection Limit (MDL), and analyte concentrations ug/L unless otherwise noted																					
EW-15	ND	ND	536 g	ND	1.1 BJkg	76100 g	1.2 BJ	0.52 BJkg	1.5 Jg	9.5 Bk	9080 g	1.3 BJkg	ND	3.2 BJkg	2920 g	ND	ND	58400 g	ND	ND	6.1 BJ
MW-01	ND	2.4 BJkq	94.5 g	ND	1.4 BJkq	13000 g	3.4 BJkq	ND	0.91 Jq	17.2 Bk	1640 g	10.3 g	ND	0.96 BJkq	1490 Bak	ND	ND	41900 g	ND	ND	4.9 BJkq
MW-02	ND	2.9 BJkq	78.8 g	ND	ND	25000 g	3.0 BJkq	ND	1.2 BJkq	ND	4090 g	2.7 BJkq	0.11 BJkq	1.5 BJkq	638 Bak	ND	0.40 BJkq	28100 g	1.2 Jq	4.2 Jq	4.1 BJkq
MW-03	2.2 BJkq	ND	4.2 Jq	ND	ND	1680 g	3.1 BJkq	ND	1.5 BJakq	2.3 Jq	37.5 BJak	13.8 g	0.14 BJkq	1.9 BJakq	390 BJakq	ND	ND	55200 g	ND	ND	83.7 g
MW-05	ND	4.9 BJkq	101 g	ND	ND	41200 g	4.6 BJkq	0.32 BJkq	2.6 BJkq	2.0 BJkq	7580 g	5.7 g	0.13 BJkq	2.3 BJkq	1140 Bak	ND	0.40 BJkq	24800 g	0.94 Jq	6.5 Jq	5.4 BJkq
MW-06	2.5 BJakq	ND	74.1 g	ND	0.23 BJkq	21100 g	ND	0.24 BJaq	ND	ND	2300 g	5.5 Bk	0.18 BJkq	1.3 BJakq	947 Bak	ND	ND	24000 g	ND	1.5 BJkq	19.7 Bk
MW-07	ND	1.6 Jq	36.6 g	0.053 Jq	0.48 BJak	14600 g	4.7 BJkq	0.37 Jq	2.0 BJakq	2.8 BJakq	2380 g	1.6 BJkq	0.16 BJkq	4.2 BJkq	1460 g	ND	0.83 BJak	13500 g	1.2 BJakq	3.2 Jq	7.7 BJkq
MW-12	ND	28.6 g	96.6 g	ND	0.39 BJak	289000 g	ND	1.9 Jq	ND	ND	43900 g	13.3 g	0.19 BJkq	2.1 BJkq	3910 g	ND	0.56 BJak	149000 g	**5.7 BJaq**	ND	9.3 BJkq
MW-15	ND	2.4 Jq	51.4 g	ND	0.38 BJak	43200 g	3.3 BJkq	ND	0.85 BJak	2.0 BJakq	7490 g	7.8 g	0.19 BJkq	5.0 Bk	893 g	ND	1.0 BJakq	49300 g	1.2 BJaq	0.99 Jq	7.5 BJkq
MW-18	ND	1.9 Jq	71.0 g	ND	0.10 BJkq	69100 Bk	0.54 BJkq	0.35 BJak	ND	1.1 BJkq	8950 Bk	11.7 g	0.15 BJkq	7.5 Bk	1700 Bk	ND	ND	44600 Bk	ND	5.1 Jq	2.8 BJkq
MW-19	3.6 BJaq	3.5 Jq	50.0 g	ND	0.19 BJkq	21900 Bk	0.46 BJkq	1.0 BJakq	1.7 BJakq	ND	3720 Bk	7.8 g	0.13 BJkq	3.5 BJkq	560 Bak	ND	ND	17300 Bk	ND	1.0 Jq	16.2 Bk
MW-40	2.1 BJaq	ND	22.5 g	ND	ND	35000 Bk	1.4 BJkq	ND	ND	ND	2420 Bk	0.61 BJaq	0.14 BJkq	2.2 BJakq	1580 Bk	5.8 BJkq	ND	30600 Bk	1.1 BJaq	8.6 Jq	11.1 Bk
MW-42	2.5 Jq	6.0 Ba	87.2 Bk	ND	0.20 Jq	33700 g	1.7 BJakq	0.73 BJkq	6.8 BJkq	1.3 BJkq	5120 g	7.4 Bk	0.20 BJkq	ND	1500 Ba	ND	0.81 BJak	23700 g	**3.2 BJakq**	2.0 BJkq	2.6 BJkq
MW-43	ND	2.2 BJkq	80.8 g	ND	0.15 BJkq	24800 g	1.0 BJkq	ND	1.3 BJkq	1.1 BJkq	3520 g	5.9 g	0.11 BJkq	ND	1320 Ba	ND	ND	15300 g	1.8 Jq	3.1 Jq	7.4 BJkq
MW-45	ND	1.9 Jq	72.8 g	ND	0.62 BJak	22800 g	1.5 BJkq	ND	0.98 BJak	2.2 BJakq	3840 g	7.4 g	0.11 BJkq	1.8 BJkq	2580 g	ND	ND	14200 g	0.92 BJaq	5.7 Jq	8.2 BJkq
MW-46	3.3 BJakq	ND	130 g	ND	0.35 BJkq	37700 g	1.0 BJkq	0.39 BJaq	4.9 BJakq	0.71 Jq	4900 g	10.5 g	0.16 BJkq	1.7 BJakq	1540 g	ND	0.72 BJak	26500 g	**2.8 BJakq**	7.5 Jq	10.6 Bk
MW-50	ND	2.5 Jq	71.5 g	ND	0.39 BJak	18600 g	3.0 BJkq	0.21 Jq	ND	2.8 BJakq	3240 g	2.6 BJkq	0.15 BJkq	3.1 BJkq	1100 g	ND	0.69 BJak	11300 g	ND	4.5 Jq	10.1 Bk
MW-56A	3.7 BJkq	ND	6.2 Jq	ND	ND	2890 g	5.1 Bk	0.39 BJaq	1.5 BJakq	1.4 Jq	1030 g	12.9 g	0.26 BJkq	1.5 BJakq	1650 g	ND	ND	57700 g	ND	ND	66.5 Bk
MW-56B	ND	5.2 Ba	64.4 Bk	0.058 BJk	ND	27600 g	1.7 BJakq	0.22 BJkq	4.7 BJkq	1.9 BJkq	4870 g	2.6 BJkq	0.15 BJkq	1.7 BJkq	647 Bak	ND	0.37 BJak	30600 g	**4.6 BJakq**	7.8 BJkq	7.0 BJkq
MW-57A	ND	1.5 BJkq	86.1 g	ND	ND	26500 g	3.8 BJkq	0.23 BJkq	0.95 BJkq	ND	4970 g	3.1 BJkq	0.12 BJkq	4.8 BJkq	1450 Ba	ND	ND	18600 g	1.7 Jq	3.5 Jq	4.6 BJkq
MW-58D	ND	3.9 BJkq	60.2 g	ND	0.24 BJkq	25700 g	5.5 Bk	2.1 BJkq	5.0 BJkq	1.3 BJkq	4970 g	2.4 BJkq	0.11 BJkq	6.7 g	1240 Bak	ND	ND	20400 g	ND	4.5 Jq	15.6 Bk
MW-59B	ND	3.3 BJkq	48.7 g	ND	15.4 g	16300 g	5.7 Bk	ND	1.1 Jq	**15.7 Bk**	10300 g	10.1 g	ND	3.7 BJkq	10900 g	ND	ND	53900 g	1.1 BJkq	3.5 Jq	10.7 Bk
MW-62A	2.0 Jq	2.0 BJaq	96.5 Bk	ND	0.20 Jq	29900 g	6.3 Bk	0.59 BJkq	6.1 BJkq	3.8 BJkq	5630 g	3.0 BJkq	0.17 BJkq	2.7 BJkq	1030 Bak	ND	0.65 BJak	18300 g	**4.9 BJakq**	5.2 BJkq	8.2 BJkq
MW-63	2.0 BJaq	ND	66.7 g	ND	0.13 BJkq	26600 Bk	0.40 BJkq	0.93 BJak	ND	ND	4640 Bk	0.81 BJaq	0.13 BJkq	3.4 BJkq	1320 Bk	4.2 BJkq	ND	15100 Bk	1.1 BJaq	0.73 Jq	14.0 Bk
OW-02	ND	ND	64.7 g	ND	0.20 BJkq	18800 g	4.0 BJkq	0.95 BJaq	2.3 BJakq	1.1 Jq	3350 g	6.1 Bk	0.15 BJkq	4.4 BJkq	1670 g	3.8 Jq	ND	12600 g	1.0 BJakq	5.3 Jq	21.2 Bk

Validation Qualifiers

B: The sample result is less than 5 times the blank contamination. The result qualified for blank contamination is considered not to have originated from the environmental sample, since cross-contamination is suspected.

J: The analyte was positively identified, but the analyte concentration is an estimated value.

Qualifiers Descriptors

a: The analyte was found in the method blank.

g: The datum met prescribed method criteria.

k: The analyte was found in a field blank.

q: The analyte detection was below the Practical Quantitation Limit (PQL).

MCL=Maximum Contaminant Level

MDL=Method Detection Limit

(.)=No MCL listed

*=MCL listed as a secondary MCL (odor and taste)

ND = Non-detect

NS = Not Sampled

Bolded analyte detected at a level exceeding the Maximum Contaminant level

Table 5-7
Groundwater Analytical Data Summary- Anions Analytes
Beaumont No. 1 Site
Lockheed Martin, Corporation

Sample	Total Dissolved Solids	Chloride	Nitrate asN	Sulfate	Bicarbonate
MCL	500*	250*	45	250*	-
MDL	3.4	0.035	0.038	0.084	1.2
Maximum Contaminant Levels (MCL), Method Detection Limit (MDL) and analyte concentrations mg/L unless otherwise noted					
EW-15	**847 g**	122 g	11.9 g	23.0 Bk	68.1 g
MW-01	191 g	9.1 g	2.7 g	17.9 g	85.9 g
MW-02	229 g	7.9 Bk	12.2 g	9.5 Bk	58.6 Bk
MW-03	185 g	13.1 g	ND	13.0 g	64.9 g
MW-05	229 g	9.6 Bk	6.3 g	12.1 Bk	119 g
MW-06	172 g	9.5 g	0.11 g	3.1 g	105 g
MW-07	124 g	7.7 g	1.8 g	5.9 g	52.4 g
MW-12	**1660 g**	60.1 g	ND	**710 g**	436 g
MW-15	307 g	13.0 g	ND	47.4 g	184 g
MW-18	388 g	12.9 g	0.15 g	37.6 g	255 g
MW-19	163 g	8.8 g	0.080 g	9.3 g	88.0 g
MW-40	255 g	9.3 g	7.4 g	20.1 g	103 g
MW-42	219 Bk	9.7 Bk	ND	26.9 Bk	111 Bk
MW-43	146 Bk	6.4 Bk	0.49 Bk	10.1 Bk	79.6 g
MW-45	143 g	6.4 g	1.7 g	10.2 g	64.9 g
MW-46	254 g	7.4 g	0.10 g	10.5 g	159 g
MW-50	121 g	5.8 g	4.0 g	4.3 g	60.7 g
MW-56A	184 g	13.7 g	0.14 g	11.7 g	58.6 g
MW-56B	236 Bk	8.6 Bk	9.9 g	10.9 Bk	86.9 Bk
MW-57A	181 Bk	7.0 Bk	8.7 g	9.8 Bk	61.8 Bk
MW-58D	192 Bk	7.4 Bk	7.9 g	9.9 Bk	64.9 Bk
MW-59B	282 g	8.7 Bk	17.2 g	16.4 Bk	60.7 g
MW-62A	221 Bk	7.3 Bk	12.0 g	10.8 Bk	68.1 Bk
MW-63	219 g	7.1 g	12.5 g	9.7 Bk	57.6 g
OW-02	252 g	6.3 g	2.9 g	7.6 g	60.7 g

Validation Qualifiers

B: The sample result is less than 5 times the blank contamination. The result qualified for blank contamination is considered not to have originated from the environmental sample, since cross-contamination is suspected.

Qualifiers Descriptors

g: The datum met prescribed method criteria.

k: The analyte was found in a field blank.

MCL=Maximum Contaminant Level

MDL=Method Detection Limit

*=MCL listed as a secondary MCL (odor and taste)

(-)=No MCL listed

ND = Non-detect

NS = Not Sampled

Bolded analyte detected at a level exceeding the Maximum Contaminant level or Action level

5.1.3.2 Chemicals of Potential Concern (COPC)

As identified in the SAP, the COPCs for the Beaumont No. 1 site include perchlorate, TCE, 1,1-DCE, and 1,4-dioxane. In addition to these COPCs, lower concentrations of 1,1-DCA, 1,1,1-TCA, and 1,2-DCA have also been detected in the groundwater beneath the Site. During this investigation other analytes were also detected in the groundwater samples collected by Earth Tech. A list of all the VOCs detected are presented in Table 5-8, including data collected during the semi-annual monitoring event. The table presents summary statistics for each analyte, including the number of detections which exceeded the MCL or California recommended action level. The nine (9) analytes that were detected above the MCL or California recommended action level are 1,4-dioxane, perchlorate, 1,1,2-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, PCE, and vinyl chloride. 1,1,2-TCA was detected in four samples with only one result (200 µg/L) above the MCL from well EW-13 which also had 26,000 µg/L of 1,1-DCE. 1,1,2-TCA was detected along with 1,1,1-TCA in three of the four samples and therefore should not be considered a COPC warranting additional analysis and evaluation. cis-1,2-DCE could have been either a primary product used or disposed of at the site or an impurity in the more common solvents such as PCE and TCE. Also, cis-1,2-DCE is a breakdown product of PCE, TCE, and 1,1-DCE and could have originated from the biodegradation of either TCE or 1,1-DCE in the subsurface. However, since cis-1,2-DCE was only detected above the MCL in one well (EW-13), which also had 26,000 µg/L of 1,1-DCE, further evaluation of this analyte is not necessary at this time either. Similarly, vinyl chloride, another breakdown product of PCE, TCE, and 1,1-DCE, was detected in only one sample at a concentration of 1.2 µg/L and therefore does not require further analysis. In conclusion, no other groundwater COPCs were identified during this sampling event and therefore only the previously identified COPCs will be discussed and evaluated further at this time.

Selected metals, anions, or cations were analyzed to provide information for an updated risk assessment and to support development of risk-based clean-up goals. Additionally, the risk assessment will include a background analysis for these constituents. These tasks were not part of the scope of this report and will therefore be documented in subsequent reports. A list of all the metals, anions, and cations detected are presented in Table 5-9. The table presents summary statistics for each analyte, including the number of detections which exceeded the MCL or California recommended action level.

5.1.3.3 Spatial Distribution of Analytes

The analyte concentration isopleth maps presented in this section show the spatial distribution of the COPCs (perchlorate, 1,4-dioxane, TCE, and 1,1-DCE,) as well as the additional chlorinated compounds (1,2-DCA, 1,1-DCA, and 1,1,1-TCA) detected in the groundwater. Also, an isopleth map of the total

Table 5-8
Summary of Detected COPCs
Beaumont No. 1 Site
Lockheed Martin Corporation

Detected Organic Analytes	No. Analyzed	No. Detected	No. Over MCL	MCL or CRAL µg/L	Minimum Detected Concentration µg/L	Maximum Detected Concentration µg/L	Average Detected Concentration µg/L
1,4-Dioxane	52	32	30	3*	3	590	58.13
Perchlorate	52	35	34	4**	3.9	141,000	5214.17
1,1,1,-Trichloroethane	61	23	0	200	0.5	20	5.37
1,1,2-Trichloroethane	61	4	1	5	0.5	200	50.88
1,1-Dichloroethane	61	36	11	5	0.4	480	36.93
1,1-Dichloroethene	61	42	37	6	2	26,000	1432.15
1,2,4-Trimethylbenzene	61	3	0	-	0.4	0.4	0.4
1,2-Dichloroethane	61	25	25	0.5	0.51	1,000	72.84
Carbon Tetrachloride	61	1	0	5	1.2	1.2	1.2
Chloroform	61	16	0	100	0.7	47	4.63
cis-1,2-Dichloroethene	61	6	1	6	0.7	390	66.23
Methylene Chloride	61	26	0	5	0.7	6	2.63
o-Xylene	61	1	0	1750	0.3	0.3	0.3
Tetrachloroethene	61	7	0	5	0.4	1	0.64
Toluene	61	1	0	150	0.3	0.3	0.3
Trichloroethene	61	51	40	5	0.3	8,300	457.77
Vinyl Chloride	61	1	1	0.5	1.2	1.2	1.2

MCL = Maximum Detection Level

* California Department of Health Recommended Action Level (CRAL)

**California Department of Health Services unregulated chemicals for which monitoring is required, Recommended Action Level Listed (CRAL)

Table 5-9
Summary of Detected Inorganic Analytes-Metals, Anions, and Cations
Beaumont No. 1 Site
Lockheed Martin Corporation

Detected Organic Analytes	No. Analyzed	No. Detected	No. Over MCL	Primary MCL µg/L	Minimum Detected Concentration µg/L	Maximum Detected Concentration µg/L	Average Detected Concentration µg/L
Antimony	25	9	0	6	2	3.7	2.65
Arsenic	25	17	0	50	1.6	28.6	4.51
Barium	25	25	0	1000	4.2	536	86.1
Beryllium	25	2	0	4	0.053	0.058	0.055
Cadmium	25	18	0	5	0.10	15.4	1.23
Calcium	25	25	0	-	1680	289,000	39,574.8
Chromium	25	23	0	50	0.40	6.3	2.89
Cobalt	25	17	0	-	0.21	2.1	0.67
Copper	25	19	0	1300	0.85	6.8	2.52
Lead	25	18	2	15	0.70	17.2	3.9
Magnesium	25	25	0	-	37.5	43,900	6,158.7
Molybdenum	25	25	0	-	0.61	13.8	6.28
Mercury	25	22	0	2	0.11	0.26	0.15
Nickel	25	23	0	100	0.96	7.5	3.09
Potassium	25	25	0	-	390	10,900	1823
Selenium	25	3	0	50	3.8	5.8	4.6
Silver	25	10	0	100*	0.37	1.0	0.64
Sodium	25	25	0	-	11,300	149,000	34,196
Thallium	25	16	5	2	0.92	5.7	2.15
Vanadium	25	20	0	-	0.73	8.6	4.22
Zinc	25	25	0	5000*	2.6	83.7	14.6
Total Dissolved Solids (mg/L)	25	25	2	500*	121	1660	296
Chloride (mg/L)	25	25	0	250*	5.8	122	15.39
Nitrate as N (mg/L)	25	21	0	45	0.10	17.2	5.72
Sulfate (mg/L)	25	25	1	45*	3.1	710	42.3
Bicarbonate (mg/L)	25	25	0	-	52.4	436	104.58

*Secondary MCL

morphology. Given that the analyte concentrations are close to a lognormal distribution, the concentrations were log transformed prior to mapping. In areas where there is an absence of data, the plume boundaries where inferred based on the physical setting, groundwater gradient, and other hydrogeologic features. The contouring intervals for each analyte were based on the established MCL or California recommended action level and the range of concentrations detected.

Perchlorate

Figure 5-5 shows the spatial distribution of perchlorate in May 2002. The highest concentrations were detected at the Burn Pit Area which is one of the primary sources of affected groundwater at the Site. The highest concentration of perchlorate was 141 mg/L detected in well EW-15. The concentrations rapidly decrease by several orders of magnitude outside the footprint of the Burn Pit Area and downgradient of the source area. Several anomalies are present near the Burn Pit Area and Rocket Motor Production Area as a result of significantly different concentrations detected in several of the well clusters (shallow and deep screened intervals). Downgradient of the Burn Pit Area, perchlorate concentrations in the Rocket Motor Production Area do not exceed 5 mg/L, however low-level concentrations are fairly widespread especially in the south-central portion of the Site. The limits of the perchlorate plume are unknown in the eastern and southeastern portion of the site due to the absence of monitoring wells in these areas. In addition, the extent of the low-level perchlorate plume west of downgradient monitoring wells MW-14 and MW-18 is unknown since the furthest downgradient well (MW-16), approximately 1.5 miles southwest, is damaged and could not be sampled.

The current perchlorate affected groundwater extent mapped from the May 2002 data appears vastly different than the 1991 perchlorate plume (see Figure 2-3 in Appendix F). The reasons for the apparent difference are two-fold: The data set used to map the plume in 1991 is much smaller than the current data set, and the contouring intervals differ as a result of the recommended action level recently established. Other differences in the plume morphology are probably attributed to downgradient plume migration originating from the Burn Pit Area and possibly the Rocket Motor Production Area.

1,4-dioxane

The distribution of 1,4-dioxane in May 2002 is shown in Figure 5-6. Similar to perchlorate and the other COPCs, the highest concentrations of 1,4-dioxane are centered at the Burn Pit Area. The highest concentration (590 µg/L) was detected in well EW-15. The 1,4-dioxane plume is relatively narrow and well defined, similar to the other volatile organic plumes. However, the limits of the plume are unknown in several areas due to the absence of monitoring wells to define the low-level plume boundary. The concentrations at the source area (Burn Pit Area) decrease from 590 µg/L to near 50 µg/L just outside the boundaries of the Burn Pit Area. Downgradient of the Rocket Motor Production Area, 1,4-dioxane concentrations do not exceed 75 µg/L (MW-19). However, concentrations in the narrow plume in the western portion of the Site near MW-18 and MW-15 still remain around 10 µg/L. Also, the extent of the low-level 1,4-dioxane plume west of downgradient monitoring wells MW-15 and MW-18 is unknown since the furthest downgradient well (MW-16), approximately 1.5 miles southwest, is damaged and could not be sampled.

Figure 5-5

Perchlorate Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

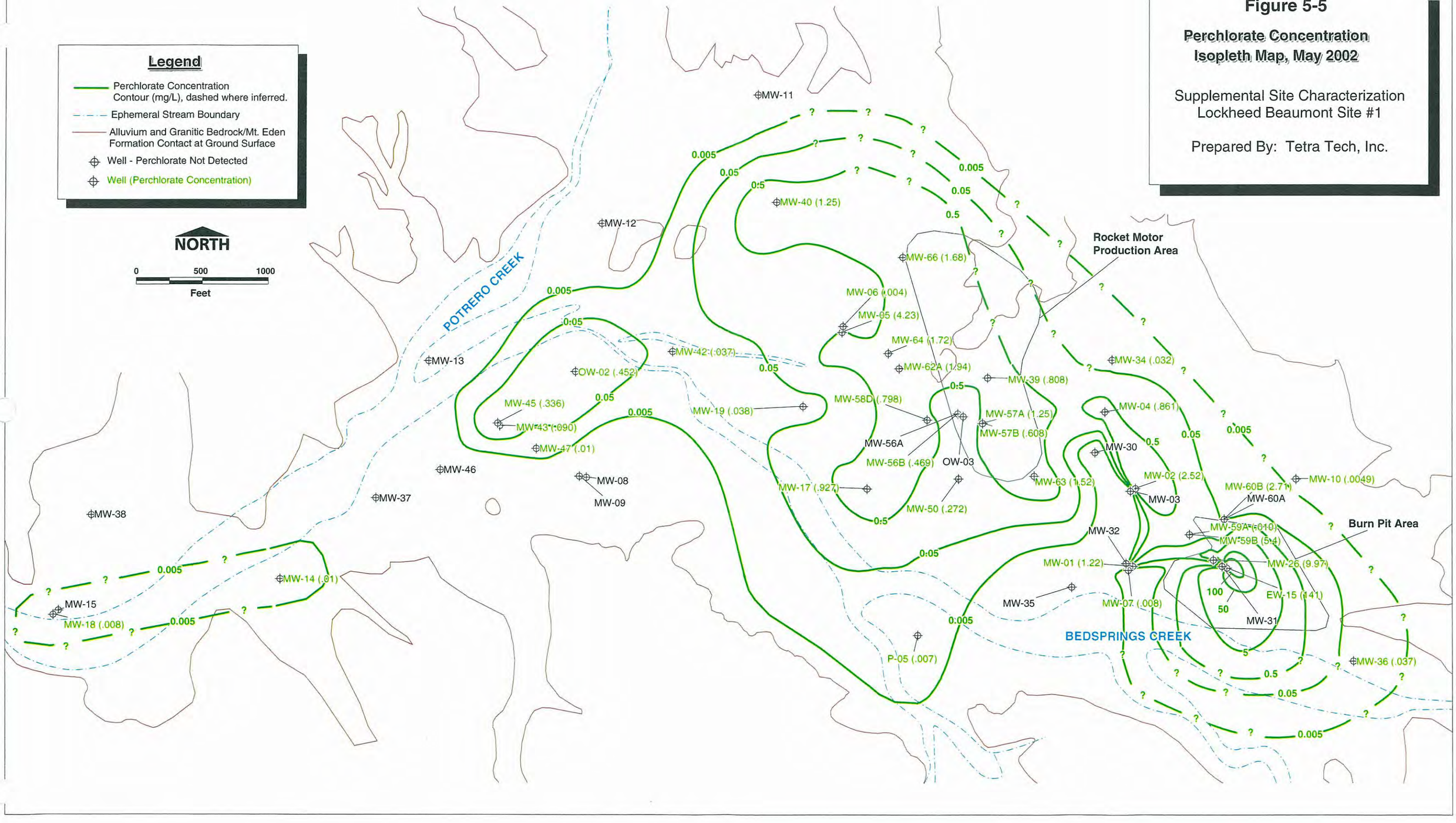


Figure 5-6

1,4-Dioxane Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- 1,4-Dioxane Concentration Contour (µg/L), dashed where inferred.
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - 1,4-Dioxane Not Detected
- Well (1,4-Dioxane Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-40 (31)
MW-12
MW-66 (23)
POTRERO CREEK
Rocket Motor Production Area
MW-06
MW-05 (26)
MW-64 (46)
MW-34
MW-13
MW-42 (34)
MW-39 (10)
OW-02 (22)
MW-62A (36)
MW-56B (11)
MW-04 (14)
MW-19 (75)
MW-56A
MW-43 (16)
MW-45 (17)
MW-57A (39)
MW-57B (22)
MW-58D (26)
OW-03 (45)
MW-30
MW-47
MW-46 (9.3)
MW-08
MW-09 (5)
MW-02 (120)
MW-03
MW-10
MW-60A (35)
MW-60B
MW-37 (11)
MW-17 (44)
MW-63 (25)
MW-50 (10)
MW-59B (60)
MW-59A
Burn Pit Area
MW-38
MW-32
MW-26 (430)
EW-15 (590)
MW-14 (3)
MW-01 (3)
MW-35
MW-07
MW-31
MW-15 (9.7)
MW-18 (12)
BEDSPRINGS CREEK
P-05
MW-36

Total VOCs

The spatial distribution of total VOCs during May 2002 shown in Figure 5-7 mimics the TCE and 1,1-DCE plumes since these are the primary volatile organic compounds detected at the Site. The highest concentrations of total VOCs are centered at the Burn Pit Area. The highest concentration (36,370 µg/L) of total VOCs was detected in well EW-13 of which TCE and 1,1-DCE make-up over 94% (34,300 µg/L) of the total VOC concentration. The total VOC plume is relatively narrow and well defined, similar to the other volatile organic plumes, except in the northeastern, southeastern, and western portions of the site where the low-level plume boundary is uncertain. The concentrations of total VOCs at the source area (Burn Pit Area) decrease two orders of magnitude just outside the boundaries of the Burn Pit Area.

Approximately 3,000 feet downgradient of the Rocket Motor Production Area, total VOC concentrations drop off to less than 100 µg/L, except for one area (MW-13) near Potrero Creek where the concentrations remain above 100 µg/L. The extent of the 5 µg/l plume boundary is unknown west of MW-15 and MW-18 since the furthest downgradient well (MW-16) could not be sampled as stated previously.

Trichloroethene (TCE)

Figure 5-8 shows the spatial distribution of TCE in May 2002. The highest concentrations (8,300 µg/L) were detected at the Burn Pit Area. The concentrations rapidly decrease to around 100 µg/L just downgradient of the source area. Several concentration anomalies exist near the Burn Pit Area and Rocket Motor Production Area as a result of the significantly different concentrations detected in several of the well clusters (shallow and deep screened intervals). The TCE plume is relatively narrow and defined except in the northeastern and southeastern portions of the site where the low-level plume boundary is uncertain. Approximately 3,000 feet downgradient of the Rocket Motor Production Area, TCE concentrations decrease to near 10 µg/L, except for one area (MW-13) near Potrero Creek where the concentrations are 63 µg/L. The downgradient limits of the TCE plume (5 µg/L) are defined by monitoring wells MW-15 and MW-18.

The overall TCE plume morphology mapped from the May 2002 data appears similar to the 1991 TCE plume except for the Burn Pit Area, and the 100 µg/L plume boundary is much smaller (see Figure 7-16 in Appendix F). The TCE source area is not apparent in the 1991 TCE plume because of the absence of wells in the Burn Pit Area. In addition, it appears that the levels of TCE in some of the downgradient wells are significantly less than the levels detected in 1991. Although there are some differences in the plumes, the differences may be the result of the difference in the data sets/monitoring wells used to map the plumes. Other differences in the plume morphology can probably be attributed to remedial activities at the Burn Pit Area and the Rocket Motor Production Area and/or downgradient plume migration originating from the Burn Pit Area source area.

Figure 5-7

Total VOCs Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Total VOCs Concentration Contour (µg/L), dashed where inferred.
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - Total VOCs Not Detected
- Well (Total VOCs Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-12
MW-40 (47)
MW-44 (205)
MW-66 (251)
MW-29 (100)
MW-06 (0.9)
MW-05 (215)
MW-41 (154)
Rocket Motor Production Area
MW-13 (137)
MW-42 (218)
MW-62A (123)
MW-39 (186)
MW-34 (0.4)
OW-02 (17)
MW-19 (59)
MW-52 (113)
MW-56C (175)
MW-04 (54)
MW-45 (19)
MW-43 (14)
MW-49 (42)
MW-56A
MW-56B (144)
MW-30 (3)
MW-51 (34)
MW-57B (166)
MW-58D (140)
MW-57A (209)
MW-02 (577)
MW-47
MW-09
MW-08
MW-46 (0.5)
MW-03 (0.8)
MW-10
MW-20 (105)
MW-55 (218)
MW-38
MW-37 (6)
MW-60A (347)
MW-60B (95)
MW-59A (1.8)
MW-59B (662)
EW-12 (4,515)
Burn Pit Area
MW-32 (0.9)
EW-13 (56,370)
EW-11 (1,218)
EW-16 (4,247)
MW-26 (7,570)
EW-18 (11,320)
MW-35
MW-01 (611)
MW-31 (0.4)
MW-07 (9)
EW-15 (16,220)
MW-14
MW-15 (1.2)
MW-18 (5.4)
BEDSPRINGS CREEK
MW-36 (17)
POTRERO CREEK

Figure 5-8

Trichloroethene Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Trichloroethene (TCE) Concentration Contour (µg/L), dashed where inferred.
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - TCE Not Detected
- Well (TCE Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-12
MW-40 (32)
MW-44 (110)
MW-66 (120)
MW-29 (60)
MW-06 (0.9)
MW-05 (83)
MW-41 (95)
MW-39 (93)
MW-34 (0.4)
Rocket Motor Production Area
MW-42 (87)
MW-62A (64)
MW-13 (63)
OW-02 (9)
MW-52 (64)
MW-56C (100)
MW-56B (77)
MW-57A (110)
MW-57B (84)
MW-04 (40)
MW-19 (20)
MW-45 (9)
MW-49 (24)
MW-51 (20)
MW-58D (67)
MW-56A
MW-47
MW-08
MW-09
MW-46 (0.5)
MW-20 (49)
MW-02 (167)
MW-03 (0.3)
MW-55 (92)
MW-10
MW-37 (3)
MW-38
MW-14
MW-15 (0.8)
MW-18 (2)
MW-59B (290)
MW-60B (8)
MW-59A (0.9)
MW-60A (111)
EW-12 (1,400)
MW-32 (0.4)
EW-13 (8,300)
EW-11 (410)
EW-16 (1,600)
MW-26 (3,200)
EW-18 (2,100)
MW-01 (332)
MW-31
5,000
EW-15 (3,600)
MW-07 (6)
2,000
1,000
MW-36 (13)
MW-60B
MW-59B
EW-12
EW-11
EW-13
MW-26
MW-31
MW-32
MW-07
MW-35
Burn Pit Area
BEDSPRINGS CREEK
POTRERO CREEK

1,1-Dichloroethene (1,1-DCE)

The distribution of 1,1-DCE in May 2002 is shown in Figure 5-9. 1,1-DCE has the highest volatile organic concentrations (26,000 µg/L) detected at the site. The highest concentrations, by two-orders of magnitude, are detected at the Burn Pit Area, the suspected source. Similar to the other COPCs, several concentration anomalies exist near the Burn Pit Area and Rocket Motor Production Area from the significantly different concentrations detected at several of the well clusters. The 1,1-DCE plume is very similar to the TCE plume and may have originated from the same source. It also can be a product of the degradation of TCE. The plume is relatively narrow and defined except in the northeastern portion of the site where the low-level plume boundary is unknown.

Approximately 3,000 feet downgradient of the Rocket Motor Production Area, concentrations decrease to near 10 µg/L except for two areas (MW-42 and MW-13) which may represent pulses of affected groundwater from the source area due to changing site conditions (i.e., remedial activities, rainfall infiltration, changes in groundwater levels). The downgradient limits of the 1,1-DCE plume (5 µg/L) are defined by monitoring wells MW-15 and MW-18.

The overall 1,1-DCE plume morphology in May 2002 data appears similar to the 1991 1,1-DCE plume except for the Burn Pit Area, and the 100 µg/L plume boundary is much smaller (see Figure 7-17 in Appendix F). Similar to TCE, the source area is not apparent in the 1991 plume map because of the absence of wells in the Burn Pit Area. In addition, it appears that the levels of 1,1-DCE in some of the downgradient wells are notably less than the levels detected in 1991. Although there are some differences in the plumes, the differences may be the result of the difference in the data sets/monitoring wells used to map the plumes. Other differences in the plume morphology can probably be attributed to remedial activities at the Burn Pit Area and the Rocket Motor Production Area downgradient plume migration originating from the Burn Pit Area source area.

Soil vapor sample results between April 1991 and August 1998 indicate an average reduction of more than 99.6 percent total VOCs removed by soil vapor extraction in the Burn Pit Area. Soil Vapor concentrations were reduced from peak concentrations of more than 147,000 ppbv to approximately 1,370 ppbv in July 1998. Concentrations in numerous wells dropped to non-detect levels. Well VMW-3, which had the highest concentration of total VOCs in 1994 (147,000 ppbv), was reduced to a low concentration of 520 ppbv in 1997 (Radian, 1998).

1,2-Dichloroethane (1,2-DCA)

Figure 5-10 shows the spatial distribution of 1,2-DCA in May 2002. In comparison to TCE and 1,1-DCE, the 1,2-DCA plume is relatively small and almost completely defined. The only areas of uncertainty are the low-level (0.5 µg/L) plume boundaries in the southeastern and northeastern portions of the plume. The highest concentration of 1,2-DCA detected in May 2002 was 1,000 µg/L at the Burn Pit Area (EW-13). 1,2-DCA can be a product of the degradation of TCE.

Figure 5-9

1,1-Dichloroethene Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

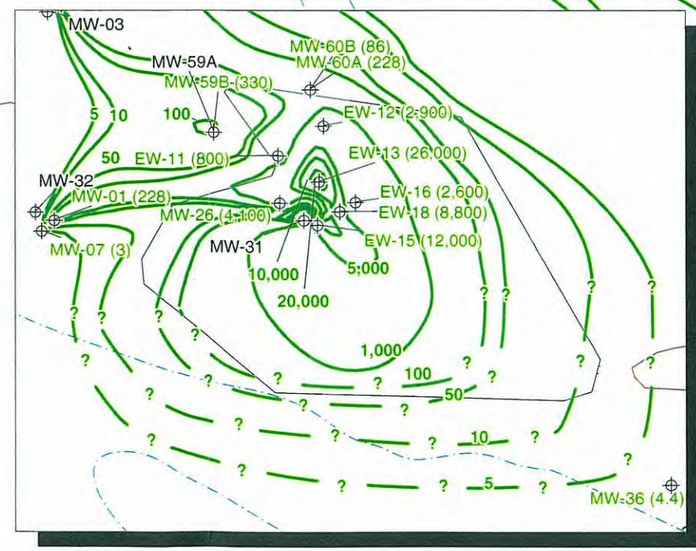
- 1,1-Dichloroethene (DCE) Concentration Contour (µg/L), dashed where inferred.
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - 1,1-DCE Not Detected
- Well (1,1-DCE Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-12
MW-40 (14)
MW-44 (85)
MW-66 (120)
MW-29 (31)
MW-06
MW-05 (120)
MW-41 (52)
Rocket Motor Production Area
MW-13 (73)
MW-42 (120)
MW-39 (86)
MW-34
OW-02 (8)
MW-62A (53)
MW-56A
MW-19 (32)
MW-52 (44)
MW-56B (61)
MW-56C (65)
MW-04 (14)
MW-45 (9)
MW-43 (8)
MW-49 (16)
MW-57A (100)
MW-47
MW-09
MW-51 (12)
MW-58D (67)
MW-57B (75)
MW-55 (120)
MW-20 (53)
MW-02 (302)
MW-10
MW-08
MW-46
MW-37 (3)
MW-03
MW-60B
MW-59B
EW-12
EW-11
EW-13
MW-26
MW-31
MW-32
MW-07
Burn Pit Area
MW-38
MW-14
MW-35
MW-15
MW-18 (3)
BEDSPRINGS CREEK
MW-36 (4.4.)
POTRERO CREEK



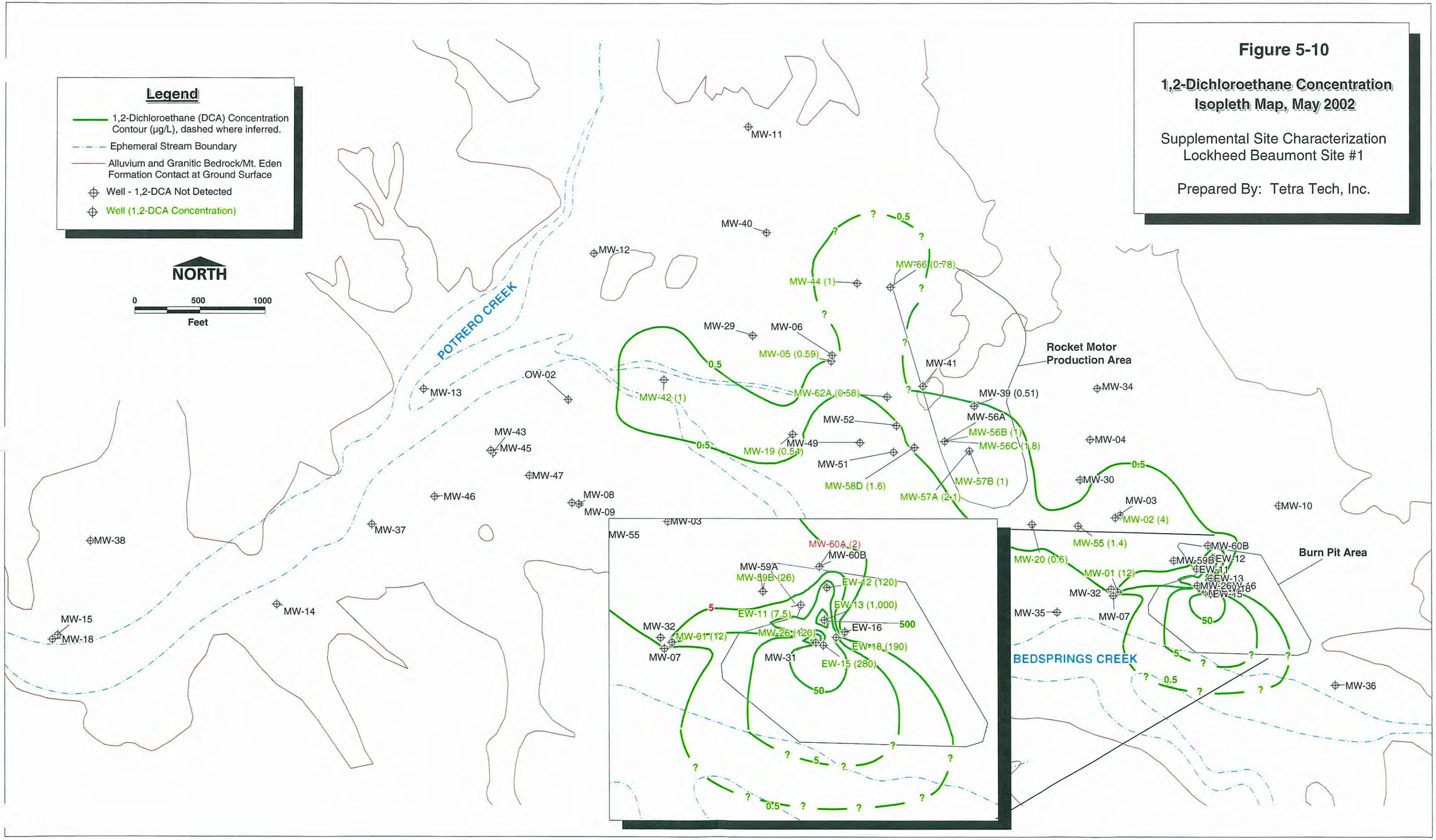


Figure 5-10

1,2-Dichloroethane Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

The length of the plume only extends approximately 2,000 feet downgradient of the Rocket Motor Production Area.

1,1-Dichloroethane (1,1-DCA)

The spatial distribution of 1,1-DCA during May 2002 shown in Figure 5-11 is very similar to 1,2-DCA, except for differences in the contouring intervals. Similar to 1,2-DCA, the 1,1-DCA plume is relatively small and almost completely defined. The only areas of uncertainty are the low-level (0.5 µg/L) plume boundaries in the southeastern and northeastern portions of the plume. In addition to these areas, 1,1-DCA was detected near the detection limit in downgradient wells MW-13, M-15, and MW-18 which should be confirmed in future monitoring events. However, since the levels are an order of magnitude less than the MCL, the plume boundary is still defined by the existing monitoring network. The highest concentration of 1,1-DCA detected was 480 µg/L at the Burn Pit Area (EW-13). Also, 1,1-DCA can be a product of the degradation of TCA. The length of the plume, defined by the 5 µg/L boundary, only extends approximately 2,000 feet downgradient of the Rocket Motor Production Area.

1,1,1-Trichloroethane (1,1,1-TCA)

Figure 5-12 shows the distribution of 1,1,1-TCA during May 2002. The spatial distribution of 1,1,1-TCA is very similar to 1,1-DCA except for differences in the contouring intervals. The 1,1,1-TCA plume, defined by the 5 µg/L boundary, is very small and limited to the Burn Pit Area. The highest concentration of 1,1,1-TCA detected was 47 µg/L at the Burn Pit Area (EW-12). Low-level (less than 5 µg/L) 1,1,1-TCA was detected in the area around the Rocket Motor Production Area and downgradient of the Rocket Motor Production Area. Except for one well (MW-13), 1,1,1-TCA does not extend more than 1,000 feet downgradient of the Rocket Motor Production Area.

5.1.3.4 Vertical Distribution of Analyte Impacts

The following sections describe the vertical distribution of analytes within the Burn Pit Area, the Rocket Motor Production Area, and the downgradient groundwater monitoring wells located near Potrero Creek. The vertical profiles were evaluated by depth using the midpoint of the screen intervals for the well clusters.

Burn Pit Area

The vertical distribution of analytes within the Burn Pit Area was determined from groundwater sampling and analysis on monitoring wells MW-59A, MW-59B, MW-01, MW-07, MW-32, MW-60A, and MW-60B. The first cluster of wells (MW-59A and MW-59B) contain high concentrations of perchlorate, TCE, and 1,1-DCE in the shallow well (MW-59B) at approximately 105 feet bgs (Figure 5-13). These

Figure 5-11

1,1-Dichloroethane Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- 1,1-Dichloroethane (DCA) Concentration Contour (µg/L), dashed where inferred.
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - 1,1-DCA Not Detected
- Well (1,1-DCA Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-40 (1.2)
MW-12
MW-44 (3.3)
MW-66 (5.4)
POTRERO CREEK
MW-29 (7)
MW-06
MW-05 (4.2)
MW-41 (2.3)
Rocket Motor Production Area
MW-13 (0.4)
MW-42 (7)
MW-62A (1.5)
MW-39 (2)
MW-34
OW-02
MW-52 (1.3)
MW-56A
MW-45
MW-56C (3)
MW-19 (3.6)
MW-56B (2)
MW-04
MW-43
MW-49
MW-51
MW-47
MW-58D (2.1)
MW-57A (2.5)
MW-30
MW-57B (2)
MW-46
MW-08
MW-02 (3)
MW-10
MW-03
MW-37
MW-20
MW-55 (1.5)
MW-60B
MW-38
MW-59B
EW-12
EW-11
EW-13
MW-26
MW-32
MW-07
EW-15
Burn Pit Area
MW-14
MW-35
MW-15 (0.4)
MW-18 (0.4)
BEDSPRINGS CREEK
MW-36
MW-60A (2)
MW-59A
MW-59B (16)
EW-11
EW-12 (48)
EW-13 (480)
MW-26 (110)
EW-16
MW-32
MW-01 (13)
EW-18 (230)
MW-31
EW-15 (340)
MW-07

Figure 5-12

1,1,1-Trichloroethane Concentration Isopleth Map, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- 1,1,1-Trichloroethane Concentration Contour (µg/L)
- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well - 1,1,1-TCA Not Detected
- Well (1,1,1-TCA Concentration)

NORTH

0 500 1000

Feet

MW-11
MW-40
MW-12
MW-44 (3)
MW-66 (1.6)
POTRERO CREEK
MW-29
MW-06
MW-05 (3.2)
Rocket Motor Production Area
MW-41 (1)
MW-42
MW-13 (0.5)
MW-39 (1.1)
MW-34
OW-02
MW-62A (2.4)
MW-56A
MW-19 (2.9)
MW-52 (2.5)
MW-43
MW-45
MW-56B (2)
MW-04
MW-49 (2.1)
MW-56C (3.4)
MW-47
MW-08
MW-57A (3.6)
MW-30
MW-51 (2.2)
MW-58D (2.5)
MW-57B (3)
MW-46
MW-09
MW-20 (2)
MW-55 (3.1)
MW-02
MW-03
MW-60A
MW-10
MW-37
MW-60B
MW-38
MW-59B
MW-59A
EW-12
Burn Pit Area
MW-32
EW-11
EW-13
EW-16
MW-26
EW-18
MW-01
MW-EW-15
MW-14
MW-35
MW-07
MW-15
MW-18
BEDSPRINGS CREEK
MW-36

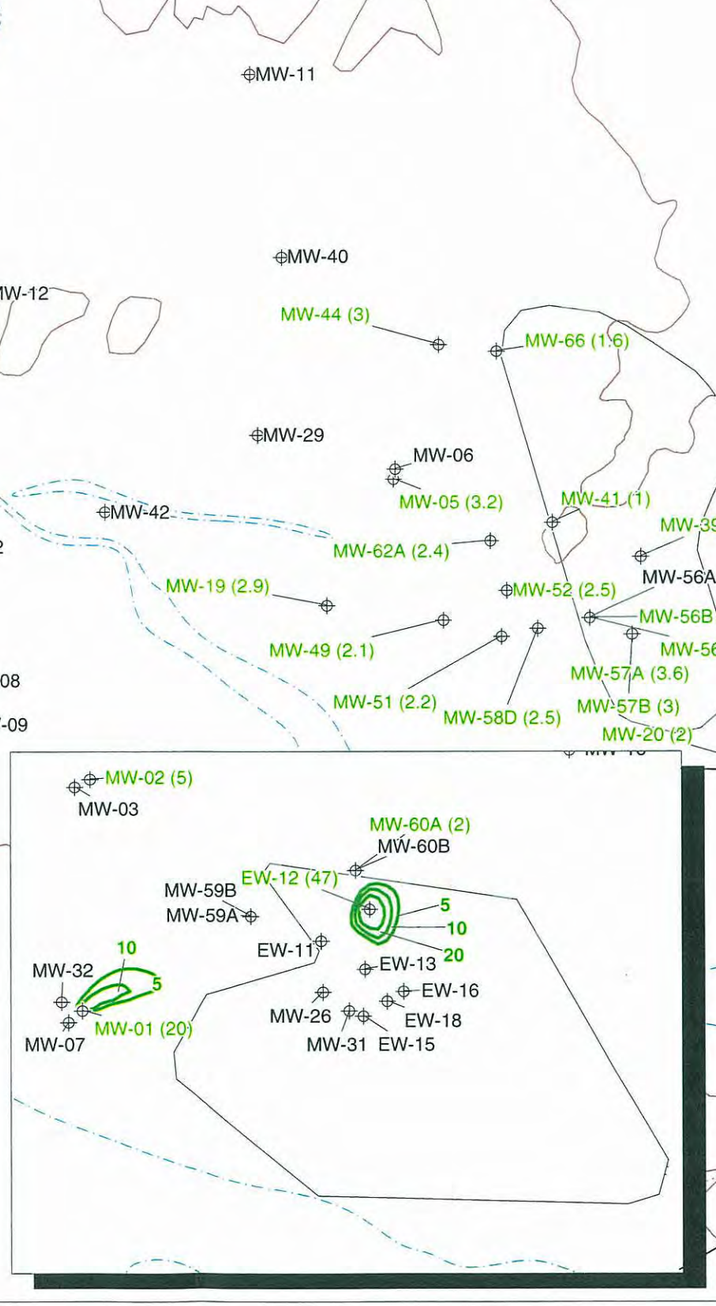
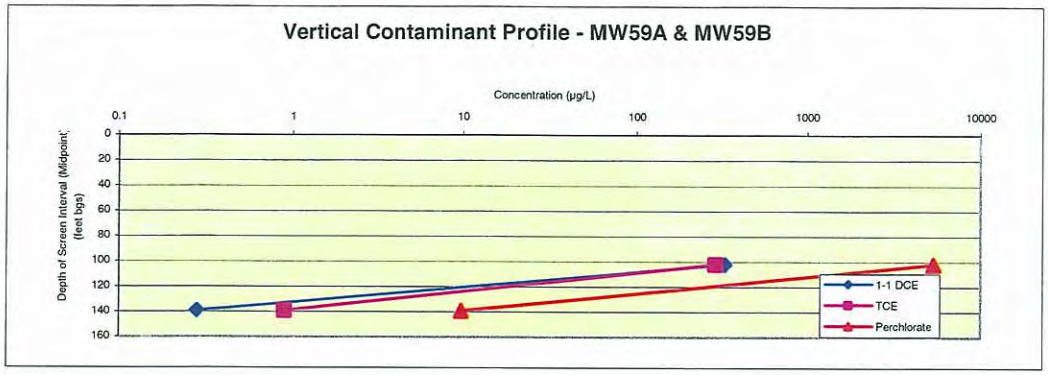
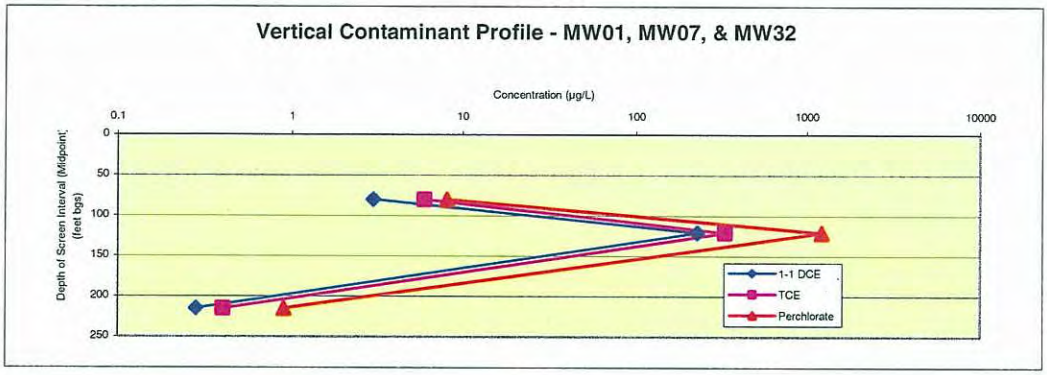
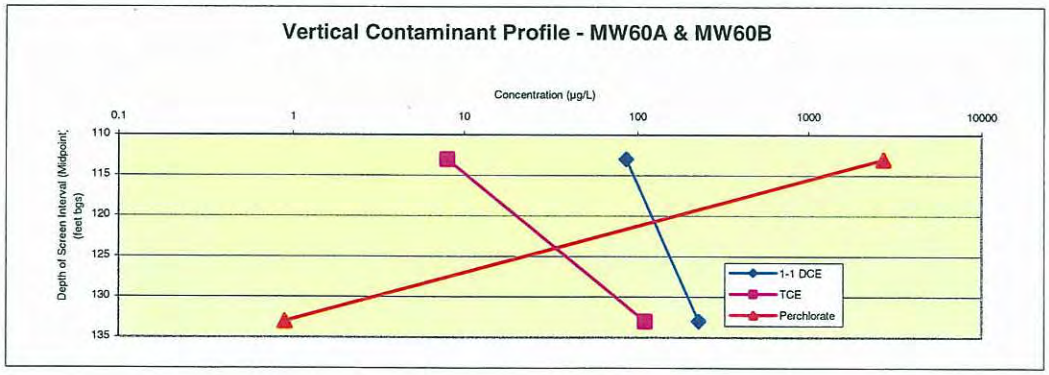


Figure 5-13-Vertical Contaminant Profile
Source Area (BPA) Depth Profile







concentrations are significantly reduced, approximately three orders of magnitude in the deeper well (MW-59A), at 140 feet bgs.

The second cluster of wells (MW-01, MW-07, and MW-32) in the Burn Pit Area reveal similar findings as those mentioned above. However, these wells show that there is an increase of approximately two orders of magnitude in analyte concentrations from approximately 80 feet bgs (MW-07) to 120 feet bgs (MW-07). Analyte concentrations are then reduced, approximately three orders of magnitude, to non-detect in MW-32 at 215 feet bgs.

The third cluster of wells (MW-60A and MW-60B) shows a decrease of nearly four orders of magnitude in the concentration of perchlorate, but shows a slight increase, less than one order of magnitude, in the concentrations of TCE and 1,1-DCE with depth. The deepest screened zone of these two wells is only 132 feet bgs, and does not likely represent the deeper, unweathered strata of the Mount Eden Formation.

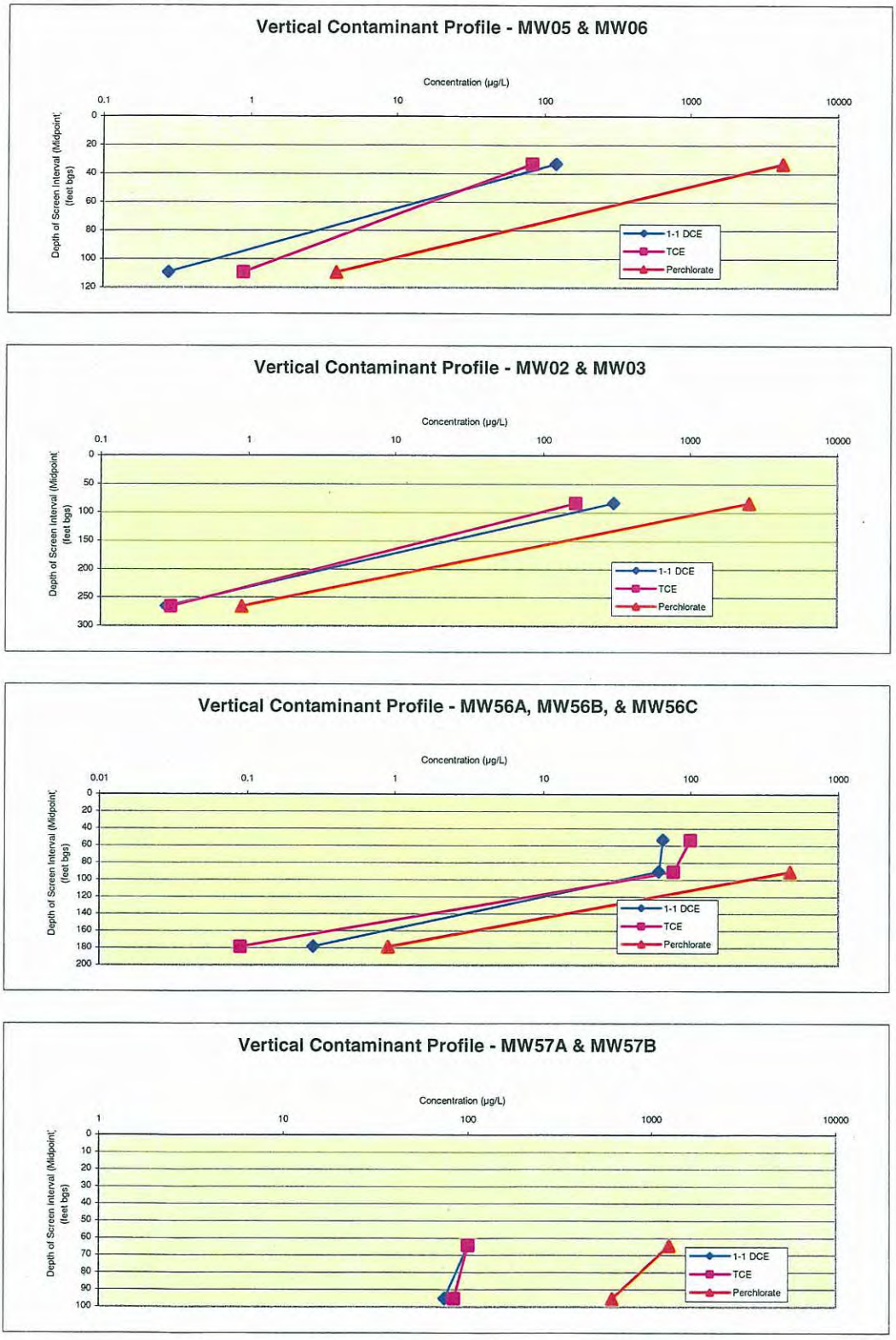
Results of the analyses of the monitoring wells screened in the Mount Eden Formation show that perchlorate and VOC affected groundwater is present only in the upper portion of the formation, beneath the Burn Pit Area. In a previous investigation, it was reported that the upper 30 to 40 feet of the Mount Eden Formation beneath the alluvium is highly weathered (Radian, 1990). As a result, this zone is more permeable than the underlying (less weathered) Mount Eden rock. Screening of drill cuttings during drilling indicated the presence of VOCs in the weathered portion of the Mount Eden. In contrast, VOCs were not detected in the less weathered Mount Eden rock at greater depths (Radian, 1990).

Downgradient of the Burn Pit Area

The vertical distribution of analytes downgradient of the Burn Pit Area, near the Rocket Motor Production Area, was determined from monitoring wells MW-02, MW-03, MW-56A, MW-56B, MW-56C, MW-05, MW-06, MW-57A, and MW-57B (Figure 5-14). The first cluster of wells (MW-02 and MW-03) contain high concentrations of perchlorate, TCE, and 1,1-DCE at approximately 95 feet bgs (MW-02). These concentrations are significantly reduced, approximately three orders of magnitude in the deeper well MW-03 at 260 feet bgs.

The second cluster of wells (MW-56A, MW-56B, and MW-56C) located within the Rocket Motor Production Area, reveal similar findings as those mentioned above. Analyte concentrations are reduced, approximately three orders of magnitude, to non-detect in the deepest well MW-56A at approximately 180 feet bgs.

Figure 5-14-Vertical Contaminant Profile
Downgradient of Source Area (BPA) and Near RMPA



The third cluster of wells (MW-05 and MW-06) show a decrease of nearly three orders of magnitude in concentrations of perchlorate, and a decrease of two orders of magnitude, in the concentrations of TCE and 1,1-DCE from the shallow well MW-05 at 30 feet bgs to deeper well MW-06 at 115 feet bgs.

The fourth cluster of wells (MW-57A and MW-57B) located within the Rocket Motor Production Area, reveal analyte concentrations that are only slightly reduced with depth. The midpoint of the screened interval of these two wells is 65 and 95 feet bgs. Concentrations of perchlorate decrease slightly from 65 feet bgs to 95 feet bgs, and TCE, and 1,1-DCE exhibit generally the same pattern. Note that the maximum depth of the deeper well is only 95 feet bgs, and in surrounding wells such as MW-56A, MW-56B, and MW-56C as mentioned above, the analytes were not detected at deeper intervals.

Downgradient Monitoring Wells

The vertical distribution of analytes downgradient of the Rocket Motor Production Area, was determined from groundwater sampling and analysis on monitoring wells MW-43, MW-45, MW-15, and MW-18 (Figure 5-15). The first cluster of wells (MW-43 and MW-45), located approximately 3,400 feet downgradient of the Rocket Motor Production Area, reveal an increase of TCE and very slight increases of perchlorate and 1,1-DCE with depth. TCE increased approximately two orders of magnitude from 15 feet bgs to 48 feet bgs.

The second cluster of wells (MW-15 and MW-18), located approximately 3,600 feet downgradient of the cluster mentioned above, contain low concentrations of perchlorate, TCE, and 1,1-DCE in MW-18 at approximately 40 feet bgs. These concentrations are significantly reduced approximately one order of magnitude, to near non-detect levels in MW-15 at 85 feet bgs.

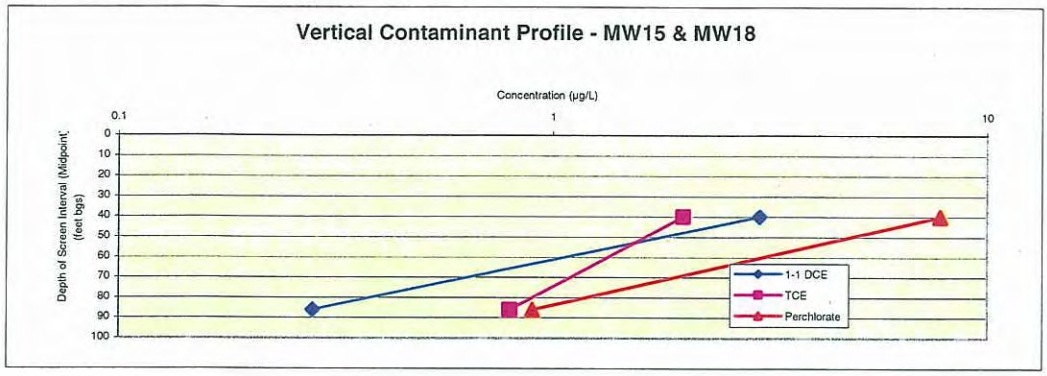
5.2 SURFACE WATER ANALYSIS

Three surface water samples (S-1, S-2, and S-3) were collected and analyzed for volatile organics, 1,4-dioxane, and perchlorate. The following section discusses the analytical results of these samples.

5.2.1 Analytical Results

Two of the three sampled surface water locations were affected. The concentrations of the seven detected analytes are shown in Table 5-5. The surface water represented by sample S-1 was fed by artesian flow from well MW-45. Ponds represented by samples S-2 and S-3 are fed by groundwater discharge only. Sample location S-3 is within the drainage area in an area of incised bedrock. No sample was taken at location S-4 because no surface water was found. The frequency and range of detected analytes are summarized in Table 5-10. Surface water analytical data are provided in Appendix D.

Figure 5-15-Vertical Contaminant Profile Downgradient of the RMPA and BPA



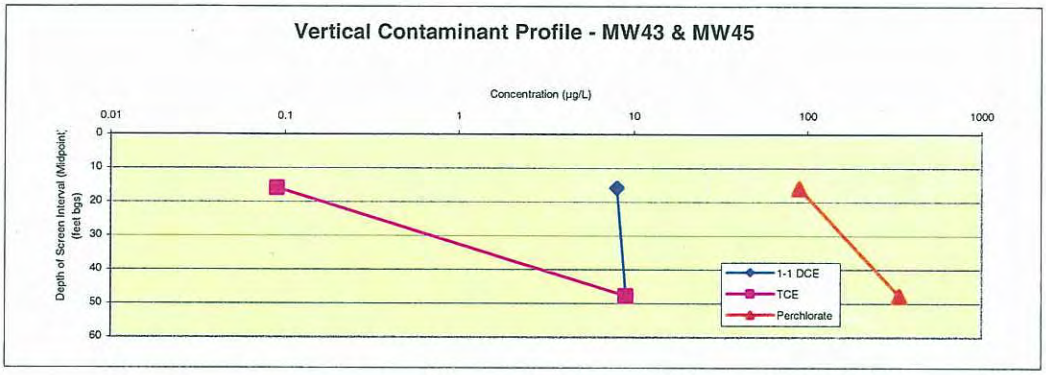


Table 5-10
Frequency and Range
of Detected Surface Water Analytes

Detected Analyte	MCL or CRAL (ug/L)	No. Analyzed	No. Detected	Maximum Detected Concentration (ug/L)	Minimum Detected Concentration (ug/L)
Perchlorate	4*	3	1	256	256
TCE	5	3	1	11	11
1,4-dioxane	3**	3	2	19	4.2
1,1-DCE	6	3	1	11	11

Notes: MCL=Maximum Contaminant Level (Drinking Water)
*=California Department of Health Recommended Action Level (CRAL)
**=California Department of Health unregulated chemicals for which monitoring is required; recommended action level listed (CRAL)

5.2.2 Interpretation of Results

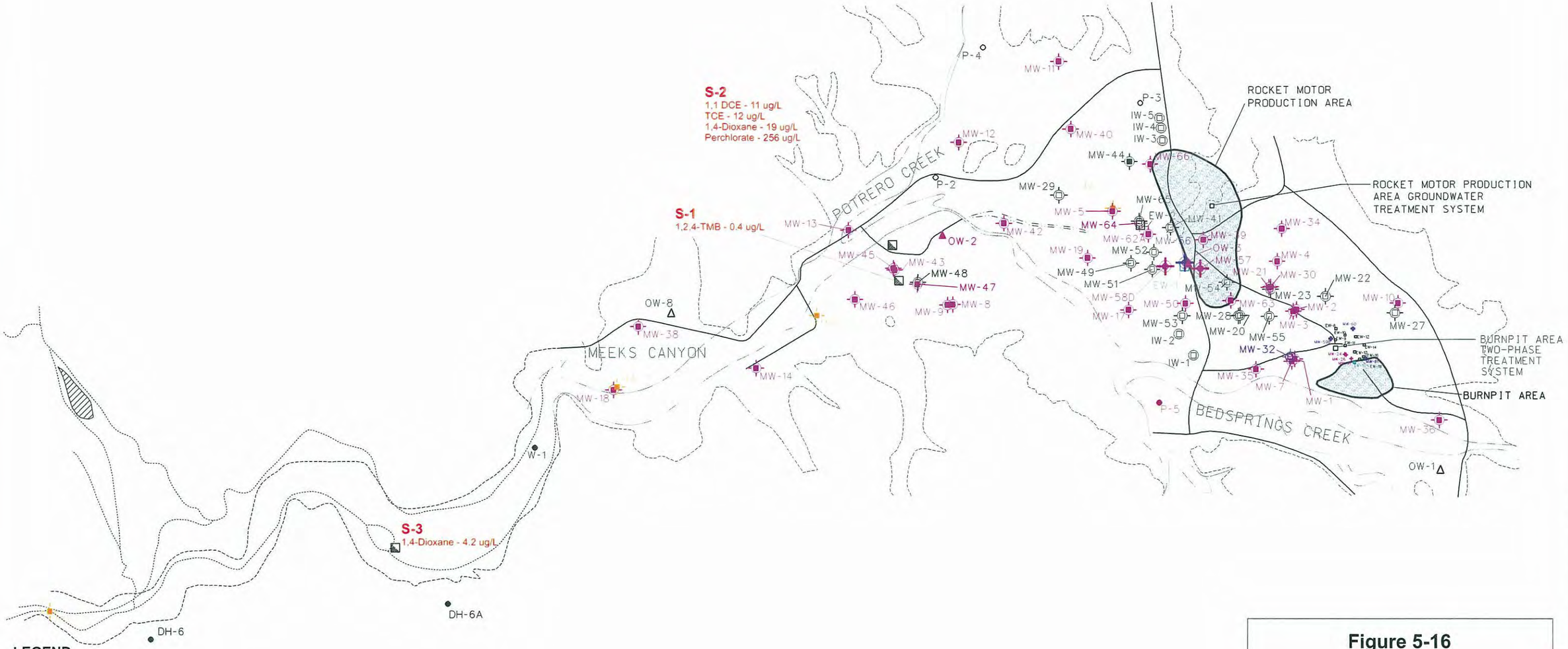
Surface water samples were taken from areas of surface water ponding downgradient from the Rocket Motor Production Area (Figure 5-16). With the exception of S-1, these samples show concentrations above MCLs or California Recommended Action Levels for perchlorate and solvents including TCE, 1,4-dioxane, and 1,1-DCE (Table 5-5).

Surface water samples S-2 and S-3 results reveal similar analytical data to nearby groundwater monitoring wells (Table 5-11). Sample S-2 shows the closest correlation with concentrations in OW-2, within a factor of 2. OW-2 is screened in the alluvium that is exposed at the location of S-2. Sample S-3 is over 3000 feet downgradient from wells MW-15 and MW-18. S-3 is in an area of incised bedrock and the sample results correlate most closely with MW-15, an upgradient well screened in the bedrock. Sample S-1 does not correlate with the nearby well MW-45, an artesian well that feeds the pond. This could be caused by stripping of volatiles as the artesian flow exits the well and volatilization from the pond.

Table 5-11
Comparison of Surface Water Results with Nearby Groundwater Results

Surface Water Sample	Nearby Monitoring Well and Screen Location	Distance from Surface Water Sample to Well	Analyte Concentrations			
			Perchlorate (ug/L)	TCE (ug/L)	1,4-dioxane (ug/L)	1,1-DCE (ug/L)
S-1	MW-45 in alluvium	200 feet	S-1: ND MW-45: 336	S-1: ND MW-45: 9	S-1: ND MW-45: 17	S-1: ND MW-45: 9
S-2	OW-2 in alluvium	600 feet	S-2: 256 OW-2: 452	S-2: 12 OW-2: 9	S-2: 19 OW-2: 22	S-2: 11 OW-2: 8
S-3	MW-18 in alluvium	Over 3000 feet	S-3: ND MW-18: 7.8	S-3: ND MW-18: 2	S-3: 4.2 MW-18: 12	S-3: ND MW-18: 3
S-3	MW-15 in bedrock	Over 3000 feet	S-3: ND MW-15: ND	S-3: ND MW-15: 0.8	S-3: 4.2 MW-15: 9.7	S-3: ND MW-15: ND

Notes: ND=Not detected



LEGEND

- ROAD
- CONTACT OF ALLUVIUM WITH GRANITIC BEDROCK AND/OR MT. EDEN FORMATION AT GROUND SURFACE
- INTERMITTENT STREAM
- BURN AREA PERIMETER ROAD
- WELLS SCREENED IN QA
- WELLS SCREENED IN ME
- WELLS SCREENED IN BOTH QA AND ME
- SURFACE WATER SAMPLE LOCATION (RED INDICATES POSITIVE RESULT)
- EXISTING GROUNDWATER MONITORING WELL
- EXISTING GROUNDWATER MONITORING WELL CLUSTER
- EXISTING GROUNDWATER EXTRACTION WELL
- EXISTING INJECTION WELL
- QA — QUATERNARY ALLUVIUM
- ME — MT. EDEN FORMATION
- QA/ME — BOTH UNITS

SOURCE: EARTH TECH, 2002.

NORTH

0 600 1200

SCALE: 1" = 1200'

Figure 5-16

Surface Water Sampling Locations, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

X:\PUBLIC\LOCKHEED-BEAUMONT\CHAR.REPORT\GRAPHICS\FIGURES\SURFACE WATER.CDR

5.3 SOIL AND GAS ANALYSIS

Soil gas samples were tested for volatile organics. A total of 53 samples were collected from soil gas probes and wells. A summary of analytical results for the tested soil gas samples is provided in Table 5-12.

Soil samples were collected from selected vapor borings. Soil samples were tested for volatile organics, 1,4-dioxane, and metals with samples from 15 feet in depth tested for perchlorate. A summary of volatile organics and perchlorate data are provided in Table 5-12 and metals data are provided in Table 5-13 and summarized in Table 5-14. Metals data are provided for subsequent use in risk assessment. Therefore, the discussions below describe existing organic compound concerns and perchlorate.

5.3.1 Analytical Results

Soil gas samples were collected at 20 locations (10 at the Burn Pit Area and 10 at the Rocket Motor Production Area) at depths of 5 and 15 feet at each location (for a total of 40 samples) and at 13 wells.

Soil gas analytes were detected in 13 of the 40 samples at 8 of the locations. Soil gas analytes were also detected in 6 of the 13 wells. A total of 8 different soil gas analytes were detected as shown in Table 5-12.

The frequency and range of detected analytes are summarized in Table 5-15. TCE, 1,1-DCE, and toluene are the predominant soil gas analytes and benzene the least detected. Soil gas analytical data are provided in Appendix D.

Soil analytes were detected in 13 of the 40 soil samples collected at 5 and 15 feet bgs. The concentrations of the detected analytes are shown in Table 5-12. However, methylene chloride is not considered a contaminant in environmental samples due to blank contamination. The frequency and range of detected environmental analytes are summarized in Table 5-16. Perchlorate was the predominant soil analyte and xylene the least detected. Soil laboratory analytical data are provided in Appendix D.

5.3.2 Interpretation of Results

Burn Pit Area

Soil gas samples were collected at ten probe locations and three vapor extraction wells at the Burn Pit Area (Figure 5-17 and Table 5-12). Seven of the locations were replicates of historic sample locations and three were new locations. Only 1,1-DCE was detected in the vapor probes at concentrations ranging from 0.4 to 0.6 µg/L in two locations (Figure 5-17). The three sampled wells had detectable TCE, 1,1-DCE, 1,1-DCA and 1,1,1-TCA (Figures 5-18 through 5-21). 1,1-DCE was detected in the three vapor

Table 5-12
Soil and Soil Gas Chemicals of Potential Concern
Beaumont No. 1 Site
Lockheed Martin, Corporation

	Soils					Soil-Gas							
Sample	1,4-Dioxane EPA Method 8270SIM	Perchlorate EPA Method 314.6	1,2,4-Trimethylbenzene	Methylene Chloride	o-Xylene	Benzene Soil-Gas (ug/L)	Toluene Soil-Gas (ug/L)	Xylenes Soil-Gas (ug/L)	MTBE Soil-Gas (ug/L)	1,1-DCE Soil-Gas (ug/L)	TCE Soil-Gas (ug/L)	1,1-DCA Soil-Gas (ug/L)	1,1,1-TCA Soil-Gas (ug/L)
PRG	44000	39000	52000	8900	210000	0.00025	0.4	0.73	3.1	0.000038	0.0011	0.52	1
MDL	5	6.1	0.090	0.21	0.070	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Preliminary Remediation Goals (PRG), Method Detection Limit (MDL), and analyte concentrations ug/kg unless otherwise noted													
BP21-15	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP21-5	ND	NS	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP25-15	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP25-5	ND	NS	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP3-15	ND	89.6 g	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP3-5	ND	NS	ND	4 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP4-15	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP4-5	ND	NS	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP5-15	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP5-5	ND	NS	0.6 Jq	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP6-15	ND	ND	ND	4 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP6-5	ND	NS	ND	4 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
BP8-15	ND	259 g	ND	3 BJakq	ND	ND	ND	ND	ND	**0.5**	ND	ND	ND
BP8-5	ND	NS	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP1-15	ND	ND	ND	3 BJakq	ND	ND	ND	ND	ND	**0.6**	ND	ND	ND
VP1-5	NS	NS	2 BJaq	7 BJakq	ND	ND	ND	ND	ND	**0.4**	ND	ND	ND
VP2-15	NS	8.6 Jq	0.8 BJaq	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP2-5	NS	NS	0.7 BJaq	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP3-15	NS	ND	0.8 BJaq	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP3-5	NS	NS	0.7 BJaq	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP4A-15	NS	47.1 g	0.5 BJaq	2 BJaq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP4A-5	NS	NS	0.6 BJaq	2 BJaq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP4B-15	NS	35.7 g	0.8 BJaq	2 BJaq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP4B-5	NS	NS	0.7 BJaq	2 BJaq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP5-15	NS	178 g	1 BJaq	3 BJaq	0.6 Jq	ND	ND	ND	ND	ND	**0.6**	ND	ND
VP5-5	NS	NS	0.7 BJaq	2 BJaq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP6-15	NS	108 g	ND	2 BJaq	ND	ND	ND	ND	ND	ND	**1**	ND	ND
VP6-5	NS	NS	ND	10 Ba	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP7A-15	ND	1040 g	ND	5 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP7A-5	ND	NS	ND	4 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP7B-15	4 Jq	1260 g	ND	2 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP7B-5	4 Jq	NS	ND	3 BJakq	ND	ND	ND	ND	ND	ND	ND	ND	ND
VP8A-15	NS	14.1 Jq	ND	2 BJaq	ND	ND	**1.3**	ND	1.3	**1.8**	**2**	ND	ND
VP8A-5	NS	NS	ND	2 BJaq	ND	**0.8**	**0.8**	ND	1.6	ND	**0.6**	ND	ND

Table 5-12
Soil and Soil Gas Chemicals of Potential Concern
Beaumont No. 1 Site
Lockheed Martin, Corporation

	Soils					Soil-Gas							
Sample	1,4-Dioxane EPA Method 8270SIM	Perchlorate EPA Method 314.6	1,2,4-Trimethylbenzene	Methylene Chloride	o-Xylene	Benzene Soil-Gas (ug/L)	Toluene Soil-Gas (ug/L)	Xylenes Soil-Gas (ug/L)	MTBE Soil-Gas (ug/L)	1,1-DCE Soil-Gas (ug/L)	TCE Soil-Gas (ug/L)	1,1-DCA Soil-Gas (ug/L)	1,1,1-TCA Soil-Gas (ug/L)
PRG	44000	39000	52000	8900	210000	0.00025	0.4	0.73	3.1	0.000038	0.0011	0.52	1
MDL	5	6.1	0.090	0.21	0.070	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Preliminary Remediation Goals (PRG), Method Detection Limit (MDL), and analyte concentrations ug/kg unless otherwise noted													
VP8B-15	NS	88.4 g	ND	2 BJaq	ND	ND	**1.1**	**1.6**	ND	ND	ND	ND	ND
VP8B-5	NS	NS	ND	3 BJaq	ND	ND	**0.8**	ND	1.5	ND	ND	ND	ND
VP9A-15	ND	ND	ND	1 BJakq	ND	**0.6**	**0.9**	ND	ND	ND	ND	ND	ND
VP9A-5	ND	NS	0.5 Jq	ND	ND	ND	**0.5**	ND	ND	ND	ND	ND	ND
VP9B-15	NS	ND	ND	2 BJaq	ND	ND	**0.6**	ND	ND	ND	ND	ND	ND
VP9B-5	NS	NS	ND	3 BJaq	ND	**0.5**	**0.8**	**1.5**	ND	ND	ND	ND	ND
VEW10	NS	NS	NS	NS	NS	ND	ND	ND	ND	**29**	**2.9**	ND	**16**
VEW11	NS	NS	NS	NS	NS	ND	ND	ND	ND	**152**	**16**	**0.7**	**12**
VEW6	NS	NS	NS	NS	NS	ND	ND	ND	ND	**80**	**7.5**	ND	**1.4**
MW08	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW13	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW14	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW27	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW29	NS	NS	NS	NS	NS	ND	ND	ND	ND	**1.3**	**1.3**	ND	ND
MW35	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW36	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW46	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND
MW63	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	**0.4**	ND	ND
MW65	NS	NS	NS	NS	NS	ND	ND	ND	ND	**1.7**	**1.9**	ND	ND

Validation Qualifiers

B: The sample result is less than 5 times the blank contamination. The result qualified for blank contamination is considered not to have originated from the environmental sample, since cross-contamination is suspected.

J: The analyte was positively identified, but the analyte concentration is an estimated value.

Qualifiers Descriptors

a: The analyte was found in the method blank.

g: The datum met prescribed method criteria.

k: The analyte was found in a field blank.

q: The analyte detection was below the Practical Quantitation Limit (PQL).

PRG=Preliminary Remediation Goals

MDL =Maximum Detection Limit

(-)=No PRG listed

EPA Method SW8260B unless otherwise noted

ND = Non-detect

NS = Not Sampled

Bolded analyte detected at a level exceeding the Preliminary Remediation Goals

Table 5-13
Soil Analytical Data Summary- Metals
Beaumont No. 1 Site
Lockheed Martin, Corporation

Sample	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Mercury EPA Method 74710A	Nickel	Selenium	Vanadium	Zinc
PRG	0.39	5400	37	210	4700	2900	400	390	23	1600	390	550	23000
MDL	0.070	0.024	0.0048	0.013	0.009	0.036	0.033	0.020	0.0065	0.019	0.13	0.025	0.055
Preliminary Remediation Goals (PRG), Method Detection Limit (MDL), and analyte concentrations mg/kg unless otherwise noted													
BP21-15	**0.71 g**	67.4 g	ND	2.7 Bk	5.5 g	0.67 Bk	0.64 g	ND	ND	1.1 Bk	0.24 Jq	17.6 g	36.6 Bk
BP21-5	**1.2 g**	131 g	ND	4.5 Bk	8.3 g	2.2 Bk	2.1 g	ND	ND	2.3 g	0.53 g	26.8 g	59.6 Bk
BP25-15	**0.79 g**	92.5 g	ND	3.4 Bk	7.3 g	1.2 Bk	1.2 g	ND	ND	1.5 Bk	0.29 Jq	23.2 g	51.7 Bk
BP25-5	**0.66 g**	76.2 g	ND	2.8 Bk	5.9 g	0.79 Bk	0.99 g	ND	0.0069 Jq	1.2 Bk	0.37 Jq	18.8 g	42.0 Bk
BP3-15	**1.4 g**	131 g	0.014 Jq	5.1 Bk	9.3 g	2.3 Bk	2.0 g	ND	0.030 Jq	2.5 g	0.73 g	30.7 g	66.9 BJck
BP3-5	**0.64 g**	77.0 g	0.011 Jq	2.0 Bk	5.8 g	0.58 Bk	0.80 g	ND	ND	0.94 Bk	0.29 Jq	19.3 g	39.8 Bk
BP4-15	**0.76 g**	80.3 g	ND	3.8 Bk	7.0 g	0.93 Bk	0.79 g	0.14 Jq	0.0070 Jq	1.4 Bk	0.46 Jq	22.4 g	44.7 Bk
BP4-5	**1.2 g**	153 g	0.0092 Jq	4.3 Bk	8.1 g	1.9 Bk	2.3 g	ND	ND	2.1 g	0.51 Jq	27.4 g	63.0 Bk
BP5-15	**1.6 g**	154 g	0.042 Jq	7.5 g	9.6 g	4.0 Bk	2.7 g	ND	ND	3.9 g	0.18 Jq	33.5 g	68.2 Bk
BP5-5	**0.69 g**	111 g	0.028 Jq	3.4 Bk	8.2 g	1.1 Bk	1.1 g	ND	ND	2.2 g	0.50 Jq	25.0 g	56.1 Bk
BP6-15	**1.3 g**	141 g	0.049 Jq	5.4 Bk	9.9 g	2.6 BJfk	2.4 g	ND	ND	2.7 g	0.32 Jq	32.4 g	71.5 Bk
BP6-5	**0.70 Jf**	84.2 g	ND	3.2 Bk	7.5 g	0.98 Bk	0.91 Jf	ND	0.0090 Jq	1.4 Bk	0.26 Jq	23.9 g	52.5 Bk
BP8-15	**1.6 g**	160 g	0.031 Jq	5.8 g	8.9 g	3.1 Bk	2.6 g	ND	ND	3.1 g	0.45 Jq	31.1 g	69.1 Bk
BP8-5	**0.81 g**	77.9 g	ND	2.6 Bk	6.3 g	0.82 Bk	1.0 g	ND	ND	1.1 Bk	0.17 Jq	20.3 g	42.9 Bk
VP1-15	**1.7 Jf**	120 g	0.023 Jq	5.2 Bk	7.7 g	3.0 BJfk	1.9 Jf	ND	ND	2.7 g	0.54 g	26.2 g	52.4 Bk
VP1-5	**0.61 g**	75.0 g	ND	2.5 Bk	6.2 g	0.65 Bk	0.85 g	ND	0.017 Jq	1.2 Bk	0.19 Jq	20.1 g	44.8 Bk
VP2-15	**1.0 g**	85.4 g	0.0075 BJ	4.1 Bk	6.1 g	1.9 Bk	0.87 g	ND	0.013 Jq	2.1 g	0.32 Jq	21.6 g	40.0 Bk
VP2-5	**0.93 g**	94.8 g	0.0090 BJ	2.9 Bk	6.4 g	1.2 Bk	1.3 g	ND	ND	1.3 Bk	0.42 Jq	22.0 g	46.3 Bk
VP3-15	**1.0 g**	86.8 g	ND	3.1 Bk	6.8 g	1.3 Bk	1.2 g	ND	0.028 Jq	1.5 Bk	0.30 Jq	22.2 g	47.5 Bk
VP3-5	**1.0 g**	97.7 g	0.0074 BJ	3.3 Bk	7.6 g	1.4 Bk	1.5 g	ND	0.021 Jq	1.6 Bk	0.43 Jq	24.9 g	51.8 Bk
VP4A-15	**1.5 g**	111 g	0.022 BJa	6.8 g	7.2 g	3.4 g	1.6 g	0.035 Jq	ND	3.0 g	0.35 Jq	26.1 g	49.4 g
VP4A-5	**2.5 g**	138 g	0.047 BJa	7.9 g	8.4 g	4.3 g	2.0 g	ND	0.029 Jq	3.9 g	ND	31.3 g	59.4 g
VP4B-15	**2.4 g**	139 g	ND	8.1 g	8.8 g	4.8 g	2.2 g	ND	0.011 Jq	3.7 g	1.1 g	31.6 g	63.9 g
VP4B-5	**2.4 g**	162 g	0.065 BJa	11.9 g	10.5 g	7.2 g	3.0 g	ND	0.0076 Jq	6.1 g	0.63 g	38.9 g	71.5 g
VP5-15	**2.7 g**	155 g	0.030 BJa	8.3 g	11.4 g	4.5 g	2.1 g	ND	0.031 Jq	4.3 g	0.42 Jq	35.6 g	71.4 g
VP5-5	**2.2 g**	140 g	0.048 BJa	8.2 g	9.8 g	4.5 g	1.9 g	ND	0.018 Jq	3.8 g	1.0 g	35.6 g	72.7 g
VP6-15	**1.8 g**	136 g	0.021 BJa	8.6 g	9.7 g	4.1 g	2.0 g	ND	0.015 Jq	4.2 g	0.49 Jq	34.5 g	66.2 g
VP6-5	**2.3 g**	185 g	0.059 BJa	17.8 g	10.6 g	12.2 g	3.2 g	ND	0.017 Jq	9.4 g	0.43 Jq	45.5 g	71.8 g
VP7A-15	**6.3 g**	275 g	0.084 BJk	15.6 g	14.1 g	14.5 Bk	7.4 g	ND	0.010 Jq	11.0 Bk	0.18 BJkq	46.1 g	93.3 g
VP7A-5	**4.7 g**	77.3 g	0.036 BJk	8.0 Bk	6.0 g	5.2 Bk	2.8 Bk	0.23 Bk	0.0070 Jq	4.2 Bk	0.33 BJkq	22.2 g	38.8 Bk
VP7B-15	**12.9 Jf**	111 Jf	0.17 BJkq	10 Bk	7.8 Jf	8.2 Bk	3.6 Bk	1.8 Bk	0.012 Jq	5.9 BJfk	0.64 Bk	30.3 g	42.7 BJfk
VP7B-5	**8.2 Jf**	96.2 Jf	0.064 BJk	7.1 BJfk	5.4 Jf	6.4 Bk	3.6 Bk	1.5 Bk	ND	4.3 BJfk	ND	21.4 Jf	33.1 BJfk
VP8A-15	**5.7 g**	163 g	0.043 BJa	9.8 g	9.1 g	5.8 g	3.2 g	ND	0.0089 Jq	5.7 g	1.2 g	34.2 g	58.3 g

Table 5-13
Soil Analytical Data Summary- Metals
Beaumont No. 1 Site
Lockheed Martin, Corporation

Sample	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Mercury EPA Method 74710A	Nickel	Selenium	Vanadium	Zinc
PRG	0.39	5400	37	210	4700	2900	400	390	23	1600	390	550	23000
MDL	0.070	0.024	0.0048	0.013	0.009	0.036	0.033	0.020	0.0065	0.019	0.13	0.025	0.055
Preliminary Remediation Goals (PRG), Method Detection Limit (MDL), and analyte concentrations mg/kg unless otherwise noted													
VP8A-5	**5.9 g**	137 g	0.054 BJa	8.9 g	8.6 g	5.4 g	2.5 Jf	ND	ND	5.5 g	0.38 Jq	28.0 g	54.8 g
VP8B-15	**4.0 g**	284 g	0.048 BJa	19.7 g	14.3 g	10.9 g	4.9 g	ND	0.020 Jq	10.9 g	0.95 g	50.1 g	90.8 g
VP8B-5	**6.7 g**	259 g	0.10 Jq	11.7 g	11.9 g	8.3 g	3.9 g	ND	ND	6.9 g	0.94 g	41.3 g	81.3 g
VP9A-15	**4.0 g**	133 g	0.021 BJk	9.3 Bk	8.2 g	5.6 Bk	2.6 Bk	ND	0.052 Jq	5.2 Bk	0.56 Bk	26.7 g	56.0 Bk
VP9A-5	**3.1 g**	101 g	0.016 BJk	7.9 Bk	7.2 g	4.0 Bk	1.9 Bk	ND	0.040 Jq	4.1 Bk	0.40 BJkq	25.2 g	47.6 Bk
VP9B-15	**2.7 g**	148 g	0.046 BJa	9.0 g	8.4 g	5.5 g	2.2 g	ND	0.026 Jq	5.0 g	0.37 Jq	26.0 g	53.5 g
VP9B-5	**6.1 g**	147 g	0.060 BJa	11.4 g	9.6 g	6.7 g	2.5 g	ND	0.012 Jq	5.9 g	ND	33.8 g	60.4 g

Validation Qualifiers

B: The sample result is less than 5 times the blank contamination. The result qualified for blank contamination is considered not to have originated from the environmental sample, since cross-contamination is suspected.

J: The analyte was positively identified, but the analyte concentration is an estimated value.

Qualifiers Descriptors

a: The analyte was found in the method blank.

c: The Matrix Sprike (MS) and/or Matrix Spike Duplicate (MSD) recoveries were outside control limits.

f: The duplicate samples Relative Percent Difference (RPD) was outside control limits.

g: The datum met prescribed method criteria.

k: The analyte was found in a field blank.

q: The analyte detection was below the Practical Quantitation Limit (PQL).

PRG=Preliminary Remediation Goals Residential Soil and Ambient Air Goals, USEPA Region IX

MDL =Maximum Detection Limit

EPA Method 6010B unless otherwise noted

ND = Non-detect

NS = Not Sampled

Bolded analyte detected at a level exceeding the Preliminary Remediation Goals

Table 5-14
Detected Inorganic Analytes-Metals
Beaumont No. 1 Site
Lockheed Martin Corporation
(mg/kg unless otherwise noted)

Detected Organic Analytes	No. Analyzed	No. Detected	No. Over PRG	PRG	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration
Arsenic	48	40	40	0.39	0.61	12.90	2.710
Barium	48	40	0	5400	67.40	284.00	129.843
Cadmium	48	30	0	37	0.007	0.170	0.042
Chromium	48	40	0	210	2.00	19.70	7.090
Cobalt	48	40	0	4700	5.40	14.30	8.385
Copper	48	40	0	2900	0.65	14.50	4.103
Lead	48	40	0	400	0.64	4.90	2.206
Molybdenum	48	5	0	390	0.04	1.80	0.741
Mercury	48	24	0	23	0.0069	0.0520	0.019
Nickel	48	40	0	1600	0.94	11.00	3.771
Selenium	48	37	0	390	0.17	1.20	0.483
Vanadium	48	40	0	550	17.60	50.10	28.845
Zinc	48	40	0	23000	33.10	90.80	57.108

PRG = USEPA Region IX Preliminary Remediation Goal Residential Soil Goal

Table 5-15
Frequency and Range
of Detected Soil Gas Analytes

Detected Analyte	No. Analyzed	No. Detected	Maximum Detected Concentration (ug/L)	Minimum Detected Concentration (ug/L)
TCE	40 probes 13 wells	In 4 probes and 6 wells	16	0.6
1,1-DCE	40 probes 13 wells	In 4 probes and 5 wells	152	0.4
1,1-DCA	40 probes 13 wells	In 1 well	0.7	0.7
1,1,1-TCA	40 probes 13 wells	In 3 wells	16	1.4
Benzene	40 probes 13 wells	In 1 probes	0.8	0.8
Toluene	40 probes 13 wells	In 8 probes	1.3	0.5
Xylene	40 probes 13 wells	In 2 probes	1.6	1.5
MTBE	40 probes 13 wells	In 3 probes	1.6	1.3

Table 5-16
Frequency and Range
of Detected Environmental Soil Analytes

Detected Analyte	No. Analyzed	No. Detected	PRG	Maximum Detected Concentration	Minimum Detected Concentration
Perchlorate	20	11	39,000	1260 ug/kg	47.1 ug/kg
1,4-dioxane	21	2	44	4 mg/kg	4 mg/kg
1,3,4-Trimethylbenzene	40	2	52	0.6 mg/kg	0.5 mg/kg
Xylene	40	1	710	0.6 mg/kg	0.6 mg/kg

Note: 11 samples were qualified for 1,3,4-trimethylbenzene for blank contamination and all soil samples were qualified for methylene chloride for blank contamination.
PRG=USEPA Region IX Residential Preliminary Remediation Goal

monitoring wells and had the highest concentrations of detected VOCs at the Burn Pit Area ranging from 152 ug/L to 29 ug/L. TCE and 1,1,1-TCA were also detected in the three vapor monitoring wells at concentrations ranging from 1.6 to 16 ug/L and 1.4 to 16 ug/L, respectively (Figures 5- 11 and 12). 1,1-DCA was detected in only one probe at a concentration of 0.7 ug/L (Figure 5-21).

The probes with detected soil gas were slightly south of the vapor extraction wells. The probes east and north of the vapor extraction wells do not have detectable VOCs in soil gas. The detected vapors from probes and wells are all in the area of the former extraction system. All detected VOCs in soil vapor were within 250 feet of VEW-11. This location also correlates to the area of highest VOC-affected groundwater as discussed in Section 5.1.

Only one soil sample had detectable VOCs in the environmental samples of the ten tested soil samples (Table 5-12). Location BP-5 at 5 feet in depth had 0.6 mg/kg of 1,2,4-trimethylbenzene. This sample does not correlate with any detected soil vapor analytes and may be a result of method blank contamination. Perchlorate was detected in three of the ten tested soil samples from 15 feet in depth at concentrations of 8.6 to 259 ug/kg (Figure 5-22). The perchlorate was detected below residential PRG concentration of 39,000 µg/kg in samples from probes along the northwest-southeast axis of the Burn Pit Area with the highest concentrations near the center of the Burn Pit Area (Figure 5-22). The perchlorate in groundwater appears to be highest in the area of the vapor extraction system. The monitoring well with the highest detected concentration of perchlorate is about 100 feet north of well probe sample location with the highest detected perchlorate in soil. However, limited groundwater data is available for the southwest portion of the Burn Pit Area to correlate to soil data. No 1,4-dioxane was detected in soils of the Burn Pit Area.

Figure 5-17

Soil and Soil Gas Concentrations, May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well or Vapor Monitoring Point

Sample locations are indicated in red.
ug/kg = concentration in soil
ug/L = concentration in soil gas

NORTH

0 500 1000
Feet

POTRERO CREEK

MW-13

MW-46

MW-08

MW-14

MW-29
1,1 DCE - 1.3 ug/L
TCE - 1.3 ug/L

MW-65
1,1 DCE - 1.7 ug/L
TCE - 1.9 ug/L

MW-64

Rocket Motor Production Area

VP-8A
At 5'
Benzene - 0.8 ug/L
Toluene - 0.8 ug/L
MTBE - 1.6 ug/L
TCE - 0.6 ug/L
At 15'
Perchlorate - 14.1 ug/kg
Toluene - 1.3 ug/L
MTBE - 1.6 ug/L
TCE - 0.6 ug/L

VP-8B
At 5'
Toluene - 0.8 ug/L
MTBE - 1.5 ug/L
At 15'
Perchlorate - 88.4 ug/kg
Toluene - 1.1 ug/L
Xylenes - 1.6 ug/L

VP-9A
At 5'
1,2,4 TMB - 0.5 ug/L
Toluene - 0.5 ug/L
At 15'
Benzene - 0.6 ug/L
Toluene - 0.9 ug/L
MTBE - 1.6 ug/L
TCE - 0.6 ug/L

VP-9B
At 5'
Benzene - 0.5 ug/L
Toluene - 0.8 ug/L
Xylenes - 1.5 ug/L
At 15'
Toluene - 0.6 ug/L

VP-7A
At 15'
Perchlorate - 1040 ug/kg

VP-7B
At 5'
1,4 Dioxane - 4.0 ug/L
At 15'
1,4 Dioxane - 4.0 ug/L
Perchlorate - 1260 ug/kg

VP-6
At 5'
Methylene Chloride - 10 ug/kg
At 15'
Perchlorate - 108 ug/kg
TCE - 1.0 ug/L

VP-4A
At 15'
Perchlorate - 47.1 ug/kg

VP-4B
At 15'
Perchlorate - 35.7 ug/kg

VP-5
At 15'
Perchlorate - 178 ug/kg
o-xylene - 0.6 ug/kg

MW-63
TCE - 0.4 ug/L

VEW-06
1,1 DCE - 80 ug/L
TCE - 7.5 ug/L
1,1 TCA - 1.4 ug/L

VEW-10
1,1 DCE - 29 ug/L
TCE - 2.9 ug/L
1,1 TCA - 16 ug/L

MW-27

VP-3

VP-2
At 15'
Perchlorate - 8.6 ug/kg

Burn Pit Area

VEW-11
1,1 DCE - 152 ug/L
TCE - 16 ug/L
1,1 DCA - 0.7 ug/L
1,1 TCA - 12 ug/L

MW-35

VP-1
At 5'
1,1 DCE - 0.4 ug/L
At 15'
1,1 DCE - 0.6 ug/L
TCE - 1.0 ug/L

BP-21

BP-25

BP-3
At 15'
Perchlorate - 89.6 ug/kg

BP-6

BP-5

BP-4

BP-8
At 15'
Perchlorate - 259 ug/kg
1,1 DCE - 0.5 ug/L

BEDSPRINGS CREEK

MW-36

Figure 5-18

1,1-DCE Soil Gas Concentrations May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well or Vapor Monitoring Point
- (80) 1,1-DCE Concentration in ug/L ND=Not Detected

1,1 DCE Concentration in Soil Gas (ug/L)

- 150 and above
- 100
- 15

NORTH

0 500 1000

Feet

POTRERO CREEK

MW-13

MW-29 (1.3)

MW-65 (1.7)

MW-64

VP-9A (ND)

VP-8A (1.8 at 15')

VP-9B (ND)

VP-8B (ND)

VP-7A (ND)

VP-7B (ND)

VP-6 (ND)

VP-5 (ND)

VP-4A (ND)

VP-4B (ND)

Rocket Motor Production Area

MW-63 (ND)

MW-46

MW-08

MW-14

VEW-10 (29)

VEW-06 (80)

MW-27 (ND)

VP-3 (ND)

Burn Pit Area

VP-2 (ND)

VEW-11 (152)

VP-1 (0.4 at 5') (0.6 at 15')

BP-21 (ND)

BP-25 (ND)

MW-35 (ND)

BP-6 (ND)

BP-3 (ND)

BP-8 (ND)

BEDSPRINGS CREEK

BP-5 (ND)

BP-4 (ND)

MW-36 (ND)

Figure 5-19

TCE Soil Gas Concentrations
May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

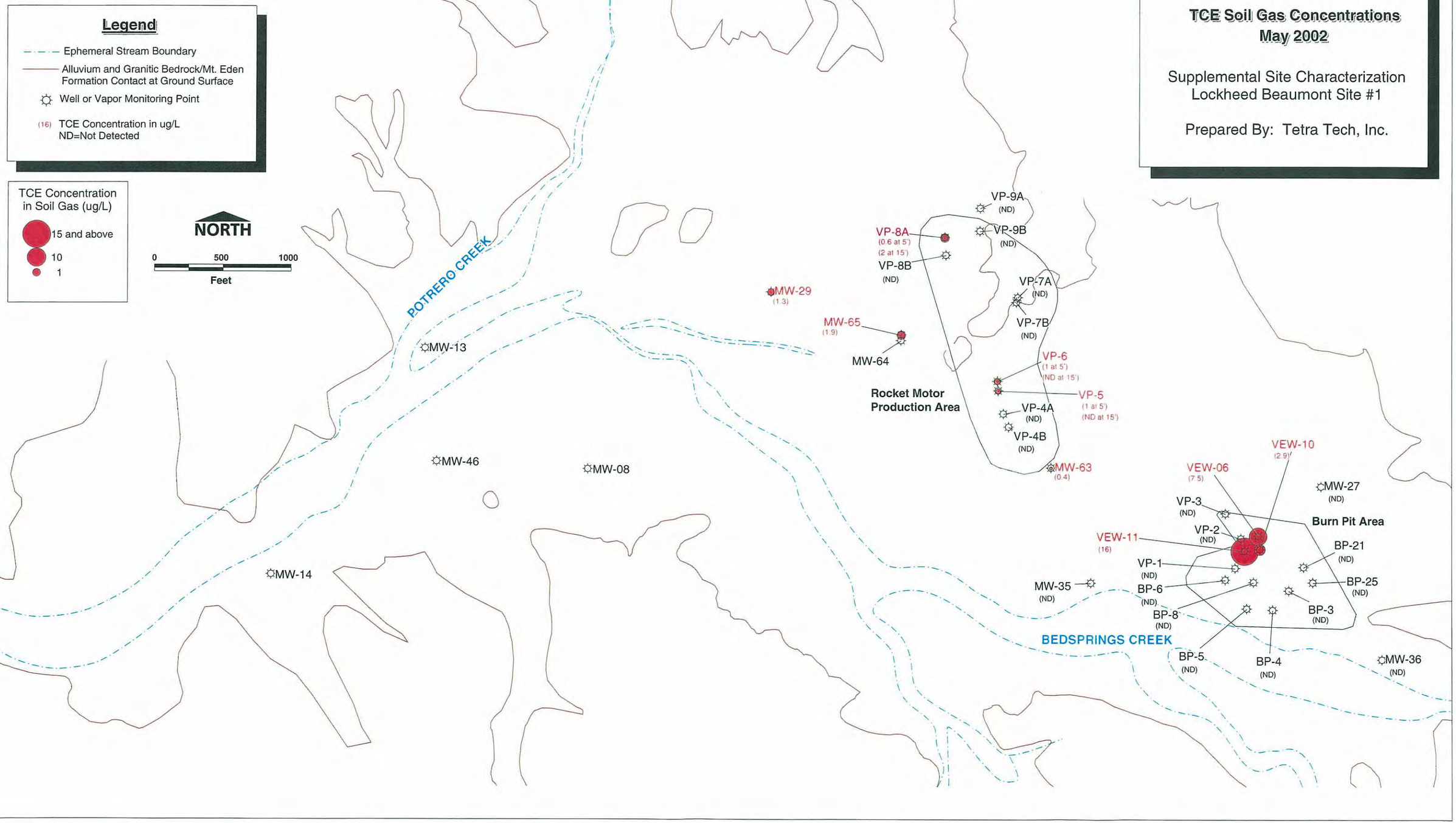


Figure 5-20

1,1,1-TCA Soil Gas Concentrations May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well or Vapor Monitoring Point
- (16) 1,1,1-TCA Concentration in ug/L ND=Not Detected

1,1,1-TCA Concentration in Soil Gas (ug/L)

- 15 and above
- 10
- 1.5 and below

NORTH

0 500 1000

Feet

POTRERO CREEK

MW-29

MW-13

MW-65

MW-64

VP-9A

VP-8A

VP-9B

VP-8B

VP-7A

VP-7B

VP-6

VP-5

VP-4A

VP-4B

Rocket Motor Production Area

MW-63 (ND)

MW-46

MW-08

MW-14

VEW-10 (16)

VEW-06 (1.4)

MW-27 (ND)

VP-3 (ND)

Burn Pit Area

VP-2 (ND)

VEW-11 (12)

VP-1 (ND)

BP-21 (ND)

BP-25 (ND)

MW-35 (ND)

BP-6 (ND)

BP-3 (ND)

BP-8 (ND)

BEDSPRINGS CREEK

BP-5 (ND)

BP-4 (ND)

MW-36 (ND)

Figure 5-21

1,1-DCA Soil Gas Concentrations May 2002

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well or Vapor Monitoring Point
- (0.7) 1,1-DCA Concentration in ug/L
  ND=Not Detected

NORTH

0 500 1000

Feet

POTRERO CREEK

MW-13

MW-29

MW-65

MW-64

VP-9A

VP-8A

VP-9B

VP-8B

VP-7A

VP-7B

VP-6

VP-5

VP-4A

VP-4B

Rocket Motor Production Area

MW-63 (ND)

MW-46

MW-08

MW-14

VEW-10 (ND)

VEW-06 (ND)

MW-27 (ND)

VP-3 (ND)

Burn Pit Area

VP-2 (ND)

VEW-11 (0.7)

VP-1 (ND)

BP-21 (ND)

BP-25 (ND)

MW-35 (ND)

BP-6 (ND)

BP-3 (ND)

BP-8 (ND)

BEDSPRINGS CREEK

BP-5 (ND)

BP-4 (ND)

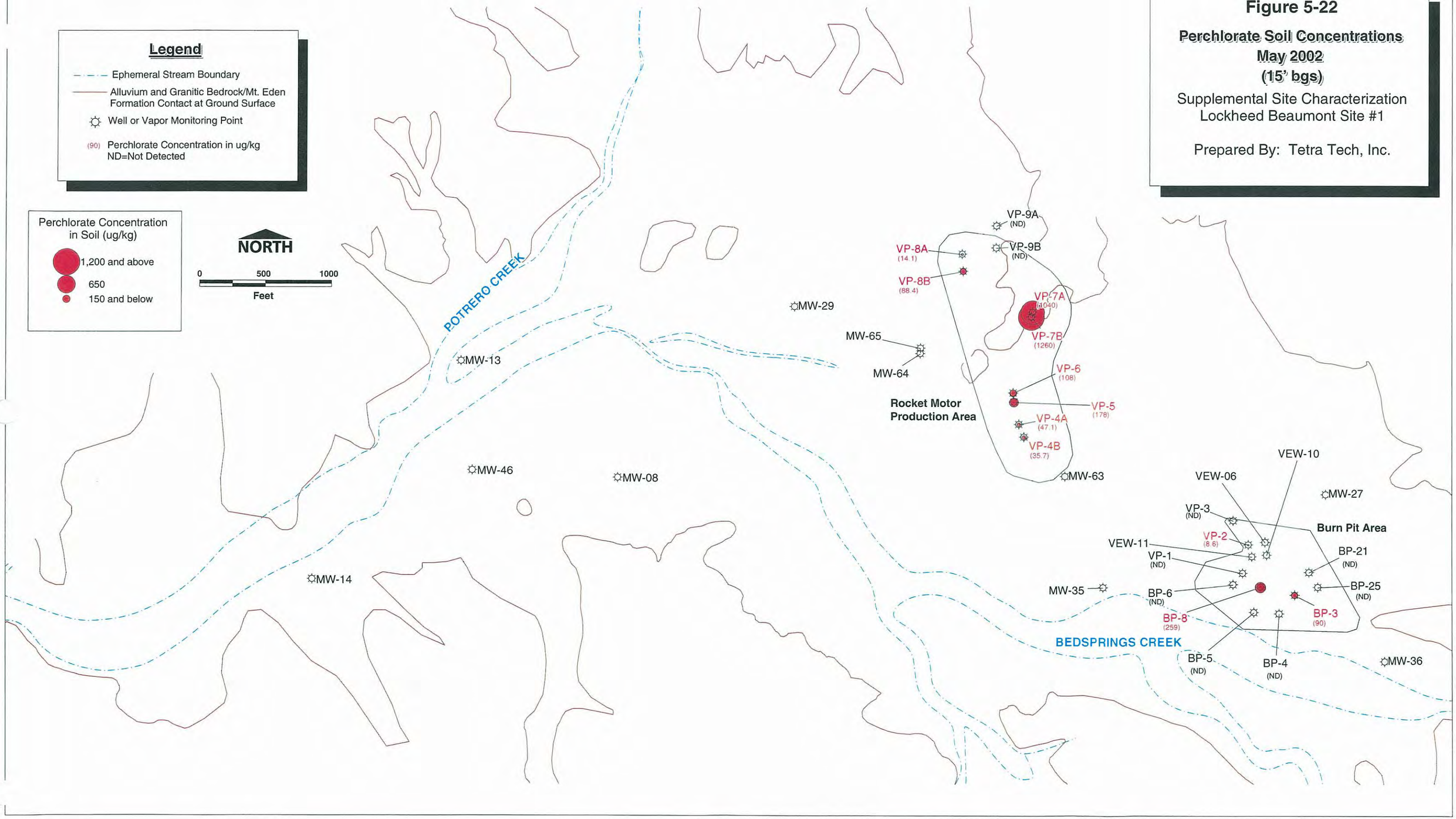
MW-36 (ND)

Figure 5-22

Perchlorate Soil Concentrations
May 2002
(15' bgs)

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.



No correlation between soil gas and soil analytes is apparent. VOCs generally were not detected in the solid soil media indicating any residual VOCs are in vapor form not sorbed to soils.

Concentrations of volatile organics in soil vapor have changed significantly since the early 1990's. In 1990, a soil vapor survey performed in the Burn Pit Area showed total halogenated VOCs at concentrations of up to about 10 ppmv (Radian 1992). A soil vapor survey with samples taken at 5 to 6 feet in depth performed in 1991 showed concentrations of less than 3 ppmv and the primary detected analytes were TCE, 1,1-DCE, and 1,1,1-TCA. A remedial system which included soil vapor extraction (SVE) system operated for approximately 4 years to mitigate VOC-affected soil. The SVE system concentrations reached asymptotic levels by January 1995 (Radian 1998) with the system continuing to operate until 1998 in pulse mode. In July 1998, maximum total VOC concentrations were 1,370 ppbv in the Burn Pit Area SVE monitoring wells.

Vapor sampling results from vapor extraction wells for this study detected total VOCs from 44 to 22 ppbv also with TCE, 1,1-DCE and 1,1,1-TCE the primary detected analytes. This shows a significant decrease in volatile organics concentrations over the concentrations detected in the early 1990's. Comparison of concentrations in individual wells shows (Table 5-17) a further decrease since the 1998 sampling that occurred during pulse testing. Generally, concentrations are at least an order of magnitude less in 2002 than in 1998.

Table 5-17
Soil Vapor Concentration Comparisons in Individual Wells

	TCE (ppbv)			1,1-DCE (ppbv)			1,1,1-TCA (ppbv)			1,1-DCA		
	5/18/98	7/29/98	6/24/02	5/18/98	7/29/98	6/24/02	5/18/98	7/29/98	6/24/02	5/18/98	7/29/98	6/24/02
VEW-06	113	82.5	1.4	390	247	20.2	34.7	30.8	1.7	1.2	ND	ND
VEW-10	42.2	224	0.5	113	479	7.3	278	570	2.9	ND	5.8	ND
VEW-11	396	270	3.0	1110	425	38.3	52.4	52.2	2.2	9.1	7.3	0.17

Notes ND= not detected
1998 sampling results from Radian 1998.
ppbv=parts per billion by volume

Rocket Motor Production Area

Soil gas samples were collected at ten probe locations and one groundwater monitoring well at the Rocket Motor Production Area (Figure 5-17 and Table 5-12). The probes were installed in five locations of interest in the area (the propellant mixing station, the motor casing washout station, the cast and cure station, the fuel slurry station, and chemical storage quonset). Only TCE and 1,1-DCE were detected in the vapor probes with three locations showing TCE and one location showing 1,1-DCE. TCE and 1,1-DCE were detected in the 15-foot samples with only one exception of a detectable TCE concentration

at 5 feet. The 1,1-DCE was detected at 0.5 ug/L and TCE ranged from 0.6 to 2 ug/L. The monitoring well adjacent to the Rocket Motor Production Area (MW-63) had detectable TCE at 0.4 ug/L (Figure 5-17). Fuel components, benzene, toluene, xylenes and MTBE, were also detected at four probe locations in the northern portion of the Rocket Motor Production Area in the probes installed at the fuel slurry station and the chemical storage quonset. Benzene was detected at one location at 15 feet in depth at 1.3 ug/L, toluene was detected at four locations at both 5 and 15 feet in depth at concentrations from 0.6 to 1.3 ug/L, xylene was detected at two locations (one at 5 and one at 15 feet in depth) at concentrations of 1.5 and 1.6 ug/L, and MTBE was detected at two locations (one at both 5 and 15 feet in depth and one at 5 feet in depth) at concentrations from 1.3 to 1.6 µg/L.

The probes with detected chlorinated solvents in soil gas were at the motor casing washout station and one location at the fuel slurry station of the Rocket Motor Production Area. The depth of detected chlorinated solvents in probes indicates that off-gassing may be occurring from affected groundwater. TCE and 1,1-DCE were detected in soil gas at the Rocket Motor Production Area and these are the analytes with the highest concentrations in groundwater. The fuel components were detected at the chemical storage quonset of the Rocket Motor Production Area. Although benzene was not detected, the presence of MTBE indicates that the fuel is of relatively recent origin and may be from a surface spill since these components were also detected at the 5-foot depth at concentrations similar to the 15 foot depth samples.

No VOCs were detected in soil samples except 1,4-dioxane, in the ten tested soil samples (Table 5-12). 1,4-dioxane was detected at one location at the propellant mixing station in both the 5 and 15-foot samples at a concentration of 4 µg/kg, below the residential PRG concentration of 444 mg/kg (Figure 5-23). This does not correlate to detected chlorinated solvents in soil gas samples. Perchlorate was detected in eight of the ten tested soil samples from 15 feet in depth at concentrations of 35.7 to 1260 ug/kg (Figure 5-22), below the residential PRG of 39,000 µg/kg. Perchlorate was detected at the Rocket Motor Production Area (Figure 5-22) in all stations except the chemical storage quonset. Limited groundwater data is available within the Rocket Motor Production Area for correlation with detected perchlorate in soils. However, elevated levels of perchlorate in groundwater were detected west of VP-5 and VP-6 which have perchlorate levels of 178 and 108 µg/kg, respectively.

No correlation between soil gas and soil analytes is apparent. VOCs generally were not detected in the solid soil media indicating any residual VOCs are in vapor form, and not sorbed to soils. Additionally, except for minor levels of 1,4-dioxane, VOCs that are detected appear to be from off-gassing from affected groundwater.

Figure 5-23

1,4-Dioxane Soil Concentrations
May 2002
(5' and 15' bgs)

Supplemental Site Characterization
Lockheed Beaumont Site #1

Prepared By: Tetra Tech, Inc.

Legend

- Ephemeral Stream Boundary
- Alluvium and Granitic Bedrock/Mt. Eden Formation Contact at Ground Surface
- Well or Vapor Monitoring Point
- (4J) 1,4-Dioxane Concentration in ug/kg
  ND=Not Detected

NORTH

0 500 1000
Feet

POTRERO CREEK

MW-13

MW-29

MW-65

MW-64

VP-9A (ND)

VP-9B

VP-8A

VP-8B

VP-7A (ND)

VP-7B (4J at 5') (4J at 15')

VP-6

VP-5

VP-4A

VP-4B

Rocket Motor Production Area

MW-63

MW-46

MW-08

MW-14

VEW-10

VEW-06

MW-27

VP-3

VP-2

Burn Pit Area

VEW-11

VP-1 (ND)

BP-21 (ND)

BP-25 (ND)

MW-35

BP-6 (ND)

BP-3 (ND)

BP-8 (ND)

BEDSPRINGS CREEK

BP-5 (ND)

BP-4 (ND)

MW-36

Concentrations of VOCs in soil vapor have decreased since the early 1990's in the general Burn Pit Area as compared to previous soil gas surveys. In 1990, a soil vapor survey performed in the RMPA showed total halogenated VOCs at concentrations of up to about 700 ppbv in 1992 (Radian, 1992) and up to 10,500 ppbv in 1989 (Radian, 1990). However, the current soil vapor results show only one repeated probe location with detectable soil gas (Table 5-18). Therefore, solvent analytes found in soil vapor have decreased, possibly due to mitigation of groundwater.

Other Potential Areas

Soil vapor samples were also taken from nine monitoring wells not within the Burn Pit Area or Rocket Motor Production Area. MW-27 is north, MW-36 is east, and MW-35 is west of the Burn Pit Area (Figure 5-17) and none of these wells had detectable VOCs. MW-29 and MW-65 are west of the Rocket Motor Production Area, within about 1200 feet. Samples from MW-29 had 1.3 ug/L of 1,1-DCE and 1.3 ug/L of TCE. Samples from MW-65 had 1.7 ug/L of 1,1-DCE and 1.9 ug/L of TCE (Figure 5-18 and 19). MW-65 is in an area where Total VOCs in groundwater are about 100 µg/L. The detected vapors may be off-gassing from groundwater. Groundwater from MW-29 shows 31ug/L of 1,1-DCE and 60 ug/L of TCE, indicating the detected soil vapors also may be off-gassing from affected groundwater. Monitoring wells MW-08, MW-13, MW-14, and MW-46 are several thousand feet southwest of the Rocket Motor Production Area and none of these wells had detectable VOCs. Groundwater from MW-13 shows 73 ug/L 1,1-DCE and 63 ug/L TCE, but no detectable vapor concentrations. No groundwater data were available for MW-27, MW-63, or MW-65. Based on soil vapor data from these monitoring wells, there is limited to no detectable soil vapor analytes in the sampled locations outside the Burn Pit Area or Rocket Motor Production Area.

Table 5-18
Comparison of Soil Gas
Results with Previous Survey
Beaumont No. 1 Site
Lockheed Martin Corporation

Sample Identification	Contractor	Sample Depth (feet bgs)	Sample Date	1,1-DCE (ppb)	1,1,1-TCA (ppb)	TCE (ppb)	PCE (ppb)	Total (ppb)
BP-3	Radian	5-6	Fall 1989	41.3	15.9	14.6	ND	72
BP3-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP3-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0
BP-4	Radian	5-6	Fall 1989	ND	4.8	1.5	0.8	7
BP4-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP4-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0
BP-5	Radian	5-6	Fall 1989	ND	4.6	3.1	ND	8
BP5-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP5-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0
BP-6	Radian	5-6	Fall 1989	148	143	102	3.9	397
BP6-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP6-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0
BP-8	Radian	5-6	Fall 1989	531	8930	1010	24.9	10496
BP8-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP8-15	Tetra Tech	15	June 2002	130	ND	ND	ND	130
BP-21	Radian	5-6	Fall 1989	19.8	7.9	3.4	ND	31
BP21-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP21-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0
BP-25	Radian	5-6	Fall 1989	ND	0.7	ND	0.2	0.9
BP25-5	Tetra Tech	5	June 2002	ND	ND	ND	ND	0
BP25-15	Tetra Tech	15	June 2002	ND	ND	ND	ND	0

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.0 CONCLUSIONS

Affected groundwater for both chlorinated solvents and perchlorate appears to extend up gradient of the Burn Pit Area and down gradient of the Rocket Motor Production Area. Chlorinated solvents and their degradation products detected in groundwater include: TCE, 1,1-DCE, 1,1-DCA, 1,1-DCE, 1,2-DCA and 1,1,1-TCA. The solvent stabilizer, 1,4-dioxane, was also detected in association with the chlorinated solvent analytes. Perchlorate in groundwater appears to be somewhat more widespread than the chlorinated solvents, extending further north, south and east of the Burn Pit Area and Rocket Motor Production Area. Perchlorate also extends up gradient of the Burn Pit Area, up gradient of MW-36. The extent of the affected groundwater is defined in the area between the Burn Pit Area and Rocket Motor Production Area and to about 2,500 feet down gradient (southwest) of the Rocket Motor Production Area. The extent of solvents and perchlorate in groundwater is not well defined at the down gradient plume margin, north of the Rocket Motor Production Area, and it may not be well define on the up gradient plume margin. 1,4-dioxane affected groundwater is not well defined down gradient, north of the Rocket Motor Production Area, and south of the Burn Pit Area. The affected groundwater data indicates that the Burn Pit Area is the primary source of chlorinated solvent, 1,4-dioxane, and perchlorate analytes. Source(s) of perchlorate may exist in the Rocket Motor Production Area but available data is inconclusive. Since insufficient data exists, this area cannot be excluded as a source. Soil data indicates levels of perchlorate north of the monitoring wells in the Rocket Motor Production Area.

Overall, the only significant temporal trends identified were the notable decreases in VOCs in the area immediately down gradient of the Burn Pit Area and in the Rocket Motor Production Area. The concentration changes that were observed are most likely due to the remedial actions conducted between 1992 and 1999, as well as plume migration over time.

Analytes were detected in two of the three surface water locations at concentrations above the MCL or California Recommended Action Level. The analytes detected include perchlorate, 1,4-dioxane, TCE, and 1,1-DCE. The analytes and concentrations detected at the locations fed by direct groundwater discharge are similar to those detected in nearby monitoring wells. Surface water samples also indicate 1,4-dioxane affected groundwater extends beyond the most down gradient well sampled during this investigation.

Based on the sampled soil and soil vapor, no soil concentrations were reported greater than residential PRGs and soil vapor concentrations show a marked decrease from levels detected in the 1990's.

All environmental data collected at the site will be carried forward and used in an updated human health risk assessment. An analysis of potential data gaps is currently underway. The human health risk assessment is scheduled to be completed after any issues concerning data gaps have been resolved.

7.0 REFERENCES

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8. ACRONYMS

8.0 ACRONYMS

1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
1,2-DCA	1,2-dichloroethane
1,1,2-TCA	1,1,2-trichloroethane
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CCR	California Code of Regulations
Cis-1,2-DCE	cis-1,2-dichloroethene
COPC	chemicals of potential concern
CRAL	California Recommended Action Level
CRWQCB	California Regional Water Quality Control Board
DHS	Department of Health Services
DO	dissolved oxygen
DQO	data quality objectives
DTSC	Department of Toxic Substances Control
EB	Equipment blank
EC	specific conductance
EPA	Environmental Protection Agency
GC/MS	Gas Chromatography/Mass Spectrometry
GPS	global positioning satellite
LCS	laboratory control sample
LPGAC	liquid phase granular activated carbon
MCL	maximum contaminant level
mg/kg	milligrams/kilogram (parts per million)
mg/l	milligrams/liter
µg/kg	micrograms per kilogram (parts per billion)
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTBE	methyl tert butyl ether
MW	monitoring well
NN	Natural Neighbor
O&M	Operations and Maintenance
ORP	oxidation reduction potential
PCE	tetrachloroethylene
ppbv	parts per billion by volume

ppm	parts per million
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RI/FS	Remedial Investigation and Feasibility Study
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVE	soil vapor extraction
TB	trip blank
TCE	trichloroethylene
VOC	volatile organic compound