Final
Resource Conservation Recovery Act Facility Investigation
Training Area T-38, Former Technical Escort
Reaction Area, Parcel 186(6)
McClellan
Anniston, Alabama

Prepared for:

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LIST OF ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
1,1-DCE	1,1-Dichloroethene
1,1,2-TCA	1,1,2-Trichloroethane
1,1,2,2-PCA	1,1,2,2-Tetrachloroethane
1,2-DCA	1,2-Dichloroethane
ADEM	Alabama Department of Environmental Management
amsl	above mean sea level
Army	U.S. Department of the Army
ASTM	American Society for Testing and Materials
bgs	below ground surface
Bhate	Bhate Environmental Associates, Inc.
BRAC	Base Realignment and Closure
CA	Cleanup agreement
CACM	chemical agent contaminated media
CAIS	chemical agent identification set
CDTF	Chemical Defense Training Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFDP	Center for Domestic Preparedness
CG	phosgene
cis-1,2-DCE	cis-1,2-Dichloroethene
CNB	Chloroacetophenone , Carbon Tetrachloride, and Benzene
COC	Constituent of concern
COPC	Constituent of potential concern
CWM	Chemical weapons material
DANC	Decontamination agent, non-corrosive
DO	Dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DQS	Data Quality Summary
DS2	Decontamination Solution Number 2
EBS	Environmental Baseline Study
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ESCA	Environmental Services Cooperative Agreement
ESE	Environmental Science & Engineering, Inc.
ESMP	Endangered Species Management Plan
ESV	Ecological screening value
FEMA	Federal Emergency Management Agency
FS	Sulfur trioxide-chlorosulfonic acid
FOSET	Finding of Suitability for Early Transfer
FOST	Finding of Suitability for Transfer

ft/ft	feet per foot
GB	Sarin chemical agent
GC/MS	Gas Chromatography/Mass Spectrometry
HD	Distilled Mustard
HI	Hazard index
HQ	Hazard quotient
HTRW	Hazardous Toxic and Radioactive Waste
IDW	Investigation Derived Waste
ILCR	Incremental lifetime cancer risk
IT	IT Corporation
JPA	Joint Powers Authority
LFS	Low flow groundwater sampling
McClellan	McClellan, Anniston, Alabama
MDC	Maximum detected concentration
MDL	Method detection limit
MES	Matrix Environmental Services, LLC
MINICAMS	miniature continuous air monitoring system
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
NFA	No Further Action
NOAEL	no-observed-adverse-effect-levels
OE	ordnance and explosives
ORP	Oxidation-reduction potential
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PID	Photo ionization detector
QAP	Quality Assurance Plan
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
RGO	Remedial goal option
RI	Remedial Investigation
RL	Reporting limit
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental, Inc.
SI	Site investigation
SINA	Special interest natural areas
SLERA	Screening-level ecological risk assessment
SSSL	Site-Specific Screening Level
STB	Supertropical bleach
SVOC	Semivolatile Organic Compound
TCE	Trichloroethene
TOC	Total Organic Compound
trans-1,2-DCE	trans-1,2-Dichloroethene

UCL	Upper confidence limit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	Unexploded ordnance
VOC	Volatile Organic Compound
VX	VX nerve agent

EXECUTIVE SUMMARY

The Anniston-Calhoun County Fort McClellan Development Joint Powers Authority (JPA) has assumed the responsibility for environmental closure of certain sites at McClellan from the U.S. Department of the Army (Army). Transfer of these sites to the JPA was conducted pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(h)(3)(C) which allows federal agencies to transfer contaminated property before all necessary cleanup has taken place. The basis for the continuing effort at these parcels is the execution of an Environmental Services Cooperative Agreement (ESCA) dated September 29, 2003 between the JPA and the Army (Army, 2003), and a Cleanup Agreement (CA), amended September 2005, between the JPA and the Alabama Department of Environmental Management (ADEM).

Training Area T-38, Parcel 186(6), also known as the Toxic Gas Yard, is approximately 150 acres in size and encompasses most of a topographic ridge known as Reservoir Ridge. A 6-acre fenced area at the crest of the ridge was reportedly used from 1961 to 1972 for training technical escort personnel in chemical munition handling techniques to minimize hazards during transportation (ESE, 1998) and for the storage of toxic agents and munitions, including four 1-ton containers of HD. In addition, decontaminants were reportedly stored in at least two locations at the Site and were used for demonstration purposes. Extensive decontamination was conducted after each training exercise to clean up spills and contaminated training aids. The types, quantities, and frequency of decontaminants used are unknown, but assumed to have included Decontamination Agent, Non-Corrosive (DANC), supertropical bleach (STB), and Decontamination Solution Number 2 (DS2) (ESE, 1998). Artillery shell tapping, CWM transfer training, and filling of aerial smoke tanks were also conducted at the Site. Shell tapping training was conducted using phosgene-filled mortar rounds. CWM transfer training involved pumping HD from 1-ton containers into drums and subsequently into gallon cans for use in training exercises. During the 1980s the Site was reportedly used as a chemical agent identification area; however precise dates are unknown (Shaw, 2004).

Chemicals used as decontamination agents at Training Area T-38 may have been either inorganic or organic materials that contained chlorine, readily available for use as an oxidizing or chlorinating agent. Inorganic materials used for large-scale decontamination through oxidation included bleach in various forms, calcium hypochlorite, and chlorine gas. Organic compounds, used only for small-scale operations such as destroying blister agent on equipment, decontaminate in the absence of moisture by chlorination and, in the presence of moisture, by oxidation. These organic compounds included the chloroamides and closely related compounds, and were usually dissolved in organic solvents such as 1,1,2,2-tetrachloroethane (1,1,2,2-PCA) and carbon tetrachloride (Shaw, 2004).

Previous investigations were performed by Shaw Environmental, Inc. (Shaw) and included a remedial investigation (RI) conducted in several phases from 2000 to 2003. During the remedial RI performed by Shaw, volatile organic compounds (VOCs) and metals were detected in groundwater, soils, and sediments at concentrations exceeding human health site-specific screening levels (SSSLs) (Shaw 2004), however the horizontal and vertical extent of contamination was not fully defined. On behalf of JPA, MES performed an additional

environmental investigation at Parcel 186(6) in May and June 2005 to further characterize the Site and fill data gaps existing from previous environmental investigations. This RFI includes summaries of past environmental investigations performed at Training Area T-38 as well as a summary of investigative procedures and results obtained during the May/June 2005 environmental investigation.

The 2005 RFI activities included:

- Installation of four monitoring wells (three in bedrock and one in the transition zone)
- Groundwater level measurements
- Sampling, analysis, and data quality review of 36 groundwater samples, 4 seep samples, and 3 surface water samples
- Evaluation of nature and extent of contamination
- Evaluation of fate and transport of contamination
- Human health and ecological risk assessments

A general understanding of natural conditions at the Site was necessary when evaluating the nature and extent, fate and transport, and risk presented as a result of Site contamination. The following is a brief synopsis of geology and hydrogeology observed at the Site.

Groundwater is generally mounded near the crest of Reservoir Ridge, in the central portion of the Site, and exhibits a localized radial flow pattern. The western portion of the groundwater radial flow pattern generally exhibits steeper groundwater gradients as the water flows toward the Jacksonville Fault. At the Fault, groundwater follows the direction of the fault system towards the north/northwest. Groundwater from the eastern portion of the radial flow pattern flows towards the base of Reservoir Ridge where it converges with groundwater flowing in a westerly direction from a hill east of the Site. At the point of convergence, the groundwater flows either towards the north or south. Groundwater flowing north at the point of convergence generally flows northwest around the base of Reservoir Ridge and joins regional flow towards the north/northwest. The northern portion of the radial flow continues towards the north where it joins regional flow towards the north/northwest, following the Jacksonville Fault. Radial flow towards the south of Reservoir Ridge eventually joins regional groundwater flow patterns, however not enough data is available at Training Area T-38 to fully describe this connection.

At points near the base of Reservoir Ridge, groundwater elevations are greater than or equal to ground surface elevations causing surface seeps. Monitoring well CWM-186-MW16 has a water level greater than the ground surface elevation, indicating artesian properties and an upward groundwater gradient. At other paired well locations, the vertical gradient is slightly downward.

The groundwater, surface water, and seep samples collected during the 2005 RFI were analyzed for VOCs. Twelve groundwater samples were also analyzed for ethane, ethene, and methane by RSK-175; and two groundwater samples were also analyzed for hexavalent chromium (chromium VI). Twenty-two VOCs were detected in the groundwater samples collected in 2005. Two VOCs were detected in the surface water samples, and seven VOCs were detected in the seep samples. Trichloroethene (TCE) and 1,1,2,2-PCA were the primary constituents detected in the groundwater, surface water, and seep samples. Methane was detected in eight, ethane in five, and ethene in two of the groundwater samples collected in 2005. Chromium VI was detected at

an estimated concentration in only one out of two of the groundwater samples collected in 2005. To evaluate the nature and extent of contamination at the site, the VOC and chromium VI results from the 2005 RFI samples were assessed to identify the contaminants at the Site. Historical VOC, SVOC, explosive, metal, and CWM breakdown product results from the investigations performed by Shaw from 2001 to 2003 were also assessed.

1,1,1,2-PCA, 1,1,2-trichloroethane (1,1,2-TCA), 1,2-dichloroethane (1,2-DCA), acetone, bromodichlorometahne, carbon tetrachloride, chloroform, cis-1,2-dichloroethene (cis-1,2-DCE), hexachlorobutadiene, tetrachloroethene (PCE), trans-1,2-dichloroethene (trans-1,2-DCE), TCE, vinyl chloride, antimony, chromium, and thallium exceeded the residential or groundskeeper SSSLs in groundwater. The highest concentrations of VOCs in groundwater were found in wells located in the northeast corner of the fenced area at the crest of Reservoir Ridge. The fenced area at the crest of Reservoir Ridge comprises the estimated source area of contamination. Generally, the VOC concentrations decreased further downgradient from the estimated source area.

The distribution of total VOCs in groundwater at the Site indicate dissolved-phase chlorinated hydrocarbon plumes that follow the local groundwater flow direction and provide evidence of preferential flow generally towards the north, west, and east sides of the hill. In addition, groundwater is expressed as surface water at several seeps near the bottom of Reservoir Ridge.

The RSK-175 analysis for ethane, ethene, and methane was performed on twelve groundwater samples from Training Area T-38 to estimate degradation of the chlorinated solvents present in groundwater. Natural degradation is accomplished through the process of chemical reduction (dechlorination) of 1,1,2,2-PCA, PCE, TCE, carbon tetrachloride, and other chlorinated hydrocarbons present in groundwater at the Site. The presence of decreasing-order chlorinated ethanes, ethenes and methanes in groundwater at the Site provides evidence of the occurrence of natural degradation.

1,1,2,2-PCA, TCE, chromium, and thallium exceeded the recreational SSSL in surface water and seeps. Beryllium, chromium, and thallium exceeded the ecological screening value (ESV) in surface water and seeps. Acetone, cadmium, chromium, mercury, selenium, and zinc exceeded ESVs in surface soil. 1,1,2,2-PCA and TCE exceeded the groundskeeper SSSLs in subsurface soil. 1,1,2,2-PCA, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and selenium exceeded the ESVs in subsurface soil.

A clearer understanding of contaminant nature and extent for the Site has been accomplished through additional sampling completed as part of the 2005 RFI. Based on the results of this RFI and data collected during previous investigations, no further environmental data collection is required to define the nature and extent of contamination at the Site.

Site contamination did not appear to be a result of direct dumping into surface water, and surface water is not considered a main source for contamination. Based on the Site history and an understanding of the contamination involved, the most likely methods of transport are volatilization and subsequent degradation in air, and infiltration to groundwater.

A human health risk assessment was performed to evaluate the potential threat to human health from exposure to environmental media at the Site. Two receptor scenarios were evaluated based on future land use: groundskeeper and recreational user. The human health risk assessment at the Site consisted of identifying the COCs, identifying the exposure point concentrations (EPCs) for the COCs, calculating the incremental lifetime cancer risk (ILCR) and non-cancer hazard index (HI), and identifying the total cancer risk and total non-cancer hazard index. The following is a summary of results from the human health risk assessment.

- Groundwater at the Site presents an unacceptable increased cancer-based risk to the groundskeeper. Groundwater cancer-based COCs for the groundskeeper were identified as 1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, TCE, and vinyl chloride.

- Surface water at the Site presents an acceptable cancer-based risk to the recreational user. The cancer-based COCs for the recreational user in surface water were identified as 1,1,2,2-PCA and TCE.

- The subsurface soil presents a negligible cancer risk to the groundskeeper. Groundwater cancer-based COCs for the groundskeeper were identified as 1,1,2,2-PCA and TCE in subsurface soil.

- Because no COCs exceeded the recreational user SSSLs in subsurface soil, no constituents were considered risks for the recreational user exposed to subsurface soil.

- None of the COPCs in sediment and surface and depositional soil exceeded the SSSLs.

- The groundwater at the Site presents an unacceptable increased non-cancer hazard to the groundskeeper. Non-cancer groundwater COCs for the groundskeeper were identified as 1,1,2,2-PCA, carbon tetrachloride, cis-1,2-DCE, TCE, antimony, and thallium.

- The surface water at the Site presents an unacceptable increased non-cancer hazard to the recreational user. Non-cancer COCs for the recreational user in surface water were identified as TCE and thallium.

- No COCs exceeded the non-cancer SSSLs in subsurface soil.

- Chlorinated VOCs in groundwater are the risk drivers and are responsible for cancer risks and non-cancer hazards exceeding acceptable levels.

An ecological risk assessment was conducted to evaluate the potential for ecological risks posed by site-related constituents at the Site. The ecological risk assessment for the Site consisted of identifying the COCs, identifying the EPCs for the COCs, calculating the screening-level hazard quotients, identify the constituents of concern (COCs), and assessing the COCs in relation to the environmental setting and habitat(s) in and around the Site.

Beryllium, chromium, and thallium were identified as COCs in surface water and seeps, but with only a single sample detect each and with HQs less than ten, these constituents most likely do not

pose a significant ecological risk.

Chromium, mercury, and selenium were identified as COCs in surface and depositional soil. The HQs for mercury and selenium in surface and depositional soil were only slightly above 1; the uncertainty surrounding the data is sufficient to eliminate these compounds from consideration as COCs. Although chromium was frequently detected in surface soil, the arithmetic mean concentration of samples from the Site (29 mg/kg) is less than the naturally occurring background concentration of chromium (37 mg/kg); therefore, chromium is most likely not site-related.

1,1,2,2-PCA, chloroform, cis-1,2-DCE, PCE, and TCE were identified as COCs in subsurface soil. Because the HQs for cis-1,2-DCE, PCE, and selenium in subsurface soil were below 10 these constituents most likely do not pose significant ecological risk. Chloroform was detected at only four locations clustered within the estimated source area. Because it was not considered to be a wide-spread contaminant, chloroform was considered to pose insignificant risk to ecological populations at the Site. Based on the magnitude of their HQs, 1,1,2,2-PCA and TCE in subsurface soil may pose increased risk to ecological receptors due to Site activities.

Groundwater and surface water contamination present risk to both human health and the environment at levels sufficient to warrant either remediation or risk management decisions. In order to select an efficient mitigation or management strategy for the identified risks, an evaluation of appropriate remedial technologies is recommended. This evaluation will be performed in accordance with the appropriate requirements of both the ESCA and the CA. Based on the results of this RFI, the remedies that would be considered would include no action, monitored natural attenuation, in-situ chemical remediation, enhanced in-situ bioremediation, reactive permeable barrier, and groundwater extraction and treatment.

1.0 INTRODUCTION

Matrix Environmental Services, L.L.C. (MES) has prepared this Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) Report to summarize environmental investigations conducted at the Training Area T-38, Former Technical Escort Reaction Area, Parcel 186(6) (Training Area T-38) located within the former Fort McClellan in Anniston, Alabama (McClellan). A general site map of McClellan is included as Figure 1-1. A site location map of Training Area T-38 is included as Figure 1-2.

This report was written on behalf of the Anniston-Calhoun County Fort McClellan Development Joint Powers Authority (JPA), which has assumed the responsibility for environmental closure of certain sites at McClellan from the United States (U.S.) Department of the Army (Army). Transfer of these sites to the JPA was conducted pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(h)(3)(C) which allows federal agencies to transfer contaminated property before all necessary cleanup has taken place. The basis for the continuing effort at these parcels is the execution of an Environmental Services Cooperative Agreement (ESCA) dated September 29, 2003 between the JPA and the Army (Army, 2003). In addition, the JPA has negotiated a Cleanup Agreement (CA), amended September 2005, with the Alabama Department of Environmental Management (ADEM) that describes the responsibilities of both parties in completing the investigation and remediation of Hazardous Toxic and Radioactive Waste (HTRW) sites at McClellan (ADEM, 2003).

1.1 Status of the Site and Justification for Environmental Investigation

Training Area T-38 is currently fenced and posted. Training Area T-38, located in the north-central portion of McClellan, is approximately 150 acres in size and encompasses most of a topographic structure known as Reservoir Ridge. Between 1961 and 1972, Training Area T-38 was reportedly used for training technical escort personnel in chemical munition handling techniques to reduce or eliminate the release of toxic hazards during transport and storage of chemical warfare material (CWM) and munitions. CWM reportedly used at this site includes CNB (a mixture of chloroacetophenone tear gas, carbon tetrachloride, and benzene), FS (sulfur trioxide-chlorosulfonic acid), CG (phosgene), GB (Sarin), VX (VX nerve agent), and HD (distilled mustard). Decontamination at the site following training exercises included the use of Decontamination Agent, Non-Corrosive (DANC), supertropical bleach (STB), and Decontamination Solution No. 2 (DS2). The Site was also used for storing toxic agents and decontaminants, artillery shell tapping, CWM transfer training, and filling of aerial smoke tanks. Technical escort training and decontamination was conducted on the south side of the fenced compound (Environmental Science & Engineering, Inc. [ESE], 1998). Proposed future land use of this parcel is categorized as open space as proposed in the Re-Use Plan (November 1997 as amended by EDC Application of March 2000) (EDAW, 1997).

The ESCA describes activities and projects the JPA will perform to facilitate the reuse of early transfer parcels. The ESCA specifies that the JPA will perform further characterization of Training Area T-38. The CA further identified that an RFI is an appropriate investigation process for Training Area T-38.

Previous investigations were performed by Shaw Environmental, Inc. (Shaw) and included a Remedial Investigation (RI) conducted in several phases from 2000 to 2003. During the RI performed by Shaw, volatile organic compounds (VOCs) and metals were detected in groundwater, soils, and sediments at concentrations exceeding human health site-specific screening levels (SSSLs) (Shaw, 2004), however, the horizontal and vertical extent of contamination was not fully defined. On behalf of JPA, MES performed an additional environmental investigation at Training Area T-38 in May and June 2005 (henceforth referred to as the "2005 RFI") to further characterize the site and fill data gaps existing from previous environmental investigations. This RFI Report presents procedures and results of the 2005 RFI and includes summaries of past environmental investigations performed at Training Area T-38.

1.2 McClellan Site Description and History

McClellan is located in the foothills of the Appalachian Mountains of northeastern Alabama, near the cities of Anniston and Weaver in Calhoun County, Alabama (Figure 1-1). McClellan is approximately 60 miles northeast of Birmingham, Alabama, 75 miles northwest of Auburn, Alabama, and 95 miles west of Atlanta, Georgia.

The U.S. government purchased 18,929 acres of land near Anniston in 1917 for use as an artillery range and a training camp in response to the outbreak of World War I. The site was named Camp McClellan in honor of Major General George B. McClellan, a leader of the Union Army during the Civil War. Camp McClellan was used to train troops for World War I from 1917 until the armistice, when it was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active military units and included civilian support. Camp McClellan was re-designated as Fort McClellan in 1929 and continued to serve as a training facility for the military.

In 1940, the government acquired an additional 22,245 acres west of McClellan. This tract of land was named Pelham Range. In 1941, the Alabama Legislature leased approximately 4,488 acres to the U.S. government to provide an access corridor from the Main Post to Talladega National Forest. This corridor provides access to additional woodlands for training.

The Army operated the Chemical Defense Training Facility (CDTF) at Fort McClellan from 1951 until the school was deactivated in 1973. The CDTF was reactivated in 1979 where it was in operation until the before permanent closure of the base in 1999 (ESE, 1998). The CDTF offered advanced training in chemical, biological, and radiological warfare to personnel from all branches of the military.

In 1995, the Base Realignment and Closure (BRAC) commission recommended closure of Fort McClellan, except for minimum essential land and facilities utilized by a Reserve Component Enclave and essential facilities needed to provide support for the chemical demilitarization operation at Anniston Army Depot. The U.S. Department of Defense (DOD) announced that Fort McClellan would close by October 1999. The U.S. Department of Justice (DOJ) subsequently requested a transfer of some facilities and training areas for ongoing training exercises. The Army transferred the CDTF and ancillary support facilities to the DOJ in 2000 to establish the Center for Domestic Preparedness (CFDP).

Property determined by the Army and ADEM to be suitable for transfer (i.e., "clean property") was transferred to the JPA under a Finding of Suitability for Transfer (FOST). Remaining contaminated property was transferred to the JPA under a Finding of Suitability for Early Transfer (FOSET). The basis for the continuing effort at these FOSET parcels is the execution of the ESCA and the CA that describe the responsibilities of all parties in completing the investigation and remediation of environmentally impacted sites at McClellan.

1.3 Purpose and Objectives

The purpose of this RFI Report is to summarize data from previous environmental investigations and to present a summary of investigative procedures and results obtained during the 2005 environmental investigation. Objectives for the 2005 field activities and this RFI are as follows:

- Further define vertical and horizontal extent of groundwater contamination
- Obtain additional information regarding area hydrogeology
- Collect additional information to fill data gaps that existed from previous investigations

1.4 Report Organization

Section 2.0 of this report presents a summary of the environmental setting including location, soil types, geology, and hydrogeology of the parcels. Section 3.0 presents a summary of previous environmental investigations. Section 4.0 describes the activities conducted during the 2005 environmental investigation and Section 5.0 presents the results of the 2005 environmental investigation. Contaminant fate and transport is discussed in Section 6.0. Screening-level human health and ecological risk discussions are presented in Sections 7.0 and 8.0, respectively. Section 9.0 presents conclusions and recommendations. Section 10.0 lists the references cited in this report. Additional supporting information is provided in Tables, Figures, and Appendices. Appendices included with this report are as follows:

Appendix A Monitoring Well Installation Documentation Forms for 2005 RFI Wells
- A1: Boring Logs for 2005 RFI Wells
- A2: Well Completion Data for 2005 RFI Wells
- A3: Well Development Forms for 2005 RFI Wells

Appendix B Field Documentation Forms for 2005 RFI
- B1: Monitoring Well Sample Collection Forms for 2005 RFI Wells
- B2: Chain of Custody Forms for 2005 RFI

Appendix C Analytical Data for 2005 RFI

Appendix D *Data Quality Summary: Training Area T-38, Former Technical Escort Reaction Area, Parcel 186(6)*

Appendix E Statistical Comparison of Site and Background Data for Metals, Training Area T-38, Former Technical Escort Reaction Area, Parcel 186(6)

Appendix F Historical VOC Analytical Data for Groundwater

2.0 SITE DESCRIPTION AND PHYSICAL SETTING

The following sections provide site background information for Training Area T-38.

2.1 Site Description and History of Training Area T-38

Training Area T-38, also known as the Toxic Gas Yard, is approximately 150 acres in size and encompasses most of a topographic ridge known as Reservoir Ridge. A 6-acre fenced area at the crest of the ridge (Figure 1-2) was reportedly used from 1961 to 1972 for training technical escort personnel in chemical munition handling techniques to minimize hazards during transportation (ESE, 1998) and for the storage of toxic agents and munitions, including four 1-ton containers of HD. In addition, decontaminants were reportedly stored in at least two locations at the Site and were used for demonstration purposes. Extensive decontamination was conducted after each training exercise to clean up spills and contaminated training aids. The types, quantities, and frequency of decontaminants used are unknown, but assumed to have included DANC, STB, and DS2 (ESE, 1998). Artillery shell tapping, CWM transfer training, and filling of aerial smoke tanks were also conducted at the Site. Shell tapping training was conducted using phosgene-filled mortar rounds. CWM transfer training involved pumping HD from 1-ton containers into drums and subsequently into gallon cans for use in individual training exercises. During the 1980s the Site was reportedly used as a chemical agent identification area; however precise dates are unknown (Shaw, 2004).

An entrance gate is located in the northern section of the fenced area at the crest of the ridge (Figure 2-1). Several buildings and structures are located within the fenced area, including general installation buildings (4450 and 4456), storage buildings (4452, 4454/4455), field latrines (4458 and 4459), and a mess shelter (4461). A concrete pad (4453) located in the central eastern portion of the Site was reportedly used as a decontamination pad (Science Applications International Corporation [SAIC, 1995]). However, Parsons Engineering Science, Inc. (Parsons) indicated the pad was used as a storage area (Parsons, 1999). Structures 4462 through 4468 are grandstand/bleachers located in the southern portion of the fenced area. Reportedly, an approximate 10 feet by 20 feet by 10 feet sump or unlined pit was located in the east-central portion of the Site and was used for disposal of decontaminants and other training wastes. A burial site for an HD drum was reportedly located in the southern portion of the Site, however the precise location of the suspected HD drum could not be confirmed based on a geophysical survey conducted during a site investigation (SI) in 1993 (SAIC, 2000).

Chemicals used as decontamination agents at Training Area T-38 may have been either inorganic or organic materials that contained chlorine, readily available for use as an oxidizing or chlorinating agent. Inorganic materials used for large-scale decontamination through oxidation included bleach in various forms, calcium hypochlorite, and chlorine gas. Organic compounds, used only for small-scale operations such as destroying blister agent on equipment, decontaminate in the absence of moisture by chlorination and, in the presence of moisture, by oxidation. These organic compounds included the chloroamides and closely related compounds, and were usually dissolved in organic solvents such as 1,1,2,2-tetrachloroethane (1,1,2,2-PCA) and carbon tetrachloride (Shaw, 2004).

2.2 Geology

The geology of McClellan is discussed in the following subsections. Information contained in these subsections is adapted from previous work performed by Shaw (2004).

2.2.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province, which is characterized by metamorphosed sedimentary rocks and the Valley and Ridge Province. McClellan lies mainly within the Valley and Ridge Province, which is part of the Appalachian fold-and-thrust structural belt. The fold and thrust belt generally features southeastward-dipping thrust faults with associated minor folding consisting of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted with major structures and faults striking in a northeast-southwest direction. Geologic contacts in this region generally strike parallel to the faults and repetition of lithologic units is common in vertical sequences. These units, from oldest to youngest, include the Cambrian-aged Chilhowee Group, Shady Dolomite, Rome Formation, Conasauga Formation, and Knox Group, and the Ordovician-aged Newala and Little Oak Limestones, as well as various siltstones, sandstones, shales, dolomites and limestones that are mapped as one, undifferentiated unit in some areas of Calhoun County.

The 39-mile long Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of McClellan, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The fault is interpreted as a major splay of the Pell City fault, which serves as a fault contact between the bedrock within the McClellan window and the Rome and Conasauga Formations (Osborne and Szabo, 1984). The trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt. The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the McClellan window, and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 90 miles in length) consisting mainly of thin imbricate thrust slices (Thomas and Drahovzal, 1974). An Ordovician-aged sequence comprising the Eden thrust sheet includes an erosional window in the overlying thrust sheet at McClellan. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984).

2.2.2 Site-Specific Geology

Rocks comprising Reservoir Ridge and Training Area T-38 are part of the Jacksonville thrust sheet that frames the eastern edge of the Fort McClellan window. Obsorne et al. (1989) have mapped these rocks as Cambrian (Shady Dolomite) in age, thrust by the Jacksonville fault over younger and now exposed Mississippian/Ordovician (Floyd/Athens Shale) and Ordovician (Little Oak and Newala Limestone) strata (Figure 2-2). The Mississippian and Ordovician rocks exposed in the window to the west of the Site folded into a series of northeast-southwest striking, complex asymmetric to overturned folds. Exposures of the Jacksonville fault along the edge of the Fort McClellan window are rare because of deep weathering and thick colluvium

accumulation. Geologic mapping conducted recently by Osborne et al. in 1997, however, indicates that the Jacksonville fault trends northwest-southwest approximately 600 feet to the west of Training Area T-38. A trench excavated at Reservoir Ridge, south of Training Area T-38, indicated that the Athens shale and residuum of the Shady Dolomite is in thrust contact on the southeast edge of the window. The fault contact is characterized by approximately 6 feet of brecciated shale and mudstone (Shaw, 2004).

Site-specific geologic conditions at Training Area T-38 were assessed using lithologic logs from residuum and bedrock soil borings and cores, and monitoring wells. The geologic map from Osborne et al. (1997) was revised by Shaw to reflect the data collected during field activities as part of the 2003 RI investigation. The locations of geologic cross sections constructed from the data are shown on Figure 2-3, along with surface geologic features additional to those shown on Figure 2-2. Based on the data collected during the investigation, a contact between residuum that is believed to be largely derived from the Shady Dolomite and between that believed to be largely derived from the Chilhowee Group is shown. This interpretation is also presented on the geologic cross sections, Figures 2-4 and 2-5. A sharp contact is not definable, but the basis includes criteria such as the presence of chert and dolomite pebbles and a lesser amount of sand and sandstone in Shady residuum, and pebbles identified as quartzite and an increase to high occurrence of gravel, sand, sandstone, and quartzite in the Chilhowee residuum. It is noted that the interpretation presented on Figure 2-2 also depicts an area mapped as Chilhowee Group on a ridge to the northwest of Training Area T-38 associated with the leading edge of the Jacksonville fault. Figure 2-3 shows an unnamed thrust fault east of the Site that trends north-south and is approximately parallel to the Jacksonville fault. The figure also shows the trace of a small imbricate fault that cuts the eastern end of one of the cross sections (Shaw, 2004).

Figure 2-4 includes a geologic cross section (A-A') prepared by Shaw that cuts west to east across the strike of Reservoir Ridge and shows units of the Floyd/Athens Shale and Little Oak/Newala Limestone overridden by the Jacksonville fault and units of the Shady Dolomite and Chilhowee Group and residuum. Figure 2-5 presents a geologic cross section (B-B') prepared by Shaw that transects the ridge mainly in a south to north direction. In addition to the Jacksonville fault, a small, imbricate fault of undetermined lateral extent, thrusts quartzites of the Chilhowee Group over dolomites of the Shady. The fault is extended to the east-northeast where it is interpreted to cut CWM-186-MW15 and CWM-186-MW16 (Shaw, 2004).

During drilling and rock coring activities, the Jacksonville fault and underlying bedrock of the Floyd/Athens Shale or the Little Oak/Newala Limestone were encountered within Training Area T-38 at depths ranging from 115 ft below ground surface (bgs) at CWM-186-MW25 along the crest of the ridge to 215 ft bgs at CWM-186-MW22 on the eastern flanks of the ridge. Three-point structural calculations were made to determine the strike and dip of the Jacksonville fault (Shaw, 2004). The strike of the fault ranged from 14 to 74 degrees west of north with dips ranging from 3.7 degrees east-northeast to 10.2 degrees north-northeast. The higher dips on the fault were recorded to the north of the ridge. The steep dips shown on the geologic cross sections are due to vertical exaggeration of scale (Shaw, 2004).

The Floyd/Athens shale typically consists of moderately hard, fissile, highly to intensely fractured, gray to black shale with contorted calcite veins. The Little Oak/Newala Limestone

consists of hard fractured, gray dolomitic limestone with occasional intervals of gray calcareous shale. Rocks of the Shady Dolomite typically consist of hard, fractured, light gray dolomite with some pyrite and, occasionally, fractured, pale greenish yellow or purple brown shale. The Chilhowee Group bedrock consists of very hard, fractured light gray quartzite (Shaw, 2004).

Depending on the location, bedrock formations encountered at Training Area T-38 included the Athens Shale and Newala Limestone beneath the Jacksonville Fault and the Shady Dolomite and Chilhowee Group of the overriding thrust sheet. Depth to the bedrock varied considerably: 24 ft bgs in Athens Shale (CWM-186-MW13 and CWM-186-MW28); 135 ft bgs in the Chilhowee Group (CWM-186-MW10 and CWM-186-MW24); 137 ft bgs in the Shady Dolomite (CWM-186-MW09 and CWM-186-MW23); and 155 ft bgs in the Newala Limestone (CWM-186-MW10 and CWM-186-MW24) (Shaw, 2004).

2.3 Soil

The soil types of McClellan are discussed in the following subsections. Information contained in these subsections is adapted from previous work performed by Shaw (2004).

2.3.1 Regional Soil

The soil associations found at McClellan (U.S. Department of Agriculture [USDA], 1961), include:

- **Anniston-Allen, Decatur-Cumberland**. Alluvium, resulting from weathering of older residual soils developed from sandstone, shale and quartzite; deep, well-drained, level to moderately steep soil in valleys underlain by limestone and shale. Subsoil is dark red sandy clay loam. Cumberland and Decatur soils are dark reddish brown gravelly loam developed from weathered limestone.
- **Clarksville-Fullerton.** Well-drained to moderately well-drained stony or cherty soils developed in the residuum of cherty limestone. This association is limited to Pelham Range. The soils are generally dark brown to dark gray-brown silt loam.
- **Rarden-Montevallo-Lehew.** Moderately deep or shallow soils on ridgetops and steep slopes and in local alluvium in draws. Soils are developed from the residuum of shale and fine-grained, micaceous sandstone; reddish brown to dark gray-brown to yellow-brown silt loam, clay or silty clay.
- **Stony Rough Land**. Shallow, steep, and stony soils formed from the weathering of sandstone, limestone, and Talladega Slate. Infiltration is slow; the soils contain many boulders and fragments with clayey residuum. This association underlies a large portion of the Main Post at McClellan.

2.3.2 Site-Specific Soil

The soil type at Training Area T-38 is classified as Anniston Gravelly Loam 10 to 15 percent slope, severely eroded (AbD3) (U.S. Department of Agriculture, 1961). The soil type is

characterized by strongly acid, deep well-drained soils that have developed in old local alluvium. The surface horizon is mainly dark brown loam, and the subsoil is mainly dark-red sandy clay loam. Sandstone and quartzite gravel and cobbles, as much as 8 inches in diameter, are on the surface and throughout the soil. These soils occur on uplands and foot slopes. Permeability is moderate, infiltration is moderately low, runoff is medium and rapid and the capacity for supplying available moisture is low. Natural fertility is low to moderate and organic matter is low.

2.4 Hydrogeology

The hydrogeology of McClellan is discussed in the following subsections. Information contained in these subsections is adapted from previous work performed by Shaw (2004).

2.4.1 Regional Hydrogeology

The hydrogeology of Calhoun County has been investigated by the Geologic Survey of Alabama (Moser and DeJarnette, 1992) and the U.S. Geological Survey (USGS) in cooperation with the Geological Survey of Alabama (Warman et al., 1960) and ADEM (Planert and Pritchette, 1989). Groundwater in the vicinity of McClellan occurs in residuum derived from bedrock decomposition within fractured bedrock along fault zones and from the development of karst frameworks. Groundwater flow direction is generally toward major surface water features. Areas with well-developed residuum horizons may subtly reflect the surface topography, but the groundwater flow direction also may exhibit the influence of pre-existing structural fabrics or the presence of perched water horizons on unweathered ledges or impermeable clay lenses.

Precipitation and subsequent infiltration provide recharge to the groundwater flow system in the region. The main recharge areas for the aquifers in Calhoun County are located in the valleys. The ridges generally consist of sandstone, quartzite, and slate which are resistant to weathering, relatively unaffected by faulting, and therefore, relatively impermeable. The ridges have steep slopes and thin to no soil cover, which enhances runoff to the edges of the valleys (Planert and Pritchette, 1989).

The thrust fault zones typical of the county form large storage reservoirs for groundwater. Points of discharge occur as springs, effluent streams, and lakes. Coldwater Spring is one of the largest springs in the State of Alabama, with a discharge of approximately 32 million gallons per day. This spring is the main source of water for the Anniston Water Department, and serves McClellan. The spring is located approximately five miles southwest of Anniston and discharges from the brecciated zone of the Jacksonville Fault (Warman et al., 1960).

Shallow groundwater at McClellan occurs principally in the residuum developed from Cambrian sedimentary and carbonate bedrock units of the Weisner Formation, the Shady Dolomite and locally in lower Ordovician carbonates. The residuum may yield adequate groundwater for domestic and livestock needs but may go dry during prolonged dry weather. Groundwater within the residuum serves as a recharge reservoir for the underlying bedrock aquifers. Bedrock permeability is locally enhanced by fracture zones associated with thrust faults and by the development of solution (karst) features.

Two major aquifers were identified by Planert and Pritchette (1989): the Knox-Shady aquifer and the Tuscumbia-Fort Payne aquifer. The continuity of these aquifers has been disrupted by the complex geologic structure of the region, such that each major aquifer occurs repeatedly in different areas. The Knox-Shady aquifer group occurs over most of Calhoun County and is the main source of groundwater in the county. It consists of the Cambrian-and-Ordovician aged quartzite and carbonates. The Conasauga Formation is the most utilized unit of the Knox-Shady aquifer, with twice as many wells drilled as any other unit (Moser and DeJarnette, 1992).

Regional groundwater flow in the bedrock for the McClellan vicinity was described by the USGS (Scott, et al., 1987). Regional groundwater elevation ranged from 800 feet above mean sea level (amsl) at McClellan to about 600 feet amsl to the west on Pelham Range, based on water depths in wells completed across multiple formations. Groundwater elevation contours suggest that regional groundwater flow is from McClellan toward the northwest. Scott et al. (1987) concluded that the groundwater surface broadly coincides with the surface topography and that the regional aquifers are hydraulically connected. Groundwater flow on a local scale may be more complex and affected by geologic structures such as the shallow thrust faults, rock fracture systems, and karst development in soluble formations.

2.4.2 Site-Specific Hydrogeology

Groundwater levels were measured in the monitoring wells at Training Area T-38 as part of the RI conducted by Shaw (2004) and the 2005 RFI. These groundwater levels are discussed in the following subsections.

2.4.2.1 2003 RI Groundwater Levels

Static groundwater level data were collected on several occasions from March 2000 to June 2003 (Shaw, 2004). Groundwater elevation maps were constructed using the 2003 data. Figure 2-6 presents the April 2003 groundwater elevation data, and Figure 2-7 presents the June 2003 groundwater elevation data as interpreted by Shaw during the 2003 RI. The two groundwater elevation events performed in 2003 were intended to capture data from an above-average period of precipitation (April) and from a below-average period of precipitation (June).

As indicated in the figures, groundwater flow in 2003 followed the topography in a radial pattern off the ridge, with a steep gradient on the western side of the ridge and a lesser gradient on the eastern side. The net groundwater flow is westward away from the ridge and higher topography to the east. Shaw concluded that flow on the east slope is probably influenced by the dip of the Shady Dolomite and Jacksonville Fault. In the Shaw 2004 RI Report, horizontal hydraulic gradients were calculated using the June 2003 water level data and average horizontal gradients of 0.1954 and 0.0738 feet per foot (ft/ft) were calculated for the west slope and east slope, respectively (Shaw, 2004). It should be noted that due to the steep topography, differences in well screen elevation, and slope of the water table; horizontal gradients calculated by Shaw may include vertical force components and may be more correctly interpreted as water table gradients.

Vertical hydraulic gradients were calculated by Shaw for six well clusters (Shaw, 2004). The gradients were calculated from hydraulic head differences for groundwater elevations for April and June 2003. Shaw noted that the upward vertical gradient observed between wells CWM-186-MW02 and CWM-186-MW26 probably reflected the horizontal separation between the wells and the difference in ground elevations and the strong downward gradient observed in CWM-186-MW01 and CWM-186-MW32 in April 2003 was consistent with an area of recharge at the crest of the ridge. In addition, Shaw surmised that a downward gradient from the residuum to bedrock between CWM-186-MW01 and CWM-186-MW25, and CWM-186-MW08 and CWM-186-MW21 may arise from a difference in head across the Jacksonville Fault (Shaw, 2004).

2.4.2.2 2005 RFI Groundwater Levels

Groundwater levels were measured in the monitoring wells at Training Area T-38 on May 31 and June 1, 2005, and on October 24, 2005. The 2005 RFI groundwater levels, flow patterns, and hydraulic gradients are presented and discussed in Section 5.1.

2.5 Surface Water Hydrology

Rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at McClellan include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County. The entire central portion of McClellan is drained by these three major creeks and their tributaries. South Branch of Cane Creek receives runoff from the south-central portion then joins Cane Creek before leaving the reservation on the western boundary. Cane Creek receives surface runoff from the central section. The north-central section of McClellan is drained by Cave Creek, which leaves the post on the northwestern boundary. Other surface water features at McClellan include Lake Yahou (13.5 acres), Reilly Lake (8.5 acres), Cappington Ridge (0.3 acres), Duck Pond (0.5 acre), and an aqueduct. Surface drainage is collected in small, independent networks that drain areas varying from 20 to 60 acres. The Cane/Cave Creek watershed is among the six major watersheds occurring within Calhoun County. Cane Creek, with its tributaries (Remount Creek, South Branch of Cane Creek, and Ingram Creek), originates on the McClellan Reservation. Cave Creek, which occurs as a separate body on McClellan, originates on McClellan and discharges into Cane Creek outside McClellan. The McClellan drainage area of this system covers approximately 20 square miles. Dothard Creek headwaters originate on McClellan and flow north into the Tallasseehatchee Creek. These creek systems originate in the Choccolocco Mountains on the eastern boundary of McClellan and flow west through central McClellan. They are fed by springs originating from underlying strata (MES, 2004).

Surface run-off at Training Area T-38 follows the general topography and is divided into north and south components. Two small tributaries drain the northern portion of the parcel and flow north to join a larger, westward-flowing tributary of Cave Creek. This tributary cuts across the northern end of the parcel and joins Cave Creek 500 feet to the west. A surface water quality survey was performed along the tributary as part of a supplemental RI performed by Shaw

(2004). Drainage of the southern part of the site flows off the ridge from two minor tributaries, one flowing to the west and one to the south; these tributaries eventually drain into Cane Creek (Shaw, 2004).

Springs are not uncommon in Calhoun County, and may occur at fault contacts and in topographic low areas where the groundwater intersects the ground surface. Four springs/seeps have been observed on the flanks of Reservoir Ridge. Two are located on the tributaries draining the northern area of the Site, and two are located on tributaries draining the southern area of the Site. Groundwater discharge from the springs generally appears to be associated with the Site. This observation is based on screening and other sampling data that showed similar contaminants to those found in monitoring wells at the Site.

2.6 Wetlands

McClellan contains an estimated 3,424 acres of delineated wetlands. Major wetland communities were originally characterized and mapped in 1984 with supplementary mapping performed in 1992. Wetland habitats within McClellan are generally located in the valleys along creek floodplains, near streams, and in topographical depressions. The indicator plant species that assist in defining a wetland include water oaks, sweet gum, bulrush, needlerush, and cattail (IT, 2002). Wetland communities found on the Main Post are the Marcheta Hill Orchard Seep, Cane Creek Seep, South Branch of Cane Creek, and 200 acres west of Reilly Airfield (Endangered Species Management Plan [ESMP]) (Garland, 1996). In addition, the area in the southeast-eastern corner of Training Area T-38 (the lower southeastern slopes of Reservoir Ridge) has been designated a wetland area (IT, 2002). Wetland habitat may also exist at or around the installation's lake and creeks, for example Lake Reilly and Lake Yahou, and Cane Creek and Cave Creek (IT, 2002).

2.7 Sensitive Habitats

The ESMP (Garland, 1996) developed for McClellan identified 11 special interest natural areas (SINAs) within McClellan. SINAs are locations where the habitat fosters one or more rare, threatened, or endangered species. Because these species are sensitive to environmental degradation, SINAs require management practices that promote the continued well being of these ecosystems. According to the ESMP, the 11 SINAs located on McClellan include:

- Mountain Longleaf Community Complex
- Cave Creek Seep
- Moorman Hill Mountain Juniper
- Frederick Hill Aster Site
- Bains Gap Seep
- Marcheta Hill Crow-Poison Seep
- Marcheta Hill Orchid Seep
- South Branch of Cane Creek Seep
- Stanley Hill Chestnut Oak Forest
- Reynolds Hill Turkey Oak
- Davis Hill Honeysuckle.

No SINAs are associated with Training Area T-38 (IT, 2002 and Garland, 1996).

2.8 Threatened and Endangered Species

The following species, listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), have been recorded on McClellan (IT, 2002):

- Gray Bat (*Myotis grisescens*)
- Blue Shiner (*Cyprinella caerulea*)
- Mohr's Barbara Buttons (*Marshallia mohril*)
- Tennessee Yellow-Eyed Grass (*Xyris tennessensis*)

The Blue Shiner, Mohr's Barbara Buttons, and Tennessee Yellow-Eyed Grass have not been observed at Training Area T-38 (Garland, 1996). The Gray Bat (*Myotis grisescens*) uses the Cane Creek Corridor as a foraging habitat, and the South Branch of Cane Creek was identified as a potential habitat for the Gray Bat (IT, 2002). The potentiality of the habitat is based on surface water drainage patterns in the southern part of Training Area T-38, which indicate flow off the ridge from two minor tributaries that eventually drains into Cane Creek, creating a potential habitat for the Gray Bat. An additional endangered species, the red-cockaded woodpecker, historically has inhabited McClellan, but has not been observed at McClellan in the recent past (Garland, 1996).

2.9 Meteorology

McClellan has a temperate continental, humid climate. The annual rainfall is distributed throughout the year but tends to be heavier during the winter and spring months. The average annual precipitation totals about 53 inches. Most flood-producing storms are frontal type, and occur during the winter and spring. Summer thunderstorms have also been known to cause local flooding. Snow accumulation is generally 1 inch or less. Temperature extremes range from a few degrees below freezing to just over 100 degrees Fahrenheit (°F). Summer temperatures of 90°F or more occur about 70 days per year, and the average annual temperature is 63°F. Frosts are common but usually of short duration. Winds are typically light breezes with no persistent direction. Tornadoes are rare but do occur in the area. Humidity is moderate during cooler months and high during the warmer part of the year.

2.10 Floodplains

The Federal Emergency Management Agency (FEMA) has identified "Special Flood Hazard Areas" based on an area with a 1 percent annual chance of inundation by flooding for which base flood elevations or velocities may have been determined. Training Area T-38 is not within a recognized FEMA floodplain (IT, 2002).

3.0 PREVIOUS INVESTIGATIONS

This section describes previous investigations performed at Training Area T-38 (the Site) including:

- 1992-1993 Site Investigation (SAIC, 1993)
- 1994-1995 Remedial Investigation (SAIC, 1995)
- Environmental Baseline Study (ESE, 1998)
- Seep Screening (1999-2000) (Shaw, 2004)
- Engineering Evaluation/Cost Analysis (EE/CA) (Parsons, 2002)
- Supplemental Remedial Investigations (2000-2002) (Shaw, 2004)
- 3X Scrap Removal (2003-2004) (Shaw, 2005)

3.1 1992-1993 Site Investigation

SAIC conducted a Site Investigation (SI) in 1992 and 1993 to assess the presence or absence of environmental contamination resulting from training activities at the Site (SAIC, 1993). The investigation included a surface electromagnetic (EM) geophysical survey and the collection of four soil samples. A total of four soil borings were advanced at the Site, including two borings downslope of the concrete pad in the northeast corner of the Site, one boring in the vicinity of a possible drum burial site in the southern portion of the Site, and one boring near a possible disposal pit in the east-central portion of the Site. Four soil samples were collected and field screened using a miniature continuous air monitoring system (MINICAMS) for CWM (HD, VX, and GB). CWM was not detected in any of the soil samples at concentrations above the 0.8 milligrams per cubic meter (mg/m^3) time weighted average (TWA) (SAIC, 2000).

In addition to the field screening, two soil samples were collected from each of the four soil borings at depths of 1 foot bgs and 5 feet bgs. The soil samples were analyzed for CWM breakdown products using U.S. Army Toxic and Hazardous Material Agency (USATHAMA) analytical methods. The soil analytical results indicated that CWM breakdown products were not detected in the samples at levels above reporting limits (Shaw, 2004).

3.2 1994-1995 Remedial Investigation

SAIC performed a RI to assess the presence, nature, and extent of potential environmental contamination resulting from training activities and chemical waste disposal activities at the Site (SAIC, 1995; 2000). RI field activities included MINICAMS screening for CWM (HD, GB, and VX) on 72 soil samples from 47 locations. CWM was not detected above the 0.8 mg/m^3 TWA in the screened samples (Shaw, 2004).

Four subsurface soil samples were collected from three borings and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosives, metals, and CWM breakdown products. Analytical results

indicated that metals, pesticides, and non-target SVOCs were detected in some soil samples. VOCs, PCBs, and CWM breakdown products were not detected in the soil samples (SAIC, 2000).

Metals detected in soil above background levels included aluminum, beryllium, chromium, cobalt, copper, iron, lead, mercury, nickel, vanadium, and zinc. Four pesticides (4,4'-DDD, 4,4'-DDT, 4,4'-DDE, and aldrin) were detected in the soil samples collected from borings T38-S09 and T38-S10. Pesticides were also detected in boring T38-S06 (Shaw, 2004).

Five groundwater monitoring wells (T38-G05 through T38-G09) were installed during this RI (SAIC, 2000). Four wells were initially installed and sampled during July 1994 and February 1995. An additional well, T-38-G09, was installed at an upgradient location after groundwater contamination was detected in the four original wells. Samples from the wells were analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, metals, and CWM breakdown products (Shaw, 2004). Metals, VOCs, SVOCs, pesticides, and explosives were detected in groundwater at the Site.

Eight VOCs, acetone, carbon tetrachloride, chloroform, 1,1,2,2-PCA, total 1,2-dichloroethene, trichloroethene (TCE), 1,1,2-trichloroethane (1,1,2-TCA), and tetrachloroethene (PCE), were detected in groundwater at the Site (Shaw, 2004). 1,1,2,2-PCA was detected in wells T38-G05 through T38-G08 at concentrations ranging from 95 to 2,000 micrograms per liter (µg/L), with the highest concentration in well T38-G06. TCE was detected at concentrations ranging from 12 to 300 µg/L in wells T38-G05 through T38-G08, with the highest concentration in well T38-G06. Total 1,2-dichloroethene was found in wells T38-G06 and T38-G07 at concentrations ranging from 31 to 93 µg/L, with the highest concentration in well T38-G06. Acetone (47 to 77 µg/L), carbon tetrachloride (11 to 53 µg/L), and chloroform (6.8 to 9.2 µg/L) were detected in wells T38-G06 ad T38-G07, with maximum concentrations found in well T38-G07. Acetone, carbon tetrachloride, and chloroform were not detected in wells T38-G05 and T38-G08. 1,1,2-TCA was detected in well T38-G05 at a concentration of 21 µg/L. PCE was detected in T38-G06 at a concentration of 13 µg/L. Organic compound concentrations were below detection limits in well T38-G09. Shaw came to the conclusion that the organic solvents detected in groundwater at the Site were most likely associated with the use of decontamination solutions (Shaw, 2004).

SVOCs detected in groundwater included benzo(b)flouranthene, bis(2-ethylhexyl)phthalate, chrysene, and indeno(1,2,3-cd)pyrene. Benzo(b)flouranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected in T38-G09 at concentrations of 0.247, 0.0509 and 0.81 µg/L, respectively. Bis(2-ethylhexyl)phthalate was detected in wells T38-G05, T38-G06, and T38-G09 at concentrations of 32, 3.4, and 11 µg/L, respectively (Shaw, 2004).

Six pesticides including alpha-BHC, delta-BHC, endrin aldehyde, heptachlor, heptachlor epoxide, and isodrin were detected in wells T38-G05 through T38-G08. However, the pesticide results were unconfirmed and pesticides were detected in the method blank and QC blank samples (Shaw, 2004).

Three explosives (1,3-dinitrobenzene, 1,3,5-trinitrotoluene, and nitroglycerine) were detected in

groundwater at the Site. Nitroglycerine was found in wells T38-G05 through T38-G08, 1,3-dinitrobenzene was detected in T38-G07, and 1,3,5-trinitrotoluene was detected in wells T38-G08 and T38-G09 (Shaw, 2004).

RI activities also included additional surface EM geophysical surveys conducted in two areas: the reported area of a sump located in the central portion and a possible buried drum in the southern portion of the Site. In addition, a tandem magnetometer survey was conducted over open areas of the Site. Results of the survey were inconclusive (Shaw, 2004).

3.3 Environmental Baseline Study

The Environmental Baseline Study (EBS) was performed by ESE to document existing environmental conditions of the McClellan property (ESE, 1998). The EBS identified sites that, based on available information, had no history of contamination and complied with DOD guidance on fast-track cleanup at closing installations. The EBS also provided a baseline depiction of McClellan properties by identifying and categorizing the properties using seven categories:

1) Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred.
2) Areas where only release or disposal of petroleum products has occurred.
3) Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require removal or remedial response.
4) Areas where release, disposal and/or migration of hazardous substances has occurred and all removal or remedial actions to protect human health and the environment have been taken.
5) Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken.
6) Areas where release, disposal and/or migration of hazardous substances has occurred but required actions have not been implemented.
7) Areas that are not evaluated or require additional evaluation.

The EBS was performed in accordance with protocols of the Community Environmental Response Facilitation Act (CERFA) (Public Law 102-426) and DOD policy regarding contamination assessment. Activities performed as part of the EBS included:

- Record searches and reviews on reasonably available documents from McClellan, ADEM, EPA Region IV, and Calhoun County.
- Database search of CERCLA-regulated substances, petroleum products, and RCRA-regulated facilities.
- Reviewed available historical maps and aerial photographs to document historical land uses.
- Conducted personal and telephone interviews of past and present McClellan employees and military personnel.

- Performed visual site inspections were to verify conditions of specific property parcels.

Training Area T-38 was identified as a CERFA Category 6 parcel in the EBS, indicating that release, disposal, and/or migration of hazardous substances had occurred, but required actions had not been implemented (ESE, 1998). Subsequent investigations at Training Area T-38 were performed as described in the following sections.

3.4 IT Seep Screening

During a Site visit in December 1999, IT personnel observed four seeps, CWM-186-SEEP01 through CWM-186-SEEP04. CWM-186-SEEP01 is located approximately 650 feet southwest of the fenced area, on the southwestern flank of Reservoir Ridge. CWM-186-SEEP02 discharges into Cave Creek approximately 1,000 feet north of the fenced area in the northern portion of the Site. CWM-186-SEEP03 is located approximately 850 feet northeast of the fenced area, on the northeastern flank of Reservoir Ridge. CWM-186-SEEP04 is located approximately 1,200 feet southeast of the fenced area in the southeastern portion of the Site. Water samples were collected from the four seeps to assess the presence of contamination (Shaw, 2004).

Preliminary results indicated that site-related organic compounds were detected in three of the four water samples. TCE and 1,1,2,2,-PCA were detected in CWM-186-SEEP01, CWM-186-SEEP02, and CWM-186-SEEP03. TCE was found at concentrations 55 µg/L (estimated), 15 µg/L, and 0.82 µg/L (estimated) in CWM-186-SEEP01, CWM-186-SEEP02, and CWM-186-SEEP03, respectively. Concentrations of 1,1,2,2-PCA at 1 µg/L, 45 µg/L, and 0.52 µg/L (estimated) were detected in CWM-186-SEEP01, CWM-186-SEEP02, and CWM-186-SEEP03, respectively. Other organic compounds detected in CWM-186-SEEP01 and CWM-186-SEEP02 included carbon tetrachloride at 0.42 µg/L (estimated) and 1.6 µg/L (estimated), chloroform at 0.68 µg/L (estimated) and 0.6 µg/L (estimated), cis-1,2-dichloroethene (cis-1,2-DCE) at 0.35 µg/L (estimated) and 3.3 µg/L, and 1,1,2-TCA at 0.36 µg/L (estimated) and 0.73 µg/L (estimated), respectively. PCE and trans-1,2-drichloroethene (trans-1,2-DCE) were detected in CWM-186-SEEP02 at estimated concentrations of 0.82 µg/L and 0.63 µg/L, respectively. Chloromethane was detected in CWM-186-SEEP02 at an estimated concentration of 0.14 µg/L. A second round of seep samples was collected from CWM-186-SEEP02 and CWM-186-SEEP03 in August 2000 to support the selection of the monitoring well locations (Shaw, 2004).

3.5 Engineering Evaluation/Cost Analysis

Parsons conducted an Engineering Evaluation/Cost Analysis (EE/CA) at 33 McClellan sites, including Training Area T-38, to evaluate potential CWM contamination or other subsurface disposal. Geophysical surveys, trenching and excavation of suspect anomalies, continuous air monitoring, soil sampling, and laboratory analysis of soil samples for CWM and agent breakdown products were conducted during this investigation (Parsons, 2002).

The geophysical survey, conducted within the fenced area, identified numerous geophysical anomalies. Investigative trenching was conducted at the location of the suspected disposal pit area and eleven CWM scrap items were encountered during the trenching activities. The scrap items did not contain chemical agents and were not categorized as explosives. Items recovered

during the investigation included 55-gallon CWM drums, 4.2 inch mortars, glass vials, and numerous FS smoke balls. Nine soil samples were collected and analyzed during the trenching activities in the sump area. GB, HD, VX, and breakdown products (1,4-thioxane, and 1,4-dithiane) were not detected above the reporting limits in the soil samples (Parsons, 2002).

Two soil borings were installed in the southern portion of the Site during the EE/CA. Two soil samples were collected from each boring at depths of 0.5 to 1 foot and 3.5 to 4 feet bgs. The samples were analyzed for GB, HD, VX, and breakdown products, but were not detected above the reporting limits.

Four rusted, empty drums were observed in the vicinity of a water tank located approximately 1,600 feet south of the fenced area. Soil samples were collected near the drums and within one of the drums. GB, HD, VX, and breakdown products were not detected above the reporting limits (Parsons, 2002).

Parsons found no evidence of residual chemical agent in soil during this evaluation. Suspect CWM-related items were excavated and disposed of during the investigation. Parsons concluded that only a "remote" risk of exposure to CWM exists at the Site (Parsons, 2002). Therefore, Parsons recommended "No Further Action" with regard to CWM at Training Area T-38 (Parsons, 2002).

3.6 Supplemental Remedial Investigations

Shaw conducted site investigation activities that included environmental sampling and analysis, and groundwater monitoring well installation. These activities were conducted in several phases from 2000 to 2003 (Shaw, 2004):

- Supplemental RI Field Activity, 2000-2002
- Supplemental RI Addendum, 2002
- Supplemental RI Addendum II (Source Area Investigation), 2002-2003

3.6.1 Supplemental RI Field Activity, 2000-2002

Supplemental RI field activities were conducted by Shaw in three phases from September 2000 to March 2002 (Shaw, 2004).

- Phase 1 was conducted from September 2000 to January 2001 and consisted of drilling and collecting discrete groundwater samples from 14 deep temporary soil borings. A surface water quality survey was also conducted along a portion of Cave Creek and a tributary.
- Phase II was conducted from February 2001 to February 2002 and consisted of the installation of seven residuum wells and 16 bedrock wells (CWM-186-MW07 to CWM-186-MW11, CWM-186-MW13 to CWM-186-MW16, CWM-186-MW18 to CWM-186-MW26, and CWM-186-MW28 to CWM-186-MW32). Installation of the Phase II wells commenced in February 2001 and was completed by October 2001 for all but two of the residuum wells. The two remaining residuum wells (CWM-186-MW31 and CWM-186-

MW32) were not installed until February 2002, after the EE/CA had been completed within the fenced area. Thirteen surface soil samples and 17 subsurface soil samples were collected at locations CWM-186-MW06 to CWM-186-MW13, CWM-186-MW25, CWM-186-MW26, CWM-186-MW29, CWM-186-MW31, and CWM-186-MW32. The soil samples were submitted for analysis of VOCs, SVOCs, metals, explosives, and CWM breakdown products.

- Phase III was conducted from January 2001 to October 2001, and in March 2002, and consisted of seep, surface water, sediment, depositional soil, and groundwater sampling. Four seeps were collected in January 2001 and submitted for analysis of VOCs, SVOCs, metals, explosives, and CWM breakdown products. Four co-located surface water and sediment samples and three depositional soil samples were collected in January 2001 and March 2001 and submitted for analysis of VOCs, SVOCs, metals, explosives, and CWM breakdown products. The sediment samples were also submitted for analysis of total organic carbon (TOC). Groundwater samples were collected from the 23 wells installed during Phase II, and from 5 existing SAIC wells (CWM-186-MW01 to CWM-186-MW05 [SAIC well IDs T-38-G05 to T-38-G09, respectively]) and submitted for analysis of VOCs, SVOCs, metals, explosives, and CWM breakdown products. The groundwater samples were collected from May 2001 to October 2001 for all but the two residuum wells within the fenced area; the two residuum wells within the fenced area were sampled in March 2002.

3.6.2 Supplemental RI Addendum, 2001-2002

The Supplemental RI demonstrated the need to further define the extent of VOCs in the bedrock aquifer. Therefore, additional investigative activities were conducted, including the installation of 6 more wells, 2 residuum and 4 bedrock (CWM-186-MW33 to CWM-186-MW38), from August 2001 through January 2002, and groundwater sample collection in March 2002. The groundwater samples were submitted for analysis of VOCs, SVOCs, metals, explosives, and CWM breakdown products (Shaw, 2004).

3.6.3 Supplemental RI Addendum II (Source Area Investigation), 2002-2003

Groundwater data from the discrete groundwater samples and from monitoring wells close to the fenced area suggested that dense non-aqueous phase liquids (DNAPL) may be present hydraulically upgradient, within the fenced area. Based on available groundwater data and the suspected disposal pit location from the EE/CA, it was concluded that additional investigation within the fenced area was necessary to further evaluate the soil and delineate potential sources of groundwater contamination. Additional sampling was needed at the possible dump area approximately 1,500 feet south of the fence, along the southern boundary of the Site (Shaw, 2004). The Supplemental RI Addendum II field activities were conducted primarily within the fenced area and included the following (Shaw, 2004):

- Twenty-two surface soil and 48 subsurface soil samples were collected from locations CWM-186-GP01 to CWM-186-GP16 and CWM-186-MW39 to CWM-186-MW55 between October 2002 and February 2003 and analyzed for VOCs, SVOCs, metals, and explosives. Eight locations (CWM-186-GP07, CWM-186-GP10, CWM-186-GP11,

CWM-186-GP15, CWM-186-GP16, CWM-186-MW46, CWM-186-MW48, and CWM-186-MW55) were also analyzed for CWM breakdown products, and two locations (CWM-186-GP10 and CWM-186-GP11) were also analyzed for dioxins.

- Seventeen residuum wells, CWM-186-MW39 to CWM-186-MW55, were installed; drilling began in October 2002 and well installation was completed in March 2003. Five of the monitoring wells, CWM-186-MW49 to CWM-186-MW53, were installed just outside the fenced area, in peripheral downgradient locations. Two monitoring wells, CWM-186-MW54 and CWM-186-MW55, were installed at the 3-acre dump area near the southern boundary of the Site. During drilling, discrete groundwater samples were collected from 6 of the monitoring wells. During drilling, soil samples were collected from locations CWM-186-MW39 to CWM-186-MW55 and analyzed for VOCs, SVOCs, metals, and explosives. CWM-186-MW46, CWM-186-MW48, and CWM-186-MW55 were also analyzed for CWM breakdown products.
- Groundwater samples were collected from 17 newly installed monitoring wells and 34 existing monitoring wells, conducted from April 2003 through June 2003. The groundwater samples were analyzed for VOCs.
- Water measurements were collected in April and June 2003.
- Four seep samples, CWM-186-SEEP01 to SEEP04, were collected in July 2003.

3.6.4 Summary of Analytical Results

The analytical results for the samples collected at the Site showed detections for VOCs, SVOCs, metals, explosives, CWM products, and dioxins. To evaluate the nature and extent of contamination, the analytical results were compared to human health site-specific screening levels (SSSLs), ecological screening values (ESVs), and background screening values for McClellan (Shaw, 2004). The SSSLs and ESVs were developed by Shaw as part of the human health and ecological risk evaluations associated with site investigations conducted under the BRAC Environmental Restoration Program at McClellan. The SSSLs, ESVs, and polynuclear aromatic hydrocarbon (PAH) background screening values are presented in the *Human Health and Ecological Screening Values and PAH Background Summary Report* (IT, 2000). The PAH background screening values were developed by Shaw at the direction of the BRAC Cleanup Team to address the occurrence of PAH compounds in surface soils at McClellan. Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998).

3.6.4.1 Surface and Depositional Soil Samples

A total of 35 surface soil samples and three depositional soil samples were collected at the Site; 13 surface soil and three depositional soil samples during the Supplemental RI, and 22 surface soil samples during the Addendum II of the RI. The surface and depositional soil samples were collected in the uppermost foot of soil. Analytical results for the surface and depositional soil samples were compared to residential SSSLs, ESVs, and metals and PAH background screening values (Shaw, 2004).

VOCs

Eleven VOCs were detected in the surface and depositional soil samples: 1,1,2,2-PCA,

2-butanone, acetone, carbon disulfide, cis-1,2-DCE, ethylbenzene, methylene chloride, p-isopropyltoluene (p-cymene), PCE, toluene, and trichlorofluoromethane. The detected VOC concentrations were below SSSLs and ESVs, except for acetone which exceeded the ESV but not the SSSL in sample CWM-186-MW11.

SVOCs
Four SVOCs, benzo(g,h,i)perylene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and fluoranthene, were detected at estimated concentrations in one surface soil sample, CWM-186-MW12. The detected SVOC concentrations were below SSSLs and ESVs, except for fluoranthene which exceeded the ESV but not the SSSL.

Explosives
Two explosive compounds, 2,4-dinitrotoluene and 3-nitrotoluene, were detected at estimated concentrations in one surface soil sample each (CWM-186-MW07 and CWM-186-MW12, respectively) at concentrations below SSSLs and ESVs.

Metals
Twenty-three metals were detected in the surface and depositional soil samples. Aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium exceeded SSSLs and background screening values in one or more samples. Aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc exceeded ESVs and background screening values in one or more samples.

CWM Breakdown Products
Twenty-four of the 38 surface and depositional soil samples were analyzed for CWM breakdown products. One CWM breakdown product (thiodiglycol) was detected at one surface soil location, CWM-186-GP15.

Dioxins
Two of the 38 surface and depositional soil samples (CWM-186-GP10 and CWM-186-GP11) were analyzed for dioxins. A total of 18 dioxin congeners were detected in the samples, but were below SSSLs and ESVs.

3.6.4.2 Subsurface Soils

A total 65 subsurface soil samples were collected from 46 locations at the Site; 17 subsurface soil samples at 13 well locations during the Supplemental RI, and 48 subsurface soil samples at 33 well locations during the Addendum II of the RI. During the Supplemental RI, the subsurface soil samples were collected continuously to 12 feet bgs or until either groundwater or refusal was reached. During the Addendum II of the RI, the subsurface soil samples were collected continuously to 12 feet bgs and thereafter at 5 foot intervals to a maximum depth of approximately 100 feet (Shaw, 2004). At least one subsurface soil sample was collected for analysis from the 1 foot-to-12 feet interval of each boring. Additional subsurface soil samples were collected for VOC analysis from depths greater than 12 feet if field screening results indicated the presence of organic vapor or fluids. Analytical results for the subsurface soil samples were compared to residential SSSLs and background screening values (Shaw, 2004).

VOCs
Twenty-one VOCs were detected in the subsurface soil samples. The detected VOC concentrations were below SSSLs, except for 1,1,2,2-PCA which exceeded the SSSL in six samples from four locations (CWM-186-GP10, CWM-186-GP14, CWM-186-GP15, and CWM-186-MW40).

SVOCs
Fifty of the 65 subsurface soil samples were analyzed for SVOCs. Fluoranthene was detected in one subsurface soil sample, CWM-186-MW12, at an estimated concentration below the SSSL.

Explosives
Fifty of the 65 subsurface soil samples were analyzed for explosives. No explosives were detected in the subsurface soil samples.

Metals
Fifty of the 65 subsurface soil samples were analyzed for metals. Twenty-one metals were detected in the subsurface soil samples. Nine metals, aluminum, antimony, arsenic, barium, chromium, iron, manganese, thallium, and vanadium, had concentrations that exceeded SSSLs and background screening values in one or more samples.

CWM Breakdown Products
Twenty-five of the 65 subsurface soil samples were analyzed for CWM breakdown products. Thiodiglycol was detected at one subsurface soil sample, CWM-186-GP15, at an estimated concentration below the SSSL.

Dioxins
Two of the 65 subsurface soil samples (CWM-186-GP10 and CWM-186-GP11) were analyzed for dioxins. A total of 7 dioxin congeners were detected in the samples, but were below SSSLs.

3.6.4.3 Groundwater

A total of 46 monitoring wells were installed at the Site; 23 during the Supplemental RI, and 6 during the Addendum for the Supplemental RI. A total of 86 groundwater samples were collected from 51 monitoring wells at the Site. Analytical results for the groundwater samples were compared to residential SSSLs and background screening values (Shaw, 2004).

VOCs
Twenty-six VOCs were detected in the groundwater samples. 1,1,1,2-Tetrachloroethane (1,1,1,2-PCA), 1,1,2,2-PCA, 1,1,2-TCA, 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), acetone, bromodichloromethane, carbon tetrachloride, chloroform, cis-1,2-DCE, trans-1,2-dichloroethene (trans-1,2-DCE), PCE, TCE, and vinyl chloride had concentrations above the SSSLs.

SVOCs
Thirty-four of the 86 groundwater samples were analyzed for SVOCs. Three SVOCs, benzo(g,h,i)perylene, bis(2-ethyl)phthalate, or phenol, were detected in eight of the groundwater

samples. The benzo(g,h,i)perylene and phenol results were at estimated concentrations below SSSLs. The bis(2-ethyl)phthalate results were flagged, indicating that the compounds were also detected in an associated laboratory or field blank sample.

Explosives
Thirty-four of the 86 groundwater samples were analyzed for explosives. RDX, 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, and tetryl were detected in four samples. Six of the seven explosives were detected in the sample collected from CWM-186-MW31. Only 2-nitrotoluene was detected in the other three samples, CWM-186-MW15, CWM-186-MW23, and CWM-186-MW24. The explosives concentrations were below SSSLs.

Metals
Thirty-four of the 86 groundwater samples were analyzed for metals. Twenty-one metals were detected in the groundwater samples. Aluminum, antimony, barium, beryllium, iron, lead, manganese, and thallium had concentrations that exceeded SSSLs and background screening values. Chromium, nickel, and vanadium had concentrations that exceeded SSSLs. No background screening values were available for these three metals.

CWM Breakdown Products
Thirty-three of the 86 groundwater samples were analyzed for CWM breakdown products. Thiodiglycol was detected in two samples, CWM-186-MW25 and CWM-186-MW30. 1,4-Dithiane was detected in one sample, CWM-186-MW08. The thiodiglycol and 1,4-dithiane concentrations were below SSSLs.

3.6.4.4 Seep Water

A total of 11 seep water samples were collected from four groundwater discharge locations, CWM-186-SEEP01 to CWM-186-SEEP04, at the base of Reservoir Ridge. Each seep was sampled three times except CWM-186-SEEP04, which was sampled twice. Analytical results for the seep samples were compared to recreational SSSLs, ESVs, and metals and PAH background screening values (Shaw, 2004). To differentiate the identification of the seep samples collected during Shaw's RI from the seep samples collected during the 2005 RFI, the sample IDs for the seeps collected by Shaw were assigned a suffix of "RI" on the tables and figures presented in this report (see Sections 4.4 and 5.5.2 for further details).

VOCs
Eleven VOCs were detected in the seep samples: 1,1,2,2-PCA, 1,1,2-TCA, carbon disulfide, carbon tetrachloride, chloroform, cis-1,2-DCE, methylene chloride, styrene, PCE, trans-1,2-DCE, and TCE. The detected VOC concentrations were below SSSLs and ESVs, except for 1,1,2,2-PCA which exceeded the SSSL in three samples from CWM-186-SEEP03.

SVOCs
Seven of the 11 seep samples were analyzed for SVOCs. No SVOCs were detected in the seep samples.

Explosives
Seven of the 11 seep samples were analyzed for explosives. No explosives were detected in the seep samples.

Metals
Seven of the 11 seep samples were analyzed for metals. Sixteen metals were detected in the seep samples. Thallium exceeded the SSSL and background screening value in sample CWM-186-SEEP01. Aluminum, barium, beryllium, lead, and thallium had concentrations that exceeded the ESVs and background screening values.

CWM Breakdown Products
Seven of the 11 seep samples were analyzed for CWM breakdown products. No CWM breakdown products were detected in the seep samples.

3.6.4.5 Surface Water

Four surface water samples were collected from the intermittent streams and Cave Creek and analyzed for VOCs, SVOCs, explosives, metals, and CWM breakdown products. Analytical results for the surface water samples were compared to recreational SSSLs, ESVs, and background screening values (Shaw, 2004).

VOCs
TCE was detected at one sample location, CWM-186-SW/SD06, at an estimated concentration below its SSSL and ESV.

SVOCs
No SVOCs were detected in the surface water samples.

Explosives
No explosives were detected in the surface water samples.

Metals
Twelve metals were detected in the surface water samples. Chromium exceeded the SSSL, ESV, and background screening value in sample CWM-186-SW/SD06. It was noted by Shaw (2004) that the surface water sample collected at CWM-186-SW/SD06 was moderately turbid (209 NTUs) at the time of sample collection, which may have caused the elevated metals concentrations in the sample.

CWM Breakdown Products
CWM breakdown products were not detected in the surface water samples.

3.6.4.6 Sediment

Four sediment samples (co-located with the surface water samples) were collected and analyzed for VOCs, SVOCs, explosives, metals, CWM breakdown products, and TOC. Analytical results for the sediment samples were compared to applicable recreational SSSLs, ESVs, and

background screening values (Shaw, 2004).

VOCs
Acetone, 2-butanone, acetone, methylene chloride, p-isopropyltoluene (p-cymene), and toluene were detected in the sediment samples. The detected VOC concentrations were below SSSLs and ESVs.

SVOCs
No SVOCs were detected in the sediment samples.

Explosives
No explosives were detected in the sediment samples.

Metals
Nineteen metals were detected in the sediment samples at concentrations below SSSLs and ESVs.

CWM Breakdown Products
Thiodiglycol was detected in two sediment samples at estimated concentrations below the SSSL.

Total Organic Carbon
TOC concentrations in the sediment samples ranged from 33.5 to 118 mg/kg.

3.7 3X Scrap Removal

The Army determined that 3X items consisting of ordnance and explosives (OE) scrap existed within two subsurface geophysical anomalies (T38-12 and T38-13) at Training Area T-38 (Shaw, 2005). Removal activities were conducted at Training Area T-38 by Shaw (2005) and included:

- Unexploded ordnance (UXO) construction support.
- Chemical agent ambient air monitoring support.
- Excavation and sorting activities.
- Identification and treatment of recovered material.
- Sorting and packaging of 3X scrap.
- “Hot-boxing” and air monitoring of 3X scrap.
- Transporting hot boxes of 3X scrap to off-site treatment facility.
- Thermal treatment of 3X scrap to 5X.
- Backfilling activities.

According to the *Toxic Chemical Agent Safety Standards* (Army, 2002), 3X scrap are items that have been surface decontaminated by locally approved procedures and air monitoring has verified that concentrations of agent are at an acceptable level. 5X indicates the item has been decontaminated completely of the indicated agent and may be released for general use or sold to the general public.

After the anomalies were located, surveyed, and staked, soil excavation was conducted from the edge of the anomaly farthest from the screening plant and progressed vertically and horizontally toward the plant. Excavation ceased once the anomaly boundaries were reached or until no further evidence of 3X scrap was evident within the anomaly boundaries. As the soil and 3X material was excavated, it was placed to the side of the excavation and spread in an elongated stockpile, then inspected by UXO personnel. The excavated material was then segregated and sorted into either a soil pile or a scrap pile. The scrap pile, which contained both 3X scrap and non-3X scrap, was treated as 3X scrap. The soil was placed back into the excavation.

After the 3X scrap was screened for chemical agent contaminated media (CACM), the 3X scrap was packaged in U.S. Department of Transportation (DOT)-approved plastic-lined 1-cubic yard fiber boxes (hot-boxes). The hot-boxes were filled, sealed, and heated to a minimum temperature of 70 degrees Fahrenheit (ºF) for a minimum of 4 hours to allow vapors in the box to volatilize. The headspace in the hot-boxes was sampled and analyzed for chemical agents using a MINICAMS. After screening for CACM, any recovered OE items were removed from the hot-box, demilitarized, and repackaged into fiber boxes prior to off-site transportation. The senior UXO supervisor certified that all items placed in the fiber boxes were free of explosive or similar hazards prior to off-site shipment.

The fiber boxes containing the 3X scrap material was transported to an incinerator for final disposal of the 3X scrap. Incineration was accomplished on February 26, 2004 and October 7, 2004 using an EPA and state-approved permitted emissions incinerator with continuous monitoring to assure emissions were within source emission limits. The treated 3X scrap was reclassified as 5X material and disposed of as scrap metal.

Recovered items at Training Area T-38 included several broken chemical agent identification set (CAIS) ampoules, unidentified empty glass bottles, 4.2-inch mortars, empty FS smoke balls, cement practice bombs, compressed gas cylinders, and non-OE scrap metal. Air monitoring did not detect the presence of chemical agent on any of the recovered items. An intact ampoule containing chloropicrin and a stoppered bottle containing chloroacetophenone were also found at T38-12. A sealed brown bottle containing 1,1,2,2-PCA and assorted diesel fuels and diethylphthalate, and an intact CAIS ampoule containing CWM (5 percent HN mustard, mustard gas, and lewisite) were also found at T38-13. The vial containing CWM was safely treated on site and transported to an off-site incinerator and disposed as secondary waste. Because of the discovery of CWM at T38-13, the Army performed an assessment of the risk of an accident involving CACM. It was concluded that the probability of encountering additional chemical agent at Training Are T-38 was “remote” and assumed the risk of conducting the remaining activities as a non-CWM site.

A total of 6,202 pounds of non-OE scrap metal and 3,292 pounds of cement bomb fragments were recovered at T38-12 and T38-13. Fourteen hot-boxes totaling 5,482 pounds of non-OE scrap metal, inert OE scrap, potential CACM, cement practice bombs, and various bottles were removed from Training Area T-38 (Shaw, 2005).

4.0 2005 RCRA FACILITY INVESTIGATION

This section describes the activities performed for the 2005 RFI. Objectives of the 2005 RFI were to (1) further define vertical and horizontal extent of groundwater contamination, (2) obtain additional information regarding area hydrogeology, (3) confirm the presence of VOCs in groundwater, surface water, and seeps, (4) find evidence of natural degradation of chlorinated hydrocarbons in groundwater at the Site, and (5) confirm the presence of chromium in groundwater at two locations where it was detected during previous investigations. To help meet the objectives of the 2005 RFI the following activities were conducted:

- Installed three monitoring wells in bedrock, and one monitoring well in the transition zone between residuum and bedrock.
- Collected groundwater samples from 32 existing monitoring wells and four new monitoring wells and analyzed for VOCs. Twelve groundwater samples were also analyzed for ethane, ethene, and methane to estimate the extent of natural degradation at the Site; and two groundwater samples were also analyzed for hexavalent chromium (chromium VI).
- Collected four seep samples and analyzed for VOCs.
- Collected three surface water samples from locations along the unnamed tributary draining into Cave Creek and analyzed for VOCs.

Table 4-1 presents the sample designations for the 2005 RFI. Not all of the wells were sampled during the 2005 RFI, and no soils or sediments were collected as part of the 2005 RFI. However, to provide a more complete understanding of the nature and extent of contaminants at the Site, historical analytical data for groundwater, surface water, seeps, sediment, and soil were included in the assessment. Figure 4-1 shows the groundwater, surface water, and seep sample locations for the 2005 RFI and Shaw's RI investigations (Section 3.6). Figure 4-2 shows the sediment, surface and depositional soil, and subsurface soil sample locations from Shaw's RI investigations (Section 3.6).

4.1 Monitoring Well Installation

Four monitoring wells were installed at the Site in 2005, to further evaluate groundwater quality and hydrogeology. Figure 4-1 shows the locations of the 2005 RFI monitoring wells.

Under contract to MES, Bhate Environmental Associates, Inc. (Bhate) and Boart Longyear installed three bedrock wells and one transition zone well in May 2005. The wells were drilled using a Gus Pech GP24-300RS drilling rig utilizing rotosonic capabilities. Drilling methods were consistent with methods presented in the *Installation-Wide Sampling and Analysis Plan (SAP)* (MES, 2004). Well installation followed procedures presented in *Appendix C of the SAP* (MES, 2004). During drilling, field screening for organic vapor concentrations was performed at five-foot intervals using an organic vapor meter (OVM). Lithology was observed and recorded by a Bhate geologist from samples collected during drilling activities.

Four-inch PVC monitoring wells, each with a ten-foot section of 0.10-slot screen were constructed within the drill casing upon completion of drilling activities. A 20/40 gradational

sand filter pack was gravity fed through a tremie pipe into the borehole annular space to a level approximately 5 feet above the top of the screen as the drill casing was removed. A 5- to 9-foot thick bentonite seal was placed above the filter pack using vibrational placement of the bentonite pellets. The annulus was then sealed with bentonite chips to a depth of approximately 50 feet bgs and a Type 1 Portland cement grout with bentonite was tremied inside the annulus to approximately 2 feet bgs. Following installation, the wells were surveyed for both horizontal and vertical control by SAIN Associates, Inc, an Alabama licensed surveyor.

Table 4-2 presents monitoring well coordinates and elevations, and summarizes the construction details for monitoring wells at T-38 including those installed during the 2005 RFI. Monitoring well installation documentation forms for the wells installed in 2005 are provided in Appendix A, and include boring logs (Appendix A1), well construction diagrams (Appendix A2), and well development forms (Appendix A3).

4.2 Groundwater Sampling

Groundwater samples were collected during one round of sampling conducted in June 2005. Groundwater samples were collected from 36 monitoring wells, including 13 existing residuum monitoring wells, 18 existing bedrock monitoring wells, 1 existing transition zone well, and the 4 new wells installed May 2005. The groundwater samples were collected in accordance with methodology presented in the *SAP* (MES, 2004).

Before groundwater samples were collected, water levels were measured to the nearest hundredth of a foot using an electronic water level indicator and total well depth was measured and recorded. Because the water levels for the newly installed wells, CWM-186-MW56 to CWM-186-MW-59, were collected prior to well development, the measurements taken in May/June 2005 for these wells were not included in the groundwater analyses. Another round of water levels was collected on October 24, 2005 from 15 wells including the newly installed wells CWM-186-MW56 to CWM-186-MW59 (post development).

Groundwater samples were collected using low-flow sampling (LFS) procedures, which minimize the hydraulic stress on the aquifer during purging and sampling. In general, LFS is performed by using an adjustable rate pump to remove water from the screened interval of a monitoring well at a rate that will cause minimal draw down of the groundwater in the well. A submersible pump was lowered into the well and positioned at the screened interval. Teflon tubing leading from the discharge side of the submersible pump was connected to a flow-through cell equipped with a water quality meter and field measurements of chemical and physical parameters were collected and recorded. The chemical and physical parameters collected included pH, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), turbidity, and temperature, and were used to indicate when groundwater quality had stabilized and sampling could begin. The monitoring well sample collection logs are provided in Appendix B1.

Groundwater samples were collected from the well pump outlet after purging and stabilization of the chemical and physical parameters. Laboratory-supplied sample bottles were filled, labeled, placed in a chilled cooler, and shipped under chain-of-custody procedures to EMAX

Laboratories in Torrance, California (EMAX). The groundwater samples collected during the 2005 RFI were analyzed for VOCs by Method SW8260B. Twelve of the groundwater samples collected in June 2005 were also analyzed for dissolved hydrocarbons, methane, ethane, and ethane, by Method RSK-175. Two groundwater samples collected in June 2005 were analyzed for chromium VI using Method SW7199. Figure 4-1 shows the groundwater sampling locations. Table 4-1 presents the groundwater sample designations and analytical parameters. The chain of custody forms for the groundwater samples collected for the 2005 RFI are provided in Appendix B2.

4.3 Surface Water Sampling

Three surface water samples were collected from an unnamed tributary draining into Cave Creek during the 2005 RFI. Surface water sampling was performed following the methodology presented in the *SAP* (MES, 2004). Surface water samples were collected midstream at mid-depth. Laboratory-supplied sample bottles were filled, labeled, placed in a chilled cooler, and shipped under chain-of-custody procedures to EMAX. The surface water samples collected during the 2005 RFI were analyzed for VOCs by Method SW8260B. Figure 4-1 shows the surface water sampling locations. Table 4-1 presents the surface water sample designations and analytical parameters. The chain of custody forms for the surface water samples collected for the 2005 RFI are provided in Appendix B2.

4.4 Seep Sampling

Four seep samples were collected at various locations along the base of Reservoir Ridge during the 2005 RFI. Seep sampling was performed following the surface water methodology presented in the *SAP* (MES, 2004). Laboratory-supplied sample bottles were filled, labeled, placed in a chilled cooler, and shipped under chain-of-custody procedures to EMAX. The seep samples collected during the 2005 RFI were analyzed for VOCs by Method SW8260B. Figure 4-1 shows the seep sampling locations. Table 4-1 presents the seep sample designations and analytical parameters. The chain of custody forms for the seep samples collected for the 2005 RFI are provided in Appendix B2.

The seep samples collected during the 2005 RFI had the same sample ID as the seep samples collected during Shaw's RI. However, the 2005 RFI seep samples were not collected from the same locations as the RI seep samples, and therefore are considered to be separate samples. To clarify the identification of the seep samples on Figure 4-1 and Table 4-1, the sample IDs for the seeps collected by Shaw were assigned a suffix of "RI" and the sample IDs for the seeps from the 2005 RFI were assigned a suffix of "RFI".

4.5 Data Quality Review

MES reviewed the analytical data for the groundwater, surface water, and seep samples collected in June 2005. The data quality review was performed in accordance with the *Quality Assurance Plan (QAP)* (MES, 2005) to assess compliance with the QA objectives, and to assess hard copy and electronic deliverable consistency and integrity.

4.6 Statistical Evaluation of Metals Results

To evaluate the nature and extent of metals contamination at the site, a statistical evaluation was performed to identify metals that may be present at elevated concentrations as a result of site related activities. The statistical evaluation consisted of a multi-tiered approach described as follows:

- **Tier 1:** The maximum detected concentration (MDC) of each metal was compared to the background screening criterion (i.e., two times the mean of the background data) (SAIC 1998). Metals with MDCs that did not exceed the background screening criterion were considered to be present at background concentrations, and therefore, were not selected as site-related constituents requiring further evaluation. Metals with MDCs that exceeded the background screening criterion were evaluated under Tier 2.

- **Tier 2:** The Tier 2 evaluation included the: (a) the Wilcoxon Rank Sum (WRS) test, (b) Box Plots, and (c) the Hot Measurement Test. Metals that failed any of these tests were evaluated under Tier 3.

- **Tier 3:** Tier 3 consisted of a geochemical evaluation to determine whether concentrations of site metals were naturally occurring or elevated due to contamination. This evaluation is based on the natural association between a trace element and one or more specific soil-forming minerals with a tendency to concentrate that particular trace element. Trace elements appearing anomalously high relative to the major associated elements were considered to be present due to site related activities.

Metal results that failed all three tiers were considered to be contaminants at the Site. To evaluate which metals are constituents of potential concern (COPCs) at the Site, metal contaminants are compared to SSSLs and ESVs. The results of the statistical evaluation of metals are discussed in Section 5.5.

5.0 RESULTS OF 2005 RFI AND NATURE AND EXTENT

This section discusses the results of the 2005 RFI at the Site and presents the nature and extent of contamination based on the VOC results for groundwater, surface water, and seep samples, and chromium VI results for groundwater. To provide a more complete understanding of the nature and extent of contaminants at the Site, historical data for VOCs, SVOCs, metals, explosives, and CWM breakdown products for groundwater, surface water, sediment, seeps, surface and depositional soil, and subsurface soil samples collected during Shaw's Supplemental RI for the Site were incorporated into this assessment. When assessing the nature and extent of contamination in groundwater and seeps at the Site, only the most recent data for each location was used. As discussed in Section 2.1 of this RFI and in the *Report of Findings, Training Area T-38, Former Technical Escort Reaction Area, Parcel 186(6)* (Shaw, 2004) the primary sources of contamination at the Site are likely from releases of CWM due to training activities performed at the Site.

5.1 2005 RFI Groundwater Levels

Groundwater levels were measured in 36 monitoring wells by Bhate on May 31 and June 1, 2005, including 13 existing residuum monitoring wells, 18 existing bedrock monitoring wells, 1 existing transition zone well, 3 newly installed bedrock wells, and 1 newly installed transition well. The groundwater levels collected during the May/June event for the four new wells, CWM-186-MW56 to CWM-186-MW59, were recorded before well development was completed. Therefore, these results were not included in the water elevation analyses. Residuum and bedrock water elevation contour maps are presented in Figures 5-1 and 5-2, respectively. The groundwater levels collected in May/June 2005 are summarized in Table 5-1.

On October 24, 2005, another round of groundwater levels was collected by MES from 15 monitoring wells to determine groundwater flow in the transition zone. Figure 5-3 presents the groundwater elevation contour map for the transition zone, constructed from the October 2005 data. The groundwater levels collected in October 2005 are summarized in Table 5-1.

MES reviewed lithologic logs included in the *T-38 Report of Findings* (Shaw, 2004) for the 2001/2003 RI, and has reclassified eight wells for the 2005 RFI report based on MES' interpretation of the geologic descriptions. The revised well types are listed below and are utilized in the tables for this RFI report.

Well ID	Previous Well Type	MES-Revised Well Type
CWM-186-MW16	residuum	transition
CWM-186-MW37	residuum	bedrock
CWM-186-MW38	residuum	bedrock
CWM-186-MW41	residuum	transition
CWM-186-MW42	residuum	transition
CWM-186-MW53	residuum	bedrock
CWM-186-MW54	residuum	bedrock
CWM-186-MW55	residuum	transition

Groundwater is generally mounded near the crest of Reservoir Ridge, in the central portion of the Site, and exhibits a localized radial flow pattern.

The western portion of the groundwater radial flow pattern generally exhibits steeper groundwater gradients as the water flows toward the Jacksonville Fault. At the Fault, groundwater follows the direction of the fault system towards the north/northwest.

Groundwater from the eastern portion of the radial flow pattern flows towards the base of Reservoir Ridge where it converges with groundwater flowing in a westerly direction from a hill east of the Site. At the point of convergence, the groundwater flows either towards the north or south. Groundwater flowing north at the point of convergence generally flows northwest around the base of Reservoir Ridge and joins regional flow towards the north/northwest.

The northern portion of the radial flow continues towards the north where it joins regional flow towards the north/northwest.

Radial flow towards the south of Reservoir Ridge eventually joins regional groundwater flow patterns, however not enough data is available at Training Area T-38 to fully describe this connection.

Site-wide groundwater table gradients were calculated using water-level data collected during the 2005 RFI from several residuum, transition zone, and bedrock monitoring wells and are presented in Table 5-2. Comparison of the groundwater table gradients from the 2005 RFI and groundwater table gradients calculated from data collected during the 2003 RI (Table 5-3) indicate no or little change.

At points near the base of Reservoir Ridge, groundwater elevations are greater than or equal to ground surface elevations and surface expression of the groundwater can be seen in surface seeps and in creeks and tributaries. Monitoring well CWM-186-MW16 has a water level greater than the ground surface elevation, indicating artesian properties and an upward groundwater gradient. Vertical gradients were calculated for various well pairs at Training Area T-38 using water levels collected during the supplemental groundwater sampling conducted in October 2005, and are presented in Table 5-4.

Comparison of the vertical hydraulic gradients from the 2005 RFI (Table 5-4) and Shaw's 2003 RI (June 2003) (Table 5-5) indicate a slight decrease (less than 10%) at paired wells CWM-186-MW28 and CWM-186-MW13, and no change at well pair CWM-186-MW23 and CWM-186-MW09. Well pair CWM-186-MW18 and CWM-186-MW11 indicated a decrease of 90% from 2003 to 2005. This decrease can be traced to the drop in groundwater elevation from 2003 to 2005, from 879.13 feet amsl to 874.13 feet amsl at CWM-186-MW18 (a difference of 5.00 feet), and from 880.98 feet amsl to 874.32 feet amsl at CWM-186-MW11 (a difference of 6.66 feet).

5.2 2005 RFI Analytical Data and Data Quality Review

The analytical data for the 2005 RFI samples are provided in Appendix C. MES reviewed the analytical data in accordance with the quality assurance plan *QAP* (MES, 2005). The results of

the data quality review for the groundwater, surface water, and seep samples collected in 2005 are presented in the *Data Quality Summary* (*DQS*) in Appendix D.

Based on the data quality review, the analytical data generated for this investigation were adequate to fulfill program objectives and may be used to define the nature and extent of contamination and support the selection and implementation of any appropriate corrective measure.

5.3 2005 RFI Groundwater Field Parameter Results

Field measurements of chemical and physical parameters were used at each of the sampled wells to indicate when groundwater quality had stabilized and sampling could begin. Chemical and physical parameters included pH, conductivity, DO, ORP, turbidity, and temperature. In addition to indicating the stabilization of groundwater for sampling, these parameters can assist in identifying the condition of the well, aquifer type, groundwater quality, and contaminant degradation. The chemical and physical parameters for the 2005 RFI groundwater samples are summarized in Table 5-6.

5.4 Summary of 2005 RFI Analytical Results

This section describes the analytical results for VOCs, dissolved hydrocarbons, and chromium VI detected in the 2005 RFI samples.

5.4.1 2005 RFI Groundwater Analytical Results

During the 2005 RFI, groundwater samples were collected from 13 residuum monitoring wells, 2 transition monitoring wells, and 21 bedrock monitoring wells and analyzed for VOCs (Table 4-1). Six residuum and six bedrock monitoring wells were also analyzed for dissolved hydrocarbons; and one residuum and one bedrock monitoring well were analyzed for chromium VI. The analytical results for VOCs, dissolved hydrocarbons, and chromium VI detected in the 2005 RFI groundwater samples are presented in Table 5-7.

Twenty-two VOCs were detected in the groundwater samples collected in 2005. TCE was detected in 22 of the 36 groundwater samples with concentrations ranging from 0.21 µg/L to 3,700 µg/L. 1,1,2,2-PCA was detected in 12 of the 36 groundwater samples with concentrations ranging from 9.6 µg/L to 25,000 µg/L. PCE was detected in 12 of the 36 groundwater samples with concentrations ranging from 0.46 µg/L to 340 µg/L. Chloroform, carbon tetrachloride, cis-1,2-DCE, and 1,1,2-TCA were frequently detected in the groundwater samples with concentrations ranging from 0.26 µg/L to 300 µg/L, 0.24 µg/L to 55 µg/L, 0.21 µg/L to 1400 µg/L, and 0.25 µg/L to 27 µg/L, respectively. No VOCs were detected in samples collected from wells CWM-186-MW10, CWM-186-MW19, CWM-186-MW20, CWM-186-MW28, CWM-186-MW30, CWM-186-MW37, CWM-186-MW54, and CWM-186-MW59.

Methane was detected in eight, ethane in five, and ethene in two of the groundwater samples collected in 2005. The methane, ethane, and ethane concentrations ranged from 0.63 µg/L to 2,900 µg/L, 0.78 µg/L to 61 µg/L, and 39 µg/L to 220 µg/L, respectively.

Chromium VI was detected at an estimated concentration in one of two groundwater samples collected in 2005.

5.4.2 2005 RFI Surface Water and Seep Analytical Results

During the 2005 RFI, three surface water and four seep samples were collected and analyzed for VOCs. The analytical results for VOCs detected in the 2005 RFI surface water and seep samples are presented in Table 5-8. Two VOCs were detected in the surface water samples, and seven VOCs were detected in the seep samples. TCE and 1,1,2,2-PCA were the primary constituents in the surface water and seep samples. TCE was detected in three of the seep samples with concentrations ranging from 1.1 µg/L to 130 µg/L, and in one surface water sample at an estimated concentration of 0.3 J µg/L. 1,1,2,2-PCA was detected in two of the seep samples with concentrations ranging from 2.3 µg/L to 66 µg/L, and in one of the surface water samples at a concentration of 3.8 µg/L. Five more VOCs were detected in two of the seep samples at estimated concentrations below the reporting limit or at the reporting limit of 1 µg/L. No VOCs were detected in surface water samples CWM-186-SW07 and CWM-186-SW09, or seep sample CWM-186-SEEP04-RFI.

5.5 Nature and Extent of Contamination

To evaluate the nature and extent of contamination at the Site, the VOC and chromium VI results from the 2005 RFI samples were assessed to identify contaminants at the Site. To aid in visualizing the extent of contamination, the historical VOC, SVOC, explosive, metal, and CWM breakdown product results for groundwater, surface water, sediment, seeps, surface and depositional soil, and subsurface soil samples collected during Shaw's Supplemental RI were also assessed. During the Supplemental RI for Training Area T-38, Shaw (2004) identified the results that exceeded SSSLs and ESVs; however, no further assessment was made concerning the nature and extent of contamination at the Site. Therefore, the historical VOC, SVOC, explosive, metal, and CWM breakdown product results from Shaw's Supplemental RI investigations for Training Area T-38 were assessed by MES in conjunction with the VOC and chromium VI results from the 2005 RFI to identify whether there were any contaminants in groundwater, surface water and seep, sediment, surface and depositional soil, and subsurface soil at the Site. In cases where a groundwater well was sampled during multiple investigations, the most recent data for that well was used in the assessment. The dissolved hydrocarbon analysis performed on twelve groundwater samples from the Site provides evidence of the natural degradation of chlorinated hydrocarbons present in groundwater, and is discussed in Section 6.1.8 of this report.

Detected VOCs, non-PAH SVOCs, explosives, and CWM breakdown products were considered to be contaminants at the Site. Detected PAH compounds that exceeded the background screening values were considered to be contaminants at the Site. To evaluate the metal contaminants, a statistical evaluation was performed to identify metals that may be present at elevated concentrations as a result of site-related activities. The statistical evaluation consisted of a multi-tiered approach described in Section 4.7. Metal results that failed all three tiers were considered to be contaminants at the Site. A detailed description of the statistical evaluation for the metal results from the 2001 to 2003 Shaw RI and 2005 RFI is discussed in Appendix E. To

evaluate which analytes were constituents of potential concern (COPCs) for the Site, the VOC, SVOC, explosive, CWM breakdown products, and metal contaminants were compared to residential SSSLs, groundskeeper SSSLs, recreational SSSLs, and ESVs (IT, 2000).

5.5.1 Groundwater

Groundwater samples were not collected from the following existing well locations during the 2005 RFI: CWM-186-MW01, CWM-186-MW02, CWM-186-MW04, CWM-186-MW07, CWM-186-MW09, CWM-186-MW11, CWM-186-MW13, CWM-186-MW22, CWM-186-MW31, CWM-186-MW33, CWM-186-MW36, CWM-186-MW38, CWM-186-MW41 to CWM-186-MW44, CWM-186-MW49, CWM-186-MW50, and CWM-186-MW55. However, to aid in visualizing the extent of contamination of groundwater at the Site, an assessment of historical VOC results from previous investigations at Training Area T-38 for these wells was incorporated into this report. Appendix F presents historical analytical results for VOCs detected in groundwater. The following results from the May 2003 Shaw RI were inadvertently not reported in the groundwater analytical results table in the *Training Area T-38 Report of Findings* (Shaw, 2004): TCE for CWM-186-MW31 and CWM-186-MW42, PCE and TCE for CWM-186-MW32, and 1,1,2,2-PCA and carbon tetrachloride for CWM-186-MW47. The "Validation Qualifier Data Entry Verification" table (Shaw, 2004) indicated that these results were over the method calibration range during the undiluted analysis and were reanalyzed at dilutions. For purposes of determining nature and extent in this RFI, the results from the diluted analyses from the "Validation Qualifier Data Entry Verification" table (Shaw, 2004) were used and are shown in Appendix F, Table F1.

The historical SVOC, explosive, CWM breakdown product, and metal results from the Shaw Supplemental RI were also assessed. The historical SVOC, explosive, CWM breakdown product, and metal analytical data are presented in Shaw's *Training Area T-38 Report of Findings* (Shaw, 2004).

To evaluate the nature and extent of groundwater contamination at the site, the following analytical results were assessed to identify contaminants at the Site:

- VOC results for groundwater samples CWM-186-MW03, CWM-186-MW05, CWM-186-MW08, CWM-186-MW10, CWM-186-MW14 to CWM-186-MW16, CWM-186-MW18 to CWM-186-MW21, CWM-186-MW23 to CWM-186-MW26, CWM-186-MW28 to CWM-186-MW30, CWM-186-MW32, CWM-186-MW34, CWM-186-MW35, CWM-186-MW37, CWM-186-MW39, CWM-186-MW40, CWM-186-MW45 to CWM-186-MW48, CWM-186-MW51 to CWM-186-MW54, and CWM-186-MW56 to CWM-186-MW59 collected in 2005 (Table 5-7).
- Historical VOC results from the T-38 RI groundwater samples (Shaw, 2004) for wells that were not sampled during the 2005 RFI (i.e., well locations CWM-186-MW01, CWM-186-MW02, CWM-186-MW04, CWM-186-MW07, CWM-186-MW09, CWM-186-MW11, CWM-186-MW13, CWM-186-MW22, CWM-186-MW31, CWM-186-MW33, CWM-186-MW36, CWM-186-MW38, CWM-186-MW41 to CWM-186-MW44, CWM-186-MW49, CWM-186-MW50, and CWM-186-MW55) (Table F1).
- Historical SVOC, explosive, CWM breakdown product, and metal results from the T-38 Shaw RI groundwater samples (Shaw, 2004).

The dissolved hydrocarbon results for groundwater samples CWM-186-MW03, CWM-186-MW10, CWM-186-MW21, CWM-186-MW23, CWM-186-MW26, CWM-186-MW29, CWM-186-MW32, CWM-186-MW39, CWM-186-MW40, CWM-186-MW46, CWM-186-MW56, and CWM-186-MW57 (collected in 2005) were assessed to estimate degradation of chlorinated solvents present in groundwater at the Site and are discussed in Section 6.1.8 of this report.

5.5.1.1 VOCs in Groundwater

Twenty-two VOCs were detected in the groundwater samples and are considered contaminants in groundwater at the Site. VOC results from the Supplemental RI (Table F1) flagged with a "B", indicate the analyte concentration was impacted by the associated laboratory method blank sample, and were not considered to be contaminants at the Site.

The VOC contaminants were compared to residential and groundskeeper SSSLs as presented in Table 5-9. VOC contaminants exceeding SSSLs are considered COPCs for the Site. 1,1,2,2-PCA, 1,1,2-TCA, acetone, carbon tetrachloride, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride exceeded the residential and groundskeeper SSSLs. 1,1,1,2-PCA, 1,2-dichloroethane (1,2-DCA), bromodichloromethane, and hexachlorobutadiene exceeded the residential SSSLs but were below the groundskeeper SSSLs. Residential SSSLs are typically the most stringent of the screening levels used as part of the human health risk evaluations for site investigations conducted at McClellan. However, because the proposed future land use for the Site is open space (EDAW, 1997), only VOC COPCs exceeding the groundskeeper SSSLs were used to evaluate the nature and extent of VOC contamination in groundwater at the Site. Figures 5-4, 5-5, and 5-6 show the sample locations and VOC COPC concentrations exceeding the groundskeeper SSSLs in groundwater collected from wells in the residuum, bedrock, and transition zones, respectively.

To aid in visualizing the extent of VOCs in groundwater, the total concentrations of VOCs in the residuum, bedrock, and transition groundwater bearing zones were separately summed and plotted. Figures 5-7, 5-8, and 5-9 show the horizontal extent of total VOCs in the residuum, bedrock, and transition groundwater zones, respectively. The highest concentrations of VOCs in groundwater were found in residuum wells CWM-186-MW39 (17,580 µg/L), CWM-186-MW26 (25,369 µg/L), and CWM-186-MW40 (29,948 µg/L), all of which are located within the estimated source area of contamination near the northeast corner of the fenced area at the crest of Reservoir Ridge. High concentrations of VOCs in groundwater were also detected in residuum wells CWM-186-MW31, CWM-186-MW32, CWM-186-MW44, and CWM-186-MW46, transition well CWM-186-MW42 located within the estimated source area, and bedrock well CWM-186-MW53 located immediately downgradient of the source area. Generally, the VOC concentrations decreased as the plume migrated both horizontally and vertically from the estimated source area.

A high detection of acetone (3,400 µg/L) was found in bedrock well CWM-186-MW15 located in the north-central portion of Training Area T-38 near the tributary to Cave Creek. Elevated concentrations of acetone were detected in the soil boring collected at sample location CWM-186-MW07, which is adjacent to CWM-186-MW15. Acetone was also detected at levels below

the SSSL in bedrock wells CWM-186-MW09, CWM-186-MW11, CWM-186-MW22, CWM-186-MW30, CWM-186-MW34, CWM-186-MW36, and CWM-186-MW37. Historically, suspicious detections of acetone, the source of which is unknown, have been observed at McClellan. Because acetone is more miscible in water, and less easily adsorbed by soil or rock than chlorinated constituents such as TCE, unknown acetone source areas may be contributing to acetone contamination seen at various McClellan sites such as Training Area T-38. There is no data or information indicating a possible source of acetone contamination at Training Area T-38, and therefore no evidence that suggests acetone is Site-related.

The trend in VOC concentrations in groundwater over time was also assessed. Figures showing the VOC concentrations over time were constructed for groundwater wells that had higher concentrations of VOC contaminants and at least three sampling events, and are included in Appendix F. Figures F1 to F7 present the VOC concentrations over time for CWM-186-MW03, CWM-186-MW26, CWM-186-MW32, CWM-186-MW39, CWM-186-MW10, CWM-186-MW23, and CWM-186-MW29, respectively. The residuum groundwater zone showed a general increase in VOCs over time within the source area and immediately downgradient to the east of the estimated source area. The bedrock wells, CWM-186-MW10 and CWM-186-MW23 located downgradient of the source area on the eastern flank of Reservoir Ridge, and CWM-186-MW29 located at the southern portion of the crest of Reservoir Ridge (south of the estimated source area), showed a general decrease in VOCs over time. There is not enough historical data to evaluate the trend in VOC concentrations over time for groundwater in the transition zone.

To assist in evaluating the vertical and horizontal extent of VOC contamination, data from the 2003 RI and 2005 RFI sampling events were contoured in three dimensions for 1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, and TCE. This contouring allows the simultaneous consideration of data values in horizontal and vertical dimensions and produces a volumetric shape representing the contaminant plume. The contouring was performed using EarthVision® (EV) geospacial modeling software developed by Dynamic Graphics, Inc.

The following subsections discuss the lateral and vertical extent of 1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, TCE, and vinyl chloride based on the interpretation of groundwater data collected in 2003 and 2005 and the individual EV models.

5.5.1.1.1 1,1,2,2-PCA in Groundwater

1,1,2,2-PCA concentrations exceeded the groundskeeper SSSL of 1.36 µg/L in 18 of the 23 residuum wells ranging from 40 µg/L at well CWM-186-MW52 to 25,000 µg/L at CWM-186-MW40 (Figure 5-4). Out of 27 bedrock wells, the 1,1,2,2-PCA concentration in one well, CWM-186-MW53 (5,900 µg/L), exceeded the groundskeeper SSSL (Figure 5-5). 1,1,2,2-PCA concentrations in three of the five transition wells, ranging from 9.6 µg/L at well CWM-186-MW58 to 900 µg/L at CWM-186-MW42 (Figure 5-6), exceeded the groundskeeper SSSL. The source area for 1,1,2,2-PCA appears to be at the crest of Reservoir Ridge from monitoring well CWM-186-MW48 on the southwest portion of the ridge to monitoring well CWM-186-MW53 near the northwest portion of the ridge. The extent of 1,1,2,2-PCA contamination spreads from the estimated source area downgradient towards the east where concentrations of 9.6 µg/L were detected in groundwater from well CWM-186-MW58, towards the northeast where a concentration of 66 µg/L was detected in groundwater seep sample CWM-186-SEEP03-RFI, and

towards the southwest where a concentration of 2.3 µg/L was detected in groundwater seep sample CWM-186-SEEP01-RFI. 1,1,2,2-PCA was also detected in surface water sample CWM-186-SW08 (3.8 µg/L) located north of the estimated source area in the north-central portion of Training Area T-38, near wells CWM-183-MW07, CWM-183-MW15, and CWM-183-MW16.

Vertically, concentrations of 1,1,2,2-PCA were detected in the groundwater samples collected in 2005 at an upper elevation of approximately 921 feet amsl in residuum well CWM-186-MW32 to a lower elevation of approximately 825 feet amsl in transition well CWM-186-MW58.

Figure 5-10 depicts the estimated lateral extent of 1,1,2,2-PCA concentrations in groundwater exceeding the groundskeeper SSSL in 2005, as interpreted by EV, at depths of 900 feet amsl, 850 feet amsl, and 800 feet amsl. In the 2005 EV model, the 1,1,2,2-PCA plume is separated into two portions, north and south, and occupies an area covering most of the crest of Reservoir Ridge at 900 feet amsl. At this elevation, a large section of the northern portion of the plume shows 1,1,2,2-PCA concentrations exceeding 1,000 µg/L. At 850 feet amsl, the 1,1,2,2-PCA plume area is larger and situated more towards the north. No 1,1,2,2-PCA plume was identified at 800 feet amsl in 2005.

Figure 5-11 depicts the estimated lateral extent of 1,1,2,2-PCA concentrations exceeding the groundskeeper SSSL in 2003, as interpreted by EV, at the same depth intervals as in Figure 5-10. At 900 feet amsl the plume is situated near the center of Reservoir Ridge and has a large area of 1,1,2,2-PCA concentrations exceeding 1,000 µg/L. The 1,1,2,2-PCA plume area at 850 feet amsl is larger and situated more towards the northwest, north, and northeast, extending nearly to the base of Reservoir Ridge. At 800 feet amsl the 1,1,2,2-PCA plume area is smaller and does not extend as far to the west and north.

Figure 5-12 depicts a cross section of the 2005 1,1,2,2-PCA plume, as interpreted by EV, from the southwest portion of the Site near well CWM-186-MW19 to the northeast portion of the Site near well CWM-186-MW09. At this cross section, the 1,1,2,2-PCA plume is divided into two separate portions. One portion extends vertically to the water table immediately northeast of the crest of Reservoir Ridge with 1,1,2,2-PCA concentrations in groundwater between 1,000 µg/L and 10,000 µg/L. Further northeast of Reservoir Ridge, the second portion of the 1,1,2,2-PCA plume extends vertically to a depth of approximately 830 feet amsl with higher concentrations of 1,1,2,2-PCA in groundwater (between 1,000 µg/L and 10,000 µg/L) extending vertically to a depth of approximately 840 feet amsl.

Figure 5-13 depicts the estimated vertical extent of the 2003 1,1,2,2-PCA plume, as interpreted by EV, for the same cross section as in Figure 5-12. In 2003 the plume area extended from the crest of Reservoir Ridge towards the southwest to a depth of approximately 850 feet amsl and towards the northeast to a depth of approximately 715 feet amsl. Higher concentrations of 1,1,2,2-PCA (between 1,000 µg/L and 10,000 µg/L) were indicated at the water table under the crest of Reservoir Ridge and extended to a depth of approximately 880 feet amsl.

5.5.1.1.2 1,1,2-TCA in Groundwater

1,1,2-TCA concentrations exceeded the groundskeeper SSSL of 4.85 µg/L in three of the 23 residuum wells ranging from 5.8 µg/L in well CWM-186-MW39 to 27 µg/L in CWM-186-

MW40 (Figure 5-4). Out of 27 bedrock wells, the 1,1,2-TCA concentration in one well, CWM-186-MW53 (8.3 µg/L), exceeded the groundskeeper SSSL (Figure 5-5). 1,1,2-TCA concentrations in one of the five transition wells, CWM-186-MW42 (7.9 µg/L) exceeded the groundskeeper SSSL (Figure 5-6). The source area for 1,1,2- TCA appears to be at the crest of Reservoir Ridge, near monitoring wells CWM-186-MW26 and CWM-186-MW40. The extent of 1,1,2-TCA contamination is mostly confined to the crest of Reservoir Ridge, but has been identified towards the south in groundwater collected from well CWM-183-MW29 and to the north in groundwater collected from well CWM-183-MW53. 1,1,2-TCA was not identified in wells CWM-186-MW30, CWM-186-MW29, CWM-186-MW52, CWM-186-MW57, and CWM-186-MW56, further defining the extent of contamination. Groundwater collected from seep sample CWM-183-SEEP01-RFI southwest of Reservoir Ridge had a 1,1,2-TCA concentration of 0.47 µg/L and groundwater collected from seep sample CWM-SEEP03-RFI had a 1,1,2-TCA concentration of 0.3 µg/L.

Vertically, 1,1,2-TCA has been detected above the groundskeeper SSSL in groundwater mainly in the residuum zone, but has also been detected above the groundskeeper SSSL in the bedrock zone at well CWM-183-MW53.

Figure 5-14 depicts the estimated lateral extent of 1,1,2-TCA concentrations exceeding the groundskeeper SSSL in 2005, as interpreted by EV, at depths of 900 feet amsl, 850 feet amsl, and 800 feet amsl. At 900 feet amsl, 1,1,2-TCA concentrations up to 10 µg/L occupy an area under the northern portion of the fenced area at the crest of Reservoir Ridge. No portion of the 1,1,2-TCA plume was identified at 850 or 800 feet amsl.

Figure 5-15 depicts the estimated lateral extent of 1,1,2-TCA concentrations exceeding the groundskeeper SSSL in 2003, as interpreted by EV, at the same depth intervals as in Figure 5-14. At 900 feet amsl, the 1,1,2-TCA plume is situated below the northern portion of the fenced area at the crest of Reservoir Ridge, with concentrations up to 10 µg/L. At 850 feet, the plume is situated more towards the east with concentrations up to 4.85 µg/L. No portion of the 1,1,2-TCA plume was identified at 800 feet amsl.

5.5.1.1.3 Carbon Tetrachloride in Groundwater

Carbon tetrachloride concentrations exceeded the groundskeeper SSSL of 1.98 µg/L in 10 of the 23 residuum wells ranging from 2.8 µg/L in well CWM-186-MW43 to 67 µg/L in CWM-186-MW44. Carbon tetrachloride concentrations exceeded the groundskeeper SSSL in two of the 27 bedrock wells, CWM-186-MW18 (2.9 µg/L) and CWM-186-MW53 (23 µg/L). The carbon tetrachloride concentration in one of the five transition wells, CWM-186-MW58 (4.2 µg/L), exceeded the groundskeeper SSSL. The source area for carbon tetrachloride appears to be at the southern portion of the crest of Reservoir Ridge, near monitoring well CWM-186-MW47. The extent of carbon tetrachloride contamination generally spreads from the estimated source area towards the north, east and south. The carbon tetrachloride contamination extends northeast toward well CWM-186-MW08, east towards well CWM-186-MW58, and south towards well CWM-186-MW18. Groundwater seep sample CWM-183-SEEP01-RFI located southwest of the estimated source area on the southwest flank of Reservoir Ridge had a carbon tetrachloride concentration of 1 µg/L. Groundwater collected from seep sample CWM-SEEP03-RFI located on the northeast flank of Reservoir Ridge had a carbon tetrachloride concentration of 0.38 µg/L.

Vertically, concentrations of carbon tetrachloride were detected in groundwater at an upper elevation of approximately 921 feet amsl in residuum well CWM-186-MW46 to a lower elevation of approximately 717 feet amsl in residuum well CWM-186-MW08.

Figure 5-16 depicts the estimated lateral extent of carbon tetrachloride concentrations exceeding the groundskeeper SSSL in 2005, as interpreted by EV, at depths of 900 feet amsl, 850 feet amsl, and 800 feet amsl. At 900 feet amsl, the carbon tetrachloride plume is situated under the eastern portion of the fenced area at the crest of Reservoir Ridge and extends eastward approximately halfway to the bottom of the hill. Carbon tetrachloride concentrations between 10 µg/L and 100 µg/L comprise a majority of the plume at 900 feet amsl. At 850 feet amsl the plume area extends further to the east beyond the eastern boundary of Training Area T-38. Higher concentrations of carbon tetrachloride (between 10 µg/L and 100 µg/L) are present in the area surrounding well CWM-186-MW58. No portion of the carbon tetrachloride plume was identified at 800 feet amsl.

Figure 5-17 depicts the estimated lateral extent of carbon tetrachloride concentrations exceeding the groundskeeper SSSL in 2003, as interpreted by EV, at the same depth intervals as in Figure 5-16. At 900 feet amsl the carbon tetrachloride plume is divided into two separate portions, one large portion extending from the fenced area at the crest of Reservoir Ridge towards the north, and a smaller portion immediately southwest of the fenced area. The larger portion of the plume has two areas of higher concentrations between 10 µg/L and 100 µg/L, one under the fenced area and one northeast of the fenced area. At 850 feet amsl the plume extends from the fenced area towards the northeast, east, and southeast, nearly to the eastern boundary of Training Area T-38, and has two areas of higher carbon tetrachloride concentrations between 10 µg/L and 100 µg/L. At 800 feet amsl the plume is divided into two portions. The larger northern portion of the plume extends from the northeast corner of the fenced area towards the Training Area T-38 boundary, and the smaller portion of the plume is positioned inside the fenced area at the crest of Reservoir Ridge. The northern portion of the plume includes a small area of higher concentrations (between 10 µg/L and 100 µg/L) immediately north of wells CWM-186-MW53, CWM-186-MW56, and CWM-186-MW57.

Figure 5-18 depicts a cross section of the 2005 carbon tetrachloride plume, as interpreted by EV, from the southwest portion of the Site near well CWM-186-MW19 to the northeast portion of the Site near well CWM-186-MW09. The 2005 vertical extent of carbon tetrachloride contamination begins immediately northeast of the crest of Reservoir Ridge and extends further northeast beyond well CWM-186-MW09. The plume includes an area of higher concentrations (5 µg/L to 50 µg/L) that extends to well CWM-186-MW09. The 2005 plume extends vertically to approximately 835 feet amsl.

Figure 5-19 depicts the estimated vertical extent of the 2003 carbon tetrachloride plume, as interpreted by EV, for the same cross section as in Figure 5-18. The vertical extent of carbon tetrachloride begins under the crest of Reservoir Ridge and extends northeast to the vicinity of well CWM-186-MW09 to a depth of approximately 650 feet amsl. An area of higher concentrations (5 µg/L to 50 µg/L) extends to a depth of approximately 800 feet amsl near well CWM-186-MW45. Another area of higher concentrations is located near well CWM-186-MW23.

5.5.1.1.4 PCE in Groundwater

PCE concentrations exceeded the groundskeeper SSSL of 4.6 µg/L in 11 of the 23 residuum wells ranging from 4.6 µg/L in well CWM-186-MW43 to 340 µg/L in CWM-186-MW40. The PCE concentration in one of the 27 bedrock wells, CWM-186-MW53 (62 µg/L) exceeded the groundskeeper SSSL. The PCE concentration in one of the five transition wells, CWM-186-MW42 (6.1 µg/L) exceeded the groundskeeper SSSL. The source area for PCE appears to be at the northeastern portion of the crest of Reservoir Ridge, near monitoring wells CWM-186-MW40, CWM-186-MW39, and CWM-186-MW26. The extent of PCE contamination generally indicates radial spreading. The PCE contamination extends northeast towards groundwater seep sample location CWM-193-SEEP03-RFI and southwest towards groundwater seep sample location CWM-183-SEEP01-RFI. Monitoring well CWM-183-MW52 is the southern most well with detected concentrations of PCE. The northern extent of the PCE contamination is between well CWM-186-MW-53 at the top of the hill and wells CWM-186-MW16, CWM-186-MW-15, and CWM-186-MW08 at the bottom of the hill.

Vertically, PCE has been identified mainly in the residuum zone, but has also been identified in the bedrock zone at well CWM-183-MW53

Figure 5-20 depicts the estimated lateral extent of PCE concentrations exceeding the groundskeeper SSSL in 2005, as interpreted by EV, at depths of 900 feet amsl, 850 feet amsl, and 800 feet amsl. At 900 feet amsl the PCE plume is divided into two portions. The large northern portion extends from the north side of the fenced area towards the northwest, north, and northeast and has a higher concentration gradient (100 µg/L to 1,000 µg/L) near the center of the plume. The southern portion of the plume is smaller and includes an area between wells CWM-186-MW47 and CWM-186-MW04. At 850 feet amsl the plume occupies an area under the northeastern portion of the fenced area, with the highest concentrations between 10 µg/L and 100 µg/L. No portion of the PCE plume was identified at 800 feet amsl.

Figure 5-21 depicts the estimated lateral extent of PCE concentrations exceeding the groundskeeper SSSL in 2003, as interpreted by EV, at the same depth intervals as in Figure 5-20. At 900 feet amsl the PCE plume extends from the north side of the fenced area towards the north and northeast with higher concentrations (100 µg/L to 1,000 µg/L) near the center of the plume. At 850 feet amsl the plume extends from the northeastern portion of the fenced area towards the north and east close to the Training Area T-38 boundary with high concentrations between 10 µg/L and 100 µg/L. At 800 feet a small portion of the plume is situated between wells CWM-186-MW53 and CWM-186-MW57.

Figure 5-22 depicts a cross section of the 2005 PCE plume, as interpreted by EV, from the southwest portion of the Site near well CWM-186-MW19 to the northeast portion of the Site near well CWM-186-MW09. The 2005 vertical extent of PCE contamination begins immediately northeast of the crest of Reservoir Ridge and extends towards the northeast beyond CWM-186-MW09. The plume includes an area of higher concentrations (10 µg/L to 100 µg/L) that extends to well CWM-186-MW09. The PCE plume extends vertically to approximately 850 feet amsl.

Figure 5-23 depicts the estimated vertical extent of the 2003 carbon tetrachloride plume, as

interpreted by EV, for the same cross section as in Figure 5-22. The vertical extent of carbon tetrachloride is divided into two portions, the first is a small portion immediately northeast of the crest of Reservoir Ridge at the water table, and the second, larger portion of the plume extends from midway down the hill northeast of the crest of Reservoir Ridge towards the bottom of the hill. The vertical extent of the larger portion of the plume is approximately 850 feet amsl, and includes higher concentrations between 10 µg/L and 100 µg/L.

5.5.1.1.5 TCE in Groundwater

TCE concentrations exceeded the groundskeeper SSSL of 0.498 µg/L in 20 of the 23 residuum wells ranging from 9.6 µg/L in well CWM-186-MW08 to 3700 µg/L in CWM-186-MW40. TCE concentrations exceeded the groundskeeper SSSL in seven of the 27 bedrock wells ranging from 1.1 µg/L in CWM-186-MW23 to 2,300 µg/L in CWM-186-MW53. TCE concentrations exceeded the groundskeeper SSSL in four of the five transition wells ranging from 1 µg/L in CWM-186-MW16 to 610 µg/L in CWM-186-MW42. TCE concentrations in three residuum wells, CWM-186-MW26, CWM-186-MW39, and CWM-186-MW40, exceeded 1,000 µg/L; and 11 residuum monitoring wells, CWM-186-MW02, CWM-186-MW03, CWM-186-MW31, CWM-186-MW32, CWM-186-MW43, CWM-186-MW44, CWM-186-MW45, CWM-186-MW46, CWM-186-MW47, CWM-186-MW48, and CWM-186-MW50, had groundwater TCE concentrations equal to or greater than 100 µg/L. The source area for TCE appears to be at the crest of Reservoir Ridge, near monitoring wells CWM-186-MW39, CWM-186-MW40, CWM-186-MW26, and CWM-186-MW53. The extent of TCE contamination generally spreads in all directions from the estimated source area. The extent of TCE contamination includes monitoring well CWM-186-MW35 in the northeast portion, monitoring wells CWM-186-MW23 and CWM-186-MW24 in the eastern portion, and monitoring well CWM-186-MW29 in the southern portion. TCE was also present in groundwater collected from seep samples CWM-183-SEEP01-RFI (southwest of the estimated source area), CWM-183-SEEP02-RFI (north of the source area), and CWM-183-SEEP03-RFI (northeast of the estimated source area).

Vertically, concentrations of TCE detected seen in groundwater at an upper elevation of approximately 921 feet amsl in residuum well CWM-186-MW32 to a lower elevation of approximately 662 feet amsl in bedrock well CWM-186-MW35.

Figure 5-24 depicts the estimated lateral extent of TCE concentrations exceeding the groundskeeper SSSL in 2005, as interpreted by EV, at depths of 900 feet amsl, 850 feet amsl, and 800 feet amsl. At 900 feet the TCE plume is situated in an area that covers a majority of the crest of Reservoir Ridge and spreads towards the west, north and east in a mushroom shape. An area of high concentration (greater than 1,000 µg/L) occupies the northern portion of the plume at this elevation. At 850 feet amsl the TCE plume is divided into two portions, the larger northern portion extends from the crest of Reservoir Ridge towards the west and north, beyond the western boundary of Training Area T-38. The smaller portion of the plume is situated in the vicinity of groundwater seep sample location CWM-186-SEEP01-RFI, with high concentrations between 10 µg/L and 100 µg/L. At 800 feet amsl the TCE plume extends from the estimated source area near the top of Reservoir Ridge towards the west and north, beyond the western boundary of Training Area T-38. High concentrations, between 10 µg/L and 100 µg/L, comprise a majority of the plume area. A small portion of the TCE plume is present near groundwater seep sample location CWM-186-SEEP01-RFI.

Figure 5-25 depicts the estimated lateral extent of TCE concentrations exceeding the groundskeeper SSSL in 2003, as interpreted by EV, at the same depth intervals as in Figure 5-24. At 900 feet amsl the TCE plume covers a majority of the area comprising the crest of Reservoir Ridge, with high concentrations (greater than 1,000 µg/L) comprising the northern portion of the plume. At 850 feet amsl the TCE plume extends from the northern half of the fenced area towards the north and northeast, beyond the eastern boundary of Training Area T-38. High concentrations (greater than 1,000 µg/L) extend from the northeast corner of the fenced area to a point approximately midway down the hill. A second portion of the TCE plume at 850 feet amsl is situated near wells CWM-186-MW29 and CWM-186-MW30. At 800 feet amsl the plume extends from the northeast corner of the fenced area towards the east and north, and crosses the Training Area T-38 boundary on the east. High concentrations (greater than 1,000 µg/L) are present in the center of the plume near well CWM-186-MW53.

Figure 5-26 depicts a cross section of the 2005 TCE plume, as interpreted by EV, from the southwest portion of the Site near well CWM-186-MW19 to the northeast portion of the Site near well CWM-186-MW09. The large portion of the 2005 TCE contamination plume extends under the crest of Reservoir Ridge towards the southwest and towards the northeast to the base of Reservoir Ridge. The vertical extent of TCE contamination under well CWM-186-MW45 is approximately 675 feet amsl. A second portion of the plume is located near groundwater seep CWM-186-SEEP01-RFI. The highest area of contamination (100 µg/L to 1,000 µg/L) is within the larger plume and extends to a depth of approximately 715 feet amsl.

Figure 5-27 depicts the estimated vertical extent of the 2003 TCE plume, as interpreted by EV, for the same cross section as in Figure 5-26. The vertical extent of TCE contamination begins under the crest of Reservoir Ridge and spreads mainly towards the northeast near wells CWM-186-MW09 and CWM-186-MW23, with a vertical extent of approximately 675 feet amsl. Two higher concentration areas (100 µg/L to 1,000 µg/L) are indicated: one under the crest of Reservoir Ridge and one downgradient towards the northeast. The vertical extent of the higher concentrations is approximately 700 feet amsl.

5.5.1.1.6 Vinyl Chloride in Groundwater

Vinyl chloride concentrations exceeded the groundskeeper SSSL of 0.185 µg/L in two of the 23 residuum wells, CWM-186-MW40 (3.4 µg/L) and CWM-186-MW26 (12 µg/L). Vinyl chloride concentrations exceeded the groundskeeper SSSL in two of the 27 bedrock wells, CWM-186-MW23 (0.21 µg/L) and CWM-186-MW34 (0.33 µg/L). Vinyl chloride concentrations did not exceed the groundskeeper SSSL in the transition wells. Vinyl chloride was detected at the crest of Reservoir Ridge at the estimated TCE and PCE source areas, in monitoring well CWM-186-MW23 (0.21 µg/L) at the bottom of the east side of Reservoir Ridge, and in monitoring well CWM-186-MW34 (0.33 µg/L), north of Reservoir Ridge. These areas do not appear to be connected as a plume, and may be a result of the breakdown of TCE or another chlorinated hydrocarbon at these locations.

5.5.1.2 SVOCs, Explosives, and CWM Breakdown Products in Groundwater

Groundwater collected from 34 wells from May 2001 to March 2002, were analyzed for SVOCs and explosives (Shaw, 2004). Benzo(g,h,i)perylene and phenol were detected in eight of the

groundwater samples and are considered to be contaminants in groundwater at the Site. A total of seven explosives were detected in four of the groundwater samples and are considered to be contaminants in groundwater at the Site. The SVOC and explosive contaminants were compared to residential and groundskeeper SSSLs as presented in Table 5-10. None of the SVOC or explosive contaminants in groundwater exceeded the residential or groundskeeper SSSLs. Therefore, no SVOC or explosive compounds were considered COPCs in groundwater at the Site.

Bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was also detected in six of the groundwater samples. However, the bis(2-ethylhexyl)phthalate results were flagged by the laboratory indicating that this analyte was also detected in the associated laboratory or field blank sample. Therefore, bis(2-ethylhexyl)phthalate was not considered a contaminant in groundwater at the Site.

Groundwater collected from 33 wells from May 2001 to March 2002, were analyzed for CWM breakdown products (Shaw, 2004). 1,4-Dithiane and thiodiglycol were detected in three of the groundwater samples and are considered to be contaminants for groundwater at the Site. 1,4-Dithiane and thiodiglycol were compared to residential and groundskeeper SSSLs as presented in Table 5-10. None of the CWM breakdown products exceeded the residential or groundskeeper SSSLs, and so were not considered COPCs in groundwater at the Site.

5.5.1.3 Metals in Groundwater

Twenty-one out of 23 metals were detected in one or more of the groundwater samples. Metal results from the 2001-2003 Supplemental RI (Table F1) that were flagged indicating the analyte was also detected in the associated laboratory method or calibration blank were considered to be not detected. A statistical evaluation was performed to identify metals that may be present at elevated concentrations as a result of site-related activities. A detailed description of the statistical evaluation for the metal results is discussed in Appendix E. Based on the statistical evaluation, the following metal results were identified as site related and are considered to be contaminants in groundwater at the Site:

- Antimony in residuum well CWM-186-MW07 and transition well CWM-186-MW16.
- Chromium in residuum wells CWM-186-MW03 and CWM-186-MW08; and bedrock wells CWM-186-MW23, CWM-186-MW24, CWM-186-MW29, and CWM-186-MW30.
- Mercury in residuum well CWM-186-MW01.
- Thallium in bedrock well CWM-186-MW35.

Aluminum, calcium, iron, magnesium, potassium, and sodium failed the Tier 1 statistical evaluation (Appendix E). However, aluminum, calcium, iron, magnesium, potassium, and sodium are considered to be essential macronutrients with minimal human or ecological toxicity. Most organisms have mechanisms designed to regulate nutrient fluxes within their systems; therefore, these nutrients are generally only toxic at very high concentrations. Essential macronutrients were considered contaminants only if they were present in samples at concentrations greater than ten times the background screening criterion. Aluminum, calcium, iron, magnesium, and sodium were below ten times the background screening criterion, and

therefore, are not considered to be contaminants in groundwater at the Site. Because the potassium concentration in groundwater was above ten times the background screening criterion, Tier 2 and Tier 3 evaluations were conducted for potassium in groundwater. Based on the Tier 3 evaluation (Appendix E), potassium is not considered to be a contaminant in groundwater at the Site.

A statistical analysis could not be performed for chromium VI because only two samples were analyzed for chromium VI. Therefore, the detected chromium VI result is considered a contaminant in groundwater at the Site (Table 5-11).

The metal contaminants in groundwater were compared to residential and groundskeeper SSSLs as presented in Table 5-11. Metal contaminants exceeding SSSLs were considered to be COPCs at the Site. Antimony, chromium, and thallium exceeded the residential and/or groundskeeper SSSLs in groundwater at the Site. Residential SSSLs are typically the most stringent of the screening levels used as part of the human health risk evaluations for site investigations conducted at McClellan. However, because the proposed future land use for the Site is open space (EDAW, 1997), residential SSSLs were not used to evaluate the nature and extent of metal contamination in groundwater at the Site. Figures 5-28 and 5-29 show the sample locations and metal COPC concentrations exceeding groundskeeper SSSLs in residuum and bedrock groundwater wells, respectively. Antimony in transition well CWM-186-MW16 exceeded the groundskeeper SSSL, however, because this was the only transition well analyzed for metals, no figure was generated for the transition groundwater zone. Transition well CWM-186-MW16 is located near residuum well CWM-186-MW07 and bedrock well CWM-186-MW15.

5.5.2 Surface Water and Seeps

To evaluate the nature and extent of surface water and seep contamination at the site, the following analytical results were assessed to identify COPCs at the Site.

- VOC results for three surface water and four seep samples from the 2005 RFI (Table 5-8).
- Historical VOC, SVOC, explosives, CWM breakdown products, and metals results for four surface water and four seep samples from the RI (Shaw, 2004).

During Shaw's RI (Shaw, 2004), the seep locations were sampled during multiple investigations, therefore, the most recent data for that location was used in the assessment. The seep samples collected during the 2005 RFI had the same sample ID as the seep samples collected during Shaw's RI. However, the 2005 RFI seep samples were not collected from the same locations as the RI seep samples, and therefore are considered to be separate samples. To clarify the identification of the seep samples on the tables and figures, the sample IDs for the seeps collected by Shaw were assigned a suffix of "RI" and the sample IDs for the seeps from the 2005 RFI were assigned a suffix of "RFI".

5.5.2.1 VOCs in Surface Water and Seeps

Ten VOCs were detected in the seep samples and two VOCs were detected in the surface water samples. The detected VOCs are considered to be contaminants at the Site. VOC results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also

detected in the associated laboratory method blank sample were not considered contaminants at the Site. The VOC contaminants were compared to recreational SSSLs and ESVs as presented in Table 5-12. VOC contaminants with concentrations exceeding recreational SSSLs or ESVs were considered to be COPCs at the Site. 1,1,2,2-PCA and TCE exceeded the recreational SSSL. Figure 5-30 shows the sample locations and VOC COPC concentrations exceeding SSSLs in surface water and seeps. No VOCs exceeded the ESV in surface water and seeps.

5.5.2.2 SVOCs, Explosives, CWM Breakdown Products in Surface Water and Seeps

SVOCs, explosives, and CWM breakdown products were not detected in the surface water or seep samples at the Site.

5.5.2.3 Metals in Surface Water and Seeps

Twelve out of 23 metals were detected in one or more of the surface water and seep samples. Metal results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also detected in the associated laboratory method or calibration blank were considered to be not detected. Based on the statistical evaluation (Appendix E), the following metal results were identified as site-related and are considered to be contaminants in surface water and seeps at the Site:

- Beryllium in seep sample CWM-186-SEEP03-RI.
- Chromium in surface water sample CWM-186-SW/SD06.
- Thallium in seep sample CWM-186-SEEP01-RI.

The metal contaminants in surface water and seeps were compared to the recreational SSSL and ESV as presented in Table 5-13. Metal contaminants exceeding SSSLs or ESVs were considered to be COPCs at the Site. Beryllium, chromium, and thallium exceeded the ESV, and chromium and thallium exceeded the recreational SSSL. Figures 5-31 and 5-32 show the sample locations and metal COPC concentrations exceeding the SSSLs and ESVs, respectively, in surface water and seeps.

5.5.3 Sediments

To evaluate the nature and extent of sediment contamination at the Site, the historical VOC, SVOC, explosives, CWM breakdown products, and metals results for the four sediment samples from the RI (Shaw, 2004) were assessed to identify the COPCs in sediment at the Site.

5.5.3.1 VOCs in Sediment

Five VOCs were detected in the sediment samples and are considered to be contaminants at the Site. The VOC contaminants were compared to recreational SSSLs and ESVs as presented in Table 5-14. VOC results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also detected in the associated laboratory method blank sample were not considered contaminants at the Site. VOC contaminants with concentrations exceeding SSSLs or ESVs were considered to be COPCs at the site. No VOCs exceeded the recreational

SSSLs or ESVs in sediments.

5.5.3.2 SVOCs, Explosives, and CWM Breakdown Products in Sediment

SVOCs and explosives were not detected in the sediment samples.

One CWM breakdown product, thiodiglycol, was detected in two of the sediment samples (CWM-186-SW/SD01 and CWM-186-SW/SD02) and is considered to be a contaminant at the Site. The thiodiglycol concentrations were compared to the recreational SSSL and ESV as presented in Table 5-14. The thiodiglycol concentrations were below the recreational SSSL and ESV in sediments.

5.5.3.3 Metals in Sediment

Eighteen out of twenty-three metals were detected in one or more of the sediment samples. Metal results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also detected in the associated laboratory method or calibration blank were considered to be not detected. Based on the statistical evaluation (Appendix E), beryllium in samples CWM-186-SW/SD01 and CWM-186-SW/SD02 was identified as site related and considered to be a contaminant in sediment at the Site. The beryllium concentrations in samples CWM-186-SW/SD01 and CWM-186-SW/SD02 were compared to the recreational SSSL and ESV as presented in Table 5-14. Metal contaminants exceeding SSSLs or ESVs were considered to be COPCs for the Site. The metal contaminants had concentrations below the recreational SSSL and ESV.

5.5.4 Surface and Depositional Soil

To evaluate the nature and extent of surface and depositional soil contamination at the Site, the historical VOC, SVOC, explosives, CWM breakdown products, and metals results for the surface and depositional soil samples from Shaw's RI (Shaw, 2004) were assessed to identify the COPCs at the Site.

5.5.4.1 VOCs in Surface and Depositional Soil

Eleven VOCs were detected in the surface and depositional soil samples and are considered to be contaminants at the Site. VOC results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also detected in the associated laboratory method blank sample were not considered contaminants at the Site.

The VOC contaminants were compared to residential, groundskeeper, and recreational SSSLs, and ESVs as presented in Table 5-15. VOC contaminants with concentrations exceeding groundskeeper SSSLs, recreational SSSLs, or ESVs were considered to be COPCs at the Site. No VOC contaminants exceeded the SSSLs. Only acetone in surface soil sample CWM-186-MW11 exceeded the ESV. Figure 5-33 shows the sample location and VOC COPC concentration exceeding the ESV in surface and depositional soil.

5.5.4.2 SVOCs, Explosives, and CWM Breakdown Products in Surface and Depositional Soil

Four SVOCs, fluoranthene, benzo(b)fluoranthene, benzo(ghi)perylene, and indeno(1,2,3-cd)pyrene, were detected in surface soil sample CWM-186-MW12 (Shaw, 2004). None of these PAH compounds exceeded the background screening values and so were not considered to be contaminants at the Site.

Two explosive compounds, 2,4-dinitrotoluene and 3-nitrotoluene, were detected in the surface and depositional soil samples and are considered to be contaminants at the Site (Shaw, 2004). The explosive contaminants were compared to residential, groundskeeper, and recreational SSSLs, and ESVs as presented in Table 5-15. No explosive contaminants exceeded the SSSLs or ESVs.

One CWM breakdown product, thiodiglycol, was detected at CWM-186-GP15 and is considered to be a contaminant at the Site (Shaw, 2004). The thiodiglycol result was compared to the SSSLs as presented in Table 5-15. The thiodiglycol result was below the SSSLs.

5.5.4.3 Metals in Surface and Depositional Soil

Twenty-two metals were detected in one or more of the surface soil or depositional soil samples. Metal results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the analyte was also detected in the associated laboratory method or calibration blank were considered to be not detected. Based on the statistical evaluation (Appendix E), the following metal results were identified as site-related and are considered to be contaminants in surface and depositional soil at the Site:

- Cadmium in sample CWM-186-MW41.
- Mercury in sample CWM-186-GP16.
- Selenium in sample CWM-186-MW48.
- Zinc in sample CWM-186-GP16.

Aluminum, calcium, iron, magnesium, and potassium failed the Tier I statistical evaluation (Appendix E). However, these metals are indicative of weathering processes of the natural minerals present in the soil; and are essential macronutrients that can be regulated by many organisms, and therefore, renders minimal human or ecological toxicity. Aluminum, iron, and potassium were below ten times the background screening criterion, and therefore, are not considered to be contaminants in surface and depositional soil at the Site. Because the calcium and magnesium concentrations were above ten times the background screening criterion, Tier 2 and Tier 3 evaluations were conducted for calcium and magnesium in surface and depositional soil. Based on the Tier 3 evaluation (Appendix E), calcium and magnesium are not considered to be contaminants in surface and depositional soil at the Site.

The metal contaminants in surface and depositional soil were compared to residential, groundskeeper, and recreational SSSLs, and ESVs as presented in Table 5-15. Metal contaminants exceeding groundskeeper SSSLs, recreational SSSLs, or ESVs were considered to

be COPCs at the site. No metals exceeded the SSSLs. Cadmium, mercury, selenium, and zinc exceeded ESVs. Figure 5-33 shows the sample locations and metal COPC concentrations exceeding ESVs in surface and depositional soil.

5.5.5 Subsurface Soil

To evaluate the nature and extent of subsurface soil contamination at the Site, the historical VOC, SVOC, explosives, CWM breakdown products, and metals results for the subsurface soil samples from Shaw's RI (Shaw, 2004) were assessed to identify the COPCs at the Site.

5.5.5.1 VOCs in Subsurface Soil

Twenty-one VOCs were detected in the subsurface soil samples and are considered to be contaminants at the Site. VOC results from the 2001-2003 Supplemental RI (Shaw, 2004) that were flagged indicating the analyte was also detected in the associated laboratory method blank sample were not considered contaminants at the Site.

The VOC contaminants were compared to residential, groundskeeper, and recreational SSSLs, and ESVs as presented in Table 5-16. VOC contaminants with concentrations exceeding SSSLs or ESVs were considered to be COPCs at the Site. Residential SSSLs are typically the most stringent of the screening levels used as part of the human health risk evaluations for site investigations conducted at McClellan. However, because the proposed future land use for the Site is open space (EDAW, 1997), residential SSSLs were not used to evaluate the nature and extent of VOC contamination in subsurface soil at the Site. 1,1,2,2-PCA and TCE exceeded the groundskeeper SSSLs. Figure 5-34 shows the sample locations and VOC COPC concentrations exceeding groundskeeper SSSLs in subsurface soil. 1,1,2,2-PCA, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, and TCE exceeded the ESVs. Figure 5-35 shows the sample locations and VOC COPC concentrations exceeding ESVs in subsurface soil.

5.5.5.2 SVOCs, Explosives, and CWM Breakdown Products in Subsurface Soil

One SVOC, fluoranthene, was detected in subsurface soil sample CWM-186-MW12 (3-5 feet). However, because this PAH compound was below the background screening value, it was not considered to be a contaminant at the Site.

Explosives were not detected in subsurface soil at the Site.

One CWM breakdown product, thiodiglycol, was detected in subsurface soil sample CWM-186-GP15 (10-12 feet) and is considered to be a contaminant at the Site. The thiodiglycol result was compared to the SSSL as presented in Table 5-16. No ESV has been established for thiodiglycol. The thiodiglycol result was below the SSSLs.

5.5.5.3 Metals in Subsurface Soil

Twenty-one out of 23 metals were detected in one or more of the subsurface soil samples. Metal results from the 2001-2003 Supplemental RI (Shaw 2004) that were flagged indicating the

analyte was also detected in the associated laboratory method or calibration blank were considered to be not detected. Based on the statistical evaluation (Appendix E), the following metal results were identified as site related and are considered to be contaminants in subsurface soil at the Site:

- Selenium in sample CWM-186-GP05.
- Potassium in samples CWM-186-MW45 and CWM-186-MW53.

The metal contaminants in subsurface soil were compared to residential, groundskeeper, and recreational SSSLs, and ESVs as presented in Table 5-17. No SSSLs or ESVs have been established for potassium. Metal contaminants exceeding SSSLs or ESVs were considered to be COPCs at the Site. No metals exceeded the SSSLs. Selenium exceeded the ESV. Figure 5-35 shows the sample location and metal COPC concentration exceeding the ESV in subsurface soil.

5.5.6 Nature and Extent Conclusions

Additional sampling completed as part of the 2005 RFI has provided a more complete understanding of the nature and extent of contamination in surface water, surface soil, subsurface soil, and groundwater. Important conclusions regarding nature and extent of contamination at Training Area T-38 are as follows:

- Groundwater VOC contamination exceeding groundskeeper SSSLs at the Site included 1,1,2,2-PCA, 1,1,2-TCA, acetone, carbon tetrachloride, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, TCE, and vinyl chloride.
- Groundwater metal contamination exceeding SSSLs at the Site included antimony, chromium, and thallium.
- SVOCs, explosives, and CWM products were not detected above the SSSLs in groundwater at the Site.
- VOCs following groundwater flow have migrated in a radial pattern from the estimated contamination source area located at the crest of Reservoir Ridge.
- Groundwater VOC contamination exceeding groundskeeper SSSLs has been horizontally and vertically delineated at the Site.
- Surface water VOC contamination exceeding SSSLs included 1,1,2,2-PCA and TCE. No VOCs exceeded the ESV in surface water and seeps.
- Chromium and thallium exceeded SSSLs and ESVs at seep and surface water locations on the southwest side of Reservoir Ridge. Beryllium exceeded the ESV at a seep location on the northeast side of Reservoir Ridge.
- SVOCs, explosives, and CWM breakdown products were not detected in the surface water or seep samples at the Site.
- No VOCs, CWM breakdown products, or metals exceeded the recreational SSSLs or ESVs in sediments.
- SVOCs and explosives were not detected in the sediment samples.
- No VOCs exceeded the SSSLs in surface and depositional soil at the Site.
- Acetone exceeded the ESV in surface soil sample CWM-186-MW11, however there is no data or information indicating a possible source of acetone contamination at Training Area T-38, and therefore no evidence that suggests acetone is Site-related.

- No SVOC, explosives, or CWM breakdown products exceeded the SSSLs or ESVs in surface or depositional soil samples.
- No metals exceeded the SSSLs in surface or depositional soils at the Site. Cadmium, chromium, and selenium exceeded ESVs (at one sample location each) within the estimated contaminant source area located at the crest of Reservoir Ridge. Mercury and zinc exceeded ESVs at CWM-186-GP16.
- Subsurface soil VOC contamination exceeding SSSLs included 1,1,2,2-PCA and TCE at locations within the estimated contaminant source area located at the crest of Reservoir Ridge. Subsurface soil VOC contamination exceeding ESVs included 1,1,2,2-PCA, chloroform, cis-1,2-DCE, PCE, trans-1,2-DCE, and TCE at locations within the estimated contaminant source area located at the crest of Reservoir Ridge.
- SVOCs, explosives, and CWM breakdown products were either not detected or were detected at concentrations less than SSSLs and ESVs in subsurface soil at the Site.
- Selenium was the only metal that exceeded the ESV in subsurface soil at the Site. No metals exceeded the SSSLs.

Given the consistent and corroborative nature of the data collected during this RFI and previous investigations, and the limited number and defined extent of COPCs, this RFI has been successful in defining both the nature and extent of environmental contamination at the Site.

6.0 CONTAMINANT FATE AND TRANSPORT

The fate and transport of contaminants when released to the environment will govern the potential for exposures to ecological receptors. Contaminants in environmental media may result in direct exposure (e.g., plants exposed to surface soil) or indirect exposure (animals eating plants exposed to surface soil) and have the potential to migrate to other environmental media or areas. This section discusses the mechanisms by which contaminants can be transported.

6.1 Fate and Transport in Groundwater

Contaminants in groundwater can be transported in either a dissolved phase or a soil-adsorbed state in the direction of groundwater flow. In addition, dense non-aqueous phase liquids (DNAPL), such as chlorinated hydrocarbons used for decontamination at the Site, tend to migrate downward through the soil as a liquid phase separate from infiltrating water influenced by gravity. When enough DNAPL is released into the soil to exceed the residual saturation capacity of the unsaturated zone, the DNAPL may then enter the groundwater, where the phase-separate contamination may sink through the water table. Once in the groundwater, the DNAPL may form pockets of phase-separate contamination in fractures, dead-end pore space, or along impermeable surfaces. These DNAPL pockets may slowly interact with groundwater, releasing dissolved-phase chlorinated hydrocarbons that will then be transported in the direction of groundwater flow.

Regional groundwater flow directions in residuum, transition, and bedrock zones typically follow site topography. Geologic factors at Training Area T-38 such as the presence of bedrock fractures and faults, the thickness of the overlying residuum, the presence of karst or solution cavities and void spaces, and geologic units with different hydraulic conductivities also affect the flow direction and gradient by creating preferential flow pathways and contaminant collection areas.

At Training Area T-38, the surface topography slopes in all directions from the top of Reservoir Ridge. The most steeply sloped portion of the hill is on the west and southwest side with a smaller slope gradient on the eastern side of the hill. The top of the hill is relatively flat, with two slightly elevated peaks at the north and south. East of Reservoir Ridge is another hill that slopes towards Training Area T-38. The two slopes meet in a north to south trending valley.

A bedrock high is situated under the top of the hill at Training Area T-38 and the bedrock surface slope generally follows the slope of the surface topography. The slope gradients of the bedrock surface are typically not as steep as the surface gradients. The exception appears to be along the north side of the bedrock high where the bedrock surface slopes more steeply towards the north than the surface topography.

Groundwater at Training Area T-38 is generally mounded near the center of the hill with flow in all directions. The western portion of the groundwater flow pattern generally exhibits steeper groundwater gradients as the water flows toward the Jacksonville Fault. At the Fault, groundwater follows the direction of the fault system towards the north/northwest. The eastern portion of the groundwater flows towards the base of Reservoir Ridge where it converges with

groundwater flowing in a westerly direction from a hill east of the Site. At the point of convergence, the groundwater flows either towards the north or south. Groundwater flowing north at the point of convergence generally flows northwest around the base of Reservoir Ridge and joins regional flow towards the north/northwest. The northern portion of the groundwater flow continues towards the north where it joins regional flow towards the north/northwest, following the Jacksonville Fault. Groundwater flow towards the south of Reservoir Ridge eventually joins regional groundwater flow patterns, however not enough data are available at Training Area T-38 to fully describe this connection.

The highest VOC concentrations are located within the identified training area (fenced area) at the crest of Reservoir Ridge. The distribution of total VOCs at the Site indicates dissolved-phase chlorinated hydrocarbon plumes follow the local groundwater flow direction. Flow at the site is mainly through residuum and fractures located in the bedrock. The fate and transport of six chlorinated hydrocarbon COCs identified in groundwater at the Site (1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, TCE, and vinyl chloride) are discussed below.

6.1.1 1,1,2,2-PCA

1,1,2,2-PCA is a colorless chlorinated hydrocarbon with a molecular weight of 167.5 and a density (at 20°C) of 1.594 grams per milliliter (g/mL). It is soluble in water (2.87 grams per liter [g/L] at 20°C), is volatile in air (vapor pressure of 5.95 mm Hg at 25°C), and is highly mobile in groundwater. When introduced into the environment, much of the chemical will evaporate, while the remainder may eventually break down due to its reactions with water. However, once 1,1,2,2-PCA is transported to groundwater through infiltration (discussed in Section 6.4), breakdown of the chemical occurs, with half of the 1,1,2,2-PCA expected to disappear from groundwater in approximately 13 months (ATSDR, 1996).

The three dimensional extent of 1,1,2,2-PCA contamination in groundwater is described in Section 5.5.1.1.1. In the 2003 EV model the 1,1,2,2-PCA plume is larger than the 1,1,2,2-PCA plume indicated in the 2005 EV model, in both vertical and horizontal directions. The difference in plume volume may be evidence that natural degradation of the 1,1,2,2-PCA is occurring at the Site or may indicate a qualitative difference in the two models. The 2003 EV model incorporated more data points than the 2005 EV model but did not include data from wells CWM-186-MW56, CWM-186-MW57, CWM-186-MW58, and CWM-186-MW59. These differences add data to the 2005 data set in critical locations while also reflecting decreases in concentrations over time at locations in the plume.

6.1.2 1,1,2-TCA

1,1,2-TCA, a breakdown product of 1,1,2,2-PCA, is a colorless chlorinated hydrocarbon with a molecular weight of 133.4 and a density (at 20°C) of 1.44 g/mL. It is slightly soluble in water (4.4 g/L at 20°C), is volatile in air (vapor pressure of 22.49 mm Hg at 25°C), and is highly mobile in groundwater. When 1,1,2-TCA is introduced into the environment, most of the compound partitions into the air, although some may find its way into groundwater. Breakdown of 1,1,2-TCA in groundwater is slow, and may remain in groundwater for greater than 16 weeks to several years (ATSDR, 1989). 1,1,2-TCA is a breakdown product of 1,1,2,2-PCA as

described in section 6.1.8, and increasing concentrations of 1,1,2-TCA will be identified at the Site as 1,1,2,2-PCA degrades.

The three dimensional extent of 1,1,2-TCA contamination in groundwater is described in Section 5.5.1.1.2. In the 2003 EV model the 1,1,2-TCA plume extends deeper than the 1,1,2-TCA plume model for 2005, but does not extend as far horizontally. The 2005 model also indicates a larger high concentration contour in the shallow portion of the plume. The differences in size and extent of the plume from 2003 to 2005 may provide evidence of natural degradation of 1,1,2-TCA at the Site as well as providing evidence of the transport of 1,1,2-TCA contamination in groundwater. Differences in plume size and area may also be a result of qualitative differences in the two models. The 2003 EV model incorporated more data points than the 2005 EV model but did not include data from wells CWM-186-MW56, CWM-186-MW57, CWM-186-MW58, and CWM-186-MW59. These differences add data to the 2005 data set in critical locations while also reflecting decreases in concentrations over time at locations in the plume.

6.1.3 Carbon Tetrachloride

Carbon tetrachloride is a colorless chlorinated hydrocarbon with a molecular weight of 153.82 and a density (at 20°C) of 1.594 g/mL. It is soluble in water (0.8 g/L at 20°C), is volatile in air (vapor pressure of 90 mm Hg at 25°C), and is moderately mobile in groundwater. When introduced into the environment, most of the carbon tetrachloride will evaporate, while the remainder will follow various pathways into the surface water, soils, and groundwater. Carbon tetrachloride that does migrate to groundwater is broken down, mostly through anaerobic degradation, and can remain in groundwater for months (ATSDR, 2005).

The three dimensional extent of carbon tetrachloride contamination in groundwater is described in Section 5.5.1.1.3. In the 2003 EV model the carbon tetrachloride plume extends deeper than the carbon tetrachloride plume model for 2005, but does not extend as far horizontally towards the east. The 2005 model also indicates a larger high concentration contour (hot spot) in the shallow portion of the plume. The reason for the larger hot spot can be traced to the data sets used in the 2003 and 2005 models. In 2005, groundwater collected from newly installed well CWM-186-MW58 had a carbon tetrachloride concentration of 4.2 µg/L, causing EV to interpret the plume area further to the east. In addition, carbon tetrachloride was not detected in groundwater collected from well CWM-186-MW04 in 2003. The same well was not sampled in 2005, and, due to the lack of this data point, EV modeled a larger plume in this area. Generally, the differences in size and extent of the plume from 2003 to 2005 provide evidence of natural degradation of carbon tetrachloride at the Site as well as providing evidence of the transport of carbon tetrachloride contamination in groundwater. Differences in plume size and area may also be a result of qualitative differences in the two models. The 2003 EV model incorporated more data points than the 2005 EV model but did not include data from wells CWM-186-MW56, CWM-186-MW57, CWM-186-MW58, and CWM-186-MW59. These differences add data to the 2005 data set in critical locations while also reflecting decreases in concentrations over time at locations in the plume.

6.1.4 PCE

PCE is a chlorinated solvent with a molecular weight of 165.83 and a density (at 20°C) of 1.623 g/mL. It is soluble in water (0.15 g/L at 25°C), is volatile in air (vapor pressure of 18.5 mm Hg at 25°C), and is moderately mobile in groundwater. When introduced into the environment, most of the PCE will evaporate, while the remainder will follow various pathways into the surface water, soils, and groundwater. PCE that does migrate to groundwater may remain for several months before being broken down (ATSDR, 1997).

The three dimensional extent of PCE contamination in groundwater is described in Section 5.5.1.1.4. In the 2003 EV model the PCE plume extends deeper and farther towards the east than the PCE plume model for 2005, but does not extend as far horizontally in the shallow portion of the plume. The 2005 model also indicates a larger hot spot in the shallow portion of the plume. The reason for the larger hot spot can be traced to the data sets used in the 2003 and 2005 models. In 2005, groundwater samples were not collected from wells CWM-186-MW01, CWM-186-MW02, CWM-186-MW43, CWM-186-MW44, and CWM-186-MW49, and in 2003 groundwater collected from these wells had PCE concentrations of 10 µg/L or less. Therefore EV interpreted the hot spot for this area in 2005 based on the high concentration of PCE at well CWM-186-MW26 without considering surrounding data points of lower concentrations. Generally, the differences in size and extent of the plume from 2003 to 2005 may provide evidence of natural degradation of PCE at the Site as well as providing evidence of the transport of PCE contamination in groundwater. Differences in plume size and area may also be a result of qualitative differences in the two models. The 2003 EV model incorporated more data points than the 2005 EV model but did not include data from wells CWM-186-MW56, CWM-186-MW57, CWM-186-MW58, and CWM-186-MW59. These differences add data to the 2005 data set in critical locations while also reflecting decreases in concentrations over time at locations in the plume.

6.1.5 TCE

TCE is a colorless chlorinated solvent with a molecular weight of 131.40 and a density (at 20°C) of 1.465 g/mL. It is soluble in water (1.070 g/L at 20°C), is volatile in air (vapor pressure of 74 mm Hg at 25°C), and is moderately mobile in groundwater. When introduced into the environment, most of the TCE will evaporate, while the remainder will follow various pathways into the surface water, soils, and groundwater. TCE that does migrate to groundwater is broken down in days or weeks (ATSDR, 1997). As well as being utilized as a solvent, TCE is also a breakdown product of PCE (Section 6.1.8), and concentrations may increase as PCE is broken down.

The three dimensional extent of TCE contamination in groundwater is described in Section 5.5.1.1.5. In the 2003 EV model the TCE plume is generally smaller than the 2005 TCE plume, but extends farther towards the east in the deeper portions of the model. The 2005 model plume is larger, extends farther towards the west, and includes larger hot spots in the 900-foot amsl slice and the 850-foot amsl slice. The reason for the larger plume and hot spots can be traced to the data sets used in the 2003 and 2005 models. In 2005, groundwater samples were not collected from ten wells near the source area at the crest of Reservoir Ridge. Those same ten

wells were sampled in 2003, and each well had a concentration lower than the 1,000 µg/L hot spot concentration contour. Without those additional ten wells, EV predicted a larger plume with larger hot spots for 2005. Generally, the differences in size and extent of the plume from 2003 to 2005 provide evidence of the transport of TCE and degradation of contamination in groundwater. As mentioned, differences in plume size and area may also be a result of qualitative differences in the two models. The 2003 EV model incorporated more data points than the 2005 EV model but did not include data from wells CWM-186-MW56, CWM-186-MW57, CWM-186-MW58, and CWM-186-MW59. These differences add data to the 2005 data set in critical locations while also reflecting decreases in concentrations over time at locations in the plume.

6.1.6 Vinyl Chloride

Vinyl chloride is a colorless chlorinated compound generally seen as a breakdown product from other chlorinated solvents with a molecular weight of 62.5 and a density (at 20°C) of 0.911 g/mL. It is soluble in water (2.76 g/L at 25°C), and is highly volatile in air (vapor pressure of 2,600 mm Hg at 25°C). When introduced into the environment, most of the vinyl chloride will evaporate back to the air where it may be broken down in days, resulting in the formation of chemicals such as hydrochloric acid (HCl), formaldehyde, and CO_2. Some vinyl chloride can dissolve in water and will eventually be broken down. Much of the vinyl chloride found in groundwater is a result of the breakdown of other chlorinated solvents such as TCE and PCE (ATSDR, 2004).

Because vinyl chloride is a breakdown product of more complex hydrocarbons, the presence of vinyl chloride at the Site in 2003 and 2005 is likely due to the presence of other VOC plumes including TCE and PCE. The breakdown of complex chlorinated solvents is discussed in the Section 6.1.8.

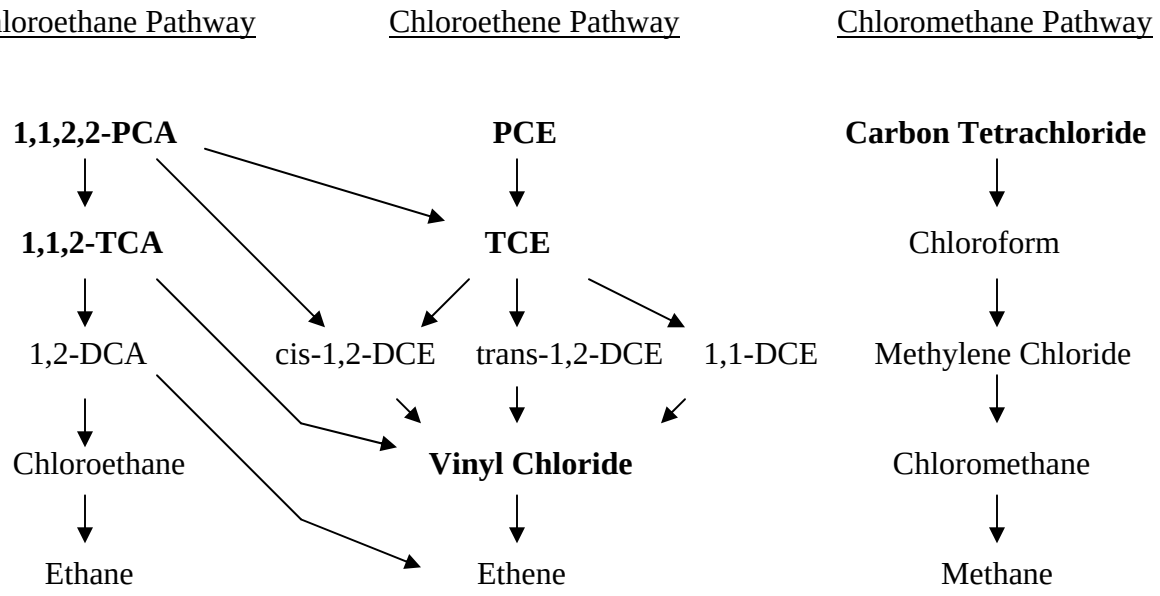
6.1.7 Metals

Metals COPCs identified in groundwater at the Site included antimony and chromium in residuum wells, thallium in bedrock wells, and antimony in transition well CWM-186-MW16. In general, metals are not degradable through biological or chemical actions and are typically considered to be persistent in the environment. In addition, metals tend to sorb easily to soil particles and are not highly mobile under natural subsurface conditions. As a result, metals generally do not move significant distances with groundwater flow.

6.1.8 Natural Degradation of Chlorinated Solvents in Groundwater

The analysis for ethane, ethene, and methane was performed on twelve groundwater samples from the Site to provide evidence of the natural degradation of chlorinated solvents present in groundwater. Natural degradation of chlorinated solvents occurs under anaerobic conditions in the environment through the process of chemical reduction (dechlorination). Highly oxidized chemicals such as PCE and TCE have a high reduction potential and are resistant to further oxidation under aerobic conditions. Ethane and ethene are the resulting daughter products of higher order chloroethanes and chloroethenes through the process of anaerobic reduction under natural environmental conditions. Methane is a product of the anaerobic degradation of higher

order chloromethanes. Methane is also a product of methanogens, which are microorganisms that release methane during breakdown of chlorinated solvents. The anaerobic pathways for the reduction of chloroethanes, chloroethenes, and chloromethanes are as follows (Fetter, 1993; Field, 2004):



The six chlorinated solvents identified as constituents of concern (COCs) in groundwater at the Site (see Section 7.4 for details concerning the identification of the COCs) are included in these anaerobic pathways in bold face type. Evaluation of the anaerobic degradation pathways at Training Area T-38 is described in the following subsections, and summarized in Table 6-1. Figures F1 to F7 (from Appendix F) presents the concentrations of chlorinated solvents over time for seven of the 12 monitoring wells that were assessed for anaerobic degradation. Contaminant extent is discussed in Section 5.

Monitoring Well CWM-186-MW03

CWM-186-MW03 is located within the 2005 1,1,2,2-PCA, carbon tetrachloride, PCE, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: No ethane or chlorinated ethanes were detected in groundwater collected from CWM-186-MW03 in 2005. Historically, 1,1,2,2-PCA has been detected in groundwater up to a concentration of 14 µg/L (2003). The absence of ethane and chloroethanes in 2005 may indicate complete degradation of 1,1,2,2-PCA in groundwater collected from monitoring well CWM-186-MW03, or may indicate a crossover from the chloroethane pathway to the chloroethene pathway as illustrated in the diagram included in this section.

Chloroethene Pathway: PCE (2.3 µg/L), TCE (180 µg/L), cis-1,2-DCE (6.4 µg/L), trans-1,2-DCE (4.7 µg/L), and 1,1-DCE (0.23 µg/L) were all detected in the 2005 groundwater samples collected from CWM-186-MW03 indicating the process of anaerobic degradation of chloroethenes is continuing at this location, although ethene was not detected.

Chloromethane Pathway: Methane (0.72 µg/L) was detected in the 2005 groundwater sample collected from CWM-186-MW03, along with carbon tetrachloride (20 µg/L) and chloroform (2.6 µg/L). The presence of these chloromethanes indicates the breakdown of carbon tetrachloride at this location through the process of natural degradation. Methane may also be present as a result of the natural degradation of PCE and TCE at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW10

CWM-186-MW10 is located near the bottom of the eastern slope of Reservoir Ridge outside of the 2005 PCE, 1,1,2,2-PCA, and TCE plume boundaries, but within the 2005 carbon tetrachloride plume boundary.

Chloroethane Pathway: No ethane or chlorinated ethanes were detected in groundwater collected from CWM-186-MW10 in 2005. Historically, 1,1,2,2-PCA has been detected in groundwater up to a concentration of 47 µg/L (2001). The absence of ethane and chloroethanes in 2005 may indicate complete degradation of 1,1,2,2-PCA in groundwater collected from monitoring well CWM-186-MW10, or may indicate a downgradient migration of 1,1,2,2-PCA.

Chloroethene Pathway: No ethene or chlorinated ethenes were detected in groundwater collected from CWM-186-MW10 in 2005. Historically, TCE has been detected in groundwater up to a concentration of 33 µg/L (2001). The absence of ethene and chloroethenes in 2005 may indicate complete degradation of TCE in groundwater collected from monitoring well CWM-186-MW10 or may indicate a downgradient migration of TCE.

Chloromethane Pathway: Methane (1.4 µg/L) was detected in CWM-186-MW10, although carbon tetrachloride, chloroform, methylene chloride, and chloromethane were not detected in 2005. Historically, carbon tetrachloride has been detected in groundwater up to a concentration of 9.5 µg/L (2001). Chloroform has also been historically detected in groundwater at well CWM-186-MW10 at concentrations up to 2.7 µg/L (2001). The presence of methane and the absence of higher-order chloromethanes at this location in 2005 may indicate degradation of carbon tetrachloride to the final dechlorination step in groundwater collected from monitoring well CWM-186-MW10.

Monitoring Well CWM-186-MW21

CWM-186-MW21 is located near the bottom of the northeastern slope of Reservoir Ridge outside of the 2005 1,1,2,2-PCA and PCE plume boundaries. In 2005, TCE was detected in well CWM-186-MW21 at a concentration of 14 µg/L.

Chloroethane Pathway: No ethane or chlorinated ethanes were detected in groundwater collected from CWM-186-MW21.

Chloroethene Pathway: TCE and cis-1,2-DCE (0.3 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW21. The presence of the cis-1,2-DCE (and absence of vinyl chloride and ethene) indicates the natural degradation of TCE is in its initial stages in groundwater collected from monitoring well CWM-186-MW21.

Chloromethane Pathway: A trace amount of carbon tetrachloride (0.25 µg/L) was detected in the 2005 groundwater sample collected from CWM-186-MW21. In 2003, a trace amount of chloroform (0.21 µg/L) was detected. No other chemical compounds comprising the chloromethane pathway outlined in this section were detected in groundwater from this location.

Monitoring Well CWM-186-MW23

CWM-186-MW23 is located near the bottom of the eastern slope of Reservoir Ridge outside of the 2005 PCE and 1,1,2,2-PCA plume boundaries, and screened below the horizontal expression of the carbon tetrachloride plume. TCE was also present in the 2005 groundwater sample collected from well CWM-186-MW23 at a concentration of 1.1 µg/L.

Chloroethane Pathway: Ethane was detected at a concentration of 12 µg/L in the 2005 groundwater sample collected from CWM-186-MW23. None of the higher-order chlorinated ethanes outlined in the chloroethane pathway were detected in groundwater collected from CWM-186-MW23 in 2005, however 1,1,2,2-PCA was detected at a concentration of 13 µg/L in 2003. The presence of ethane in 2005 and the absence of higher-order chlorinated ethanes in 2005 may indicate degradation of 1,1,2,2-PCA to the final dechlorination step in groundwater collected from monitoring well CWM-186-MW23.

Chloroethene Pathway: TCE and vinyl chloride (0.21 µg/L) were the only ethenes present in groundwater collected from CWM-186-MW23 in 2005. Historically PCE has been detected in trace amounts (0.31 µg/L in 2003) and TCE concentrations have been recorded up to 22 µg/L (2003). The presence of vinyl chloride in 2005 may indicate breakdown of TCE through the chloroethene pathway in groundwater collected from monitoring well CWM-186-MW23.

Chloromethane Pathway: Methane was detected in the 2005 groundwater sample collected from CWM-186-MW23 at a concentration of 2,900 µg/L. Historically, carbon tetrachloride (5.2 µg/L in 2001 and 9 µg/L in 2003), chloroform (0.43 µg/L in 2003), and methylene chloride (0.26 µg/L in 2003) have been detected in groundwater at CWM-186-MW23. The presence of methane in 2005 and the absence of other chloromethanes in 2005 may indicate degradation of carbon tetrachloride to the final dechlorination step in groundwater collected from monitoring well CWM-186-MW23. Methane may also be present as a result of the natural degradation of PCE and TCE at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW26

CWM-186-MW26 is located within the 2005 1,1,2,2-PCA, carbon tetrachloride, PCE, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: In 2005, concentrations of 1,1,2,2-PCA (20,000 µg/L), 1,1,2-TCA (25 µg/L), 1,2-DCA (0.73 µg/L), and ethane (61 µg/L) were detected in groundwater collected from CWM-186-MW26. The presence of these chemical compounds outlined in the chloroethane pathway indicates the active process of natural degradation of 1,1,2,2-PCA in groundwater collected from monitoring well CWM-186-MW26.

Chloroethene Pathway: In 2005 concentrations of PCE (170 µg/L), TCE (3,300 µg/L), cis-1,2-DCE (1,400 µg/L), trans-1,2-DCE (370 µg/L), 1,1-DCE (3.5 µg/L) vinyl chloride (12 µg/L), and

ethene (220 µg/L) were detected at CWM-186-MW26, demonstrating the active process of natural degradation of PCE and TCE in groundwater collected from monitoring well CWM-186-MW26.

Chloromethane Pathway: Although carbon tetrachloride was not detected in the 2005 groundwater sample collected from CWM-186-MW26, chloroform was present at a concentration of 85 µg/L. Methane was also detected in the 2005 groundwater sample collected from CWM-186-MW26 at a concentration of 2.5 µg/L. The presence of chloroform and methane indicates breakdown of chloromethanes by way of natural degradation in groundwater collected from monitoring well CWM-186-MW26. Methane may also be present as a result of the natural degradation of PCE and TCE at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW29

CWM-186-MW29 is located at the crest of Reservoir Ridge, south of the 2005 PCE plume boundary, but near the edge of the carbon tetrachloride, 1,1,2,2-PCA, and TCE plume boundaries.

Chloroethane Pathway: No ethane or chlorinated ethanes were detected in groundwater collected from CWM-186-MW29 in 2005. In 2003, 1,1,2,2-PCA and 1,1,2-TCA were detected in groundwater at concentrations of 0.91 µg/L and 0.34 µg/L, respectively. The absence of ethane and chlorinated ethanes in 2005 may indicate complete degradation of 1,1,2,2-PCA and 1,1,2-TCA in groundwater at monitoring well CWM-186-MW29.

Chloroethene Pathway: TCE (3.7 µg/L) was the only ethene present in groundwater collected from CWM-186-MW29 in 2005. Historically TCE was detected in groundwater from this location in 2001 and 2003. PCE and cis-1,2-DCE were also detected in groundwater collected from CWM-186-MW29 in 2003. The presence of cis-1,2-DCE may indicate the occurrence of natural degradation in groundwater at monitoring well CWM-186-MW29.

Chloromethane Pathway: Methane and carbon tetrachloride were detected in the 2005 groundwater sample collected from CWM-186-MW29 at concentrations of 0.68 µg/L and 0.31 µg/L, respectively. Historically, carbon tetrachloride has been detected in groundwater at this location in 2001 and 2003. Chloroform was also detected in groundwater collected in 2001. The presence of methane and carbon tetrachloride in 2005 may indicate degradation of carbon tetrachloride in groundwater collected from monitoring well CWM-186-MW29. Methane may also be present as a result of the natural degradation of PCE and TCE at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW32

CWM-186-MW32 is located within the 2005 carbon tetrachloride, PCE, 1,1,2,2-PCA, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: 1,1,2,2-PCA and 1,1,2-TCA were detected in the 2005 at concentrations of 580 µg/L and 4.8 µg/L, respectively. 1,2-DCA, chloroethane, and ethane were not detected in groundwater collected from CWM-186-MW32. The presence of 1,1,2,2-PCA and 1,2-TCA and

absence of other chlorinated ethanes outlined in the chloroethane pathway indicate degradation of 1,1,2,2-PCA in groundwater is in its beginning stages at this location.

Chloroethene Pathway: PCE (36 µg/L), TCE (510 µg/L), cis-1,2-DCE (0.89 µg/L), and trans-1,2-DCE (0.39 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW32 (ethene was not detected). 1,1,-DCE and vinyl chloride were detected in 2002. The presence of these chlorinated ethenes indicates the process of anaerobic degradation of chloroethenes is continuing in groundwater at this location.

Chloromethane Pathway: Methane and chloroform were detected in the 2005 groundwater sample collected from CWM-186-MW32 at concentrations of 0.63 µg/L and 0.26 µg/L, respectively, which indicates degradation is occurring at this location through the chloromethane pathway. Methane may also be present as a result of the natural degradation of PCE and TCE in groundwater at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW39

CWM-186-MW39 is located within the 2005 carbon tetrachloride, PCE, 1,1,2,2-PCA, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: In 2005, 1,1,2,2-PCA, 1,1,2-TCA, and ethane were detected in groundwater collected from CWM-186-MW39 at concentrations of 14,000 µg/L, 5.8 µg/L, and 1.5 µg/L, respectively. Historically, 1,1,2,2-PCA and 1,1,2-TCA have been detected in groundwater from CWM-186-MW39. The presence of these chlorinated ethane compounds indicates the active process of natural degradation of 1,1,2,2-PCA and 1,1,2-TCA in groundwater collected from monitoring well CWM-186-MW39.

Chloroethene Pathway: PCE (230 µg/L), TCE (3,300 µg/L), cis-1,2-DCE (14 µg/L), and trans-1,2-DCE (6.1 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW39 (ethene was not detected). Historically, vinyl chloride and 1,1-DCE have also been detected in groundwater from this location. The presence of these chlorinated ethenes indicate the process of anaerobic degradation is continuing at this location.

Chloromethane Pathway: Carbon tetrachloride and chloroform were detected in the 2005 groundwater sample collected from CWM-186-MW39 at concentrations of 1.2 µg/L and 14 µg/L, respectively. No methylene chloride, chloromethane, or methane were detected. The presence of the four- and three-chlorine compounds indicates the initial stages of natural degradation of carbon tetrachloride is occurring in groundwater collected from monitoring well CWM-186-MW39.

Monitoring Well CWM-186-MW40

CWM-186-MW40 is located within the 2005 carbon tetrachloride, PCE, 1,1,2,2-PCA, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: 1,1,2,2-PCA (25,000 µg/L), 1,1,2-TCA (27 µg/L), 1,2-DCA (0.68 µg/L), and ethane (42 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW40, indicating the process of anaerobic degradation is occurring in groundwater at this

location.

Chloroethene Pathway: PCE (340 µg/L), TCE (3,700 µg/L), cis-1,2-DCE (440 µg/L), trans-1,2-DCE (120 µg/L), 1,1-DCE (1.9 µg/L), vinyl chloride (3.4 µg/L), and ethene (39 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW40 indicating the process of anaerobic degradation of chloroethenes is continuing in groundwater collected at this location.

Chloromethane Pathway: Carbon tetrachloride (0.24 µg/L), chloroform (300 µg/L), and methylene chloride (1.9 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW40. Chloromethane and methane were not detected. The presence of the four-, three- and two-chlorine methanes demonstrates the ongoing process of natural degradation of carbon tetrachloride in groundwater collected from monitoring well CWM-186-MW40.

Monitoring Well CWM-186-MW46

CWM-186-MW46 is located within the 2005 carbon tetrachloride, PCE, 1,1,2,2-PCA, and TCE plume boundaries, near the contaminant source area at the crest of Reservoir Ridge.

Chloroethane Pathway: 1,1,2,2-PCA and 1,1,2-TCA were detected in the 2005 groundwater sample collected from CWM-186-MW46 at concentrations of 6,000 µg/L and 1.8 µg/L, respectively, indicating the process of natural degradation is occurring at this location. 1,2-DCA, chloroethane, and ethane were not detected. The absence of 1,2-DCA, chloroethane, and ethane indicate degradation of 1,1,2,2-PCA in groundwater is in its initial stages at CWM-186-MW46.

Chloroethene Pathway: PCE (0.58 µg/L), TCE (430 µg/L), cis-1,2-DCE (28 µg/L), and trans-1,2-DCE (8.5 µg/L) were detected in the 2005 groundwater sample collected from CWM-186-MW46 (ethene was not detected). Vinyl chloride was detected in the 2003 groundwater sample. The presence of these chlorinated ethenes indicates the process of anaerobic degradation is continuing at this location.

Chloromethane Pathway: Carbon tetrachloride and chloroform were detected in the 2005 groundwater sample collected from CWM-186-MW46 at concentrations of 6.8 µg/L and 29 µg/L, respectively. Methylene chloride was also detected at a concentration of 0.6 µg/L in 2003. Chloromethane and methane were not detected. The presence of the four-, three- and two-chlorine methanes demonstrates the ongoing process of natural degradation of carbon tetrachloride in groundwater collected from monitoring well CWM-186-MW46.

Monitoring Well CWM-186-MW56

CWM-186-MW56 is located near the middle of Reservoir Ridge. This well lies in a hollow within the 2005 plume boundaries for carbon tetrachloride, PCE, and 1,1,2,2-PCA. These contaminants were not detected in this well. TCE was detected in the 2005 groundwater sample collected from CWM-186-MW56 at a concentration of 2.6 µg/L. No groundwater samples were collected prior to well installation in 2005.

Chloroethane Pathway: No ethane or chlorinated ethanes were detected in groundwater collected from CWM-186-MW56.

Chloroethene Pathway: TCE was detected in well CWM-186-MW56 at a concentration of 2.6 µg/L. Ethene and other chlorinated ethenes were not detected. The absence of lower-order chlorinated ethenes in the chloroethene pathway may indicate natural degradation is in its earliest stages in groundwater at monitoring well CWM-186-MW56.

Chloromethane Pathway: Methane was detected at a concentration of 14 µg/L in groundwater collected from CWM-186-MW56. The presence of methane from this well may indicate degradation of chloromethanes previously existing in groundwater at this location, however without historical data this conclusion is unsupported. Another source of methane may be the result of the natural degradation of TCE in groundwater at this location by way of methane producing microorganisms.

Monitoring Well CWM-186-MW57
CWM-186-MW57 is located next to CWM-186-MW56 near the middle of Reservoir Ridge. This well lies in a hollow within the2005 plume boundaries for carbon tetrachloride, PCE, TCE and 1,1,2,2-PCA. No groundwater samples were collected prior to well installation in 2005.

Chloroethane Pathway: Ethane was detected at a concentration of 0.78 µg/L in groundwater collected from well CWM-186-MW57. No chlorinated ethanes were detected. The presence of ethane from this well may indicate natural degradation of contaminants previously existing in groundwater at this location, however without historical data this conclusion is unsupported.

Chloroethene Pathway: No ethene or chlorinated ethenes were detected in groundwater collected from CWM-186-MW57.

Chloromethane Pathway: Chloroform (0.26 µg/L), chloromethane (0.56 µg/L), and methane (52 µg/L) were detected in groundwater collected from CWM-186-MW57 in 2005, indicating degradation of chloromethanes at this location. Another source of methane may be the result of the natural degradation of another chlorinated solvent in groundwater at this location by way of methane producing microorganisms.

6.2 Fate and Transport in Surface Water

Contaminants in surface water are generally transported by overland flow, transfer to groundwater, and/or transfer to sediment. In addition, at Training Area T-38 groundwater is expressed as surface water at several seeps near the bottom of Reservoir Ridge. 1,1,2,2-PCA, TCE, beryllium, chromium, and thallium were identified as COPCs in surface water and seeps at the Site. The methods of transport in surface water at the Site are described as follows:

- **Overland Flow:** Overland flow generally follows local surface topography through tracts and tributaries, sometimes draining into main surface water features such as a lake or a creek. Once contaminants reach a surface water feature, they are diluted and follow the flow of the surface water feature. Several tributaries and drainage tracts are observed running in all directions down Reservoir Ridge into branches of Cave Creek. VOCs generally demonstrate moderate aqueous solubility and follow the flow of water until

volatilization occurs, especially in turbulent water. Metals generally tend to adsorb to sediment and soils rather than remain in solution in the surface water, and are not transported as far as VOCs.

- **Transfer to Groundwater:** The surface water/groundwater interaction mechanism allows soluble concentrations of contaminants to transfer from surface water to groundwater in a soluble state. Site contamination did not appear to be a result of direct dumping into surface water, and surface water is not considered a main source for contamination. Surface runoff with mobilized contaminants from the source area may have collected in tributaries and drainage channels at the Site, and eventually been a small source of groundwater contamination. Near the bottom of the hill, groundwater reaches the surface and causes seeps. Four of these seeps were sampled during the 2005 RFI. 1,1,2,2-PCA and TCE were identified as COPCs in seep sample CWM-186-SEEP-03-RFI.

- **Transfer to Sediment:** Contaminant transfer between surface water and sediment may occur, especially when contaminants are in the form of suspended solids. The interaction between surface water and sediments is reversible with sediments often acting as concentration reservoirs for contaminants that are gradually released into the surface water and surface water acting as a transport mechanism for contaminants that are constantly being sorbed to the sediments. No COPCs were identified in sediment samples collected from the tributary to Cave Creek.

6.3 Fate and Transport in Sediment

Sediments often act as a concentration reservoir for contaminants sorbed from surface water. Contaminants are gradually diffused back into the surface water due to a concentration gradient and may be re-adsorbed to sediments further downstream, creating a new concentration reservoir. No COPCs were identified in sediment samples collected from the tributary to Cave Creek.

6.4 Fate and Transport in Soi1

Contaminants in soil are generally transported through volatilization, dust emissions, erosion and surface runoff, and infiltration from surface soil to subsurface soil to groundwater. The methods of transport in soil at the Site are described as follows:

- **Volatilization:** VOC constituents in surface soil (0 to 1 feet bgs) have a high potential to volatilize to the atmosphere and be transported from the source area via air movement. A majority of VOCs released during past training activities were likely volatilized to the atmosphere. Metals and SVOCs in the surface soil are not expected to volatilize to any great extent, with the exception of mercury. Acetone and mercury were identified as COPCs in surface soil at the Site and may be transported into the air by volatilization. But the other metal COPCs (cadmium, chromium, selenium, and zinc) are not expected to be transported into the air.

- **Dust Emissions:** Most metals and SVOCs in the surface soil are generally closely associated with particulate matter and would be transported from their source areas by fugitive dust generation and entrainment by the wind. Because metal COPCs were identified in surface soil sample locations at the Site, transport via dust emissions is a possible route of contaminant migration at the Site.

- **Erosion and Surface Runoff:** Surface runoff via rainwater has the potential to transport contaminants either in a dissolved state or soil adsorbed state. Surface soil contaminants may be solubilized by rainwater and subsequently transported to drainage ditches, low-lying areas, and nearby surface water bodies via surface runoff. The solubility of inorganics (metals) in rainwater is largely dependent upon the pH of the rainwater. Because the rainwater in this region is most likely slightly acidic, the metal constituents in surface soil are likely to solubilize to a small degree in the rainwater and be subject to minimal transport via runoff. Because metal COPCs were identified in surface soil sample locations at the Site, transport via surface runoff is a possible route of contaminant migration at the Site.

- **Infiltration from Surface Soil to Subsurface Soil to Groundwater:** Dissolved-phase contaminants in surface soil may be transported vertically to subsurface soils and groundwater via solubilization in rainwater and infiltration. Migration in this manner is dependent upon contaminant solubility, precipitation frequency, adsorption, and infiltration rates. In addition, DNAPL, such as the chlorinated solvents used at the Site, can migrate downward through the soil (influenced by gravity) until the DNAPL exists in the soil in isolated residual globules in a condition known as residual saturation. When enough DNAPL is released into the soil to exceed the residual saturation capacity, the DNAPL may enter the groundwater, where the phase-separate contamination may sink, intact, through the water table, and may eventually be released to the groundwater in a dissolved-phase. VOCs released during training activities that were not volatilized into the atmosphere likely have been transported to groundwater through infiltration. Metals in soil at the Site may migrate vertically due to the slightly acidic nature of the rainwater in this area and the slightly increased solubility of metals that it produces. Because VOC and metal concentrations in the surface and subsurface soils were identified at the Site, transport from surface soil to subsurface soil to groundwater is a possible route of contaminant migration at the Site.

6.5 Fate and Transport Conclusions

Based on an interpretation of data collected during the 2005 RFI and other historical sampling events, known transport mechanisms, and chemical degradation pathways, the following has been concluded for fate and transport of contamination at Training Area T-38:

- Dissolved-phase chlorinated solvents are being transported in groundwater, following natural groundwater flow directions.
- The distribution of total VOCs at the Site indicates dissolved-phase chlorinated hydrocarbon plumes that follow the local groundwater flow direction mainly through the residuum and fractures located in the bedrock.
- Evidence of the natural degradation of chlorinated solvents at the site has been observed at several locations within Training Area T-38.

- Surface runoff with mobilized contaminants from the source area may have collected in tributaries and drainage channels at the Site, and eventually been a small source of groundwater contamination.
- Metal constituents in surface soil are likely to solubilize to a small degree in the slightly rainwater and may be transported via surface water runoff.
- Metal COPCs were identified in surface soil sample locations at the Site, and may have been transported via dust emissions at the Site
- A majority of VOCs released during past training activities were likely volatilized to the atmosphere.
- VOCs released during training activities that were not volatilized into the atmosphere likely have been transported to groundwater through infiltration.
- Metals in soil at the Site may migrate vertically through infiltration due to the slightly acidic nature of the rainwater in this area and the slightly increased solubility of metals that it produces.

7.0 STREAMLINED HUMAN HEALTH RISK ASSESSMENT

This section discusses the streamlined human health risk assessment at the Site based on the VOC results for groundwater, surface water, and seep samples collected during the 2005 RFI. During the Supplemental RI, Shaw (2004) identified the VOC, SVOC, explosives CWM product, and metal results that exceeded SSSLs; however, no further assessment was made concerning human health risk. To provide a complete assessment of human health risk at the Site, the results for groundwater, surface water, seep, sediment, surface and depositional soil, and subsurface soil samples collected during the Supplemental RI (Shaw, 2004) were included in this assessment. In cases where a groundwater well or seep location was sampled during multiple investigations, the most recent data were used in the assessment.

The streamlined human health risk assessment at the Site consisted of the following steps, which are discussed in the following sections.

- Select the constituents of potential concern (COPCs).
- Identify the exposure point concentrations (EPCs) for the COPCs.
- Calculate the incremental lifetime cancer risk (ILCR) and non-cancer hazard index (HI) using the appropriate SSSL and identify the total cancer risk and total non-cancer hazard index.
- Identify the constituents of concern (COCs).

7.1 Constituents of Potential Concern

SSSLs were developed by IT as part of the human health risk assessment associated with site investigations being performed under the BRAC Environmental Restoration Program at McClellan (IT, 2000). The SSSLs are medium-specific and receptor-specific, risk-based screening concentrations that are used to quickly and efficiently screen the site for potential cancer risk and non-cancer hazards from residual chemicals in the environmental media. The SSSLs address significant exposure pathways and are sufficiently site-specific with regard to exposure assumptions that they are used to estimate risk with as much precision as a typical baseline risk assessment. COPCs are selected by comparing the site-related chemical concentrations to their respective SSSLs as described in previous sections of this report.

7.1.1 VOCs

Detected VOCs, considered to be contaminants at the Site, were compared to their respective SSSLs (see Section 5.5). The VOC contaminants that exceeded the SSSLs were considered COPCs at the Site. See Sections 5.5.1.1, 5.5.2.1, 5.5.3.1, 5.5.4.1, and 5.5.5.1 for details concerning the assessment of VOC COPCs for groundwater, surface water and seeps, sediment, surface and depositional soil, and subsurface soil, respectively. Table 7-1 presents a summary of the VOC COPCs that exceeded the human health SSSLs for groundwater, surface water and seeps, and subsurface soil at the Site. No VOCs exceeded SSSLs in sediment, surface soil, or depositional soil.

7.1.2 SVOCs, Explosives, CWM Breakdown Products

Detected PAHs with concentrations above the background (IT, 2000) are considered to be contaminants at the Site. Detected non-PAH SVOCs, explosives, and CWM breakdown products are also considered to be contaminants at the Site. The SVOCs, explosives, and CWM breakdown products contaminants were compared to their respective SSSLs (see Section 5.5). The SVOC, explosives, and CWM breakdown product contaminants that exceeded groundskeeper or recreational SSSLs were considered COPCs at the Site. See Sections 5.5.1.3, 5.5.2.2, 5.5.3.2, 5.5.4.2, and 5.5.5.2 for details concerning the assessment of SVOC, explosives, and CWM breakdown product COPCs for groundwater, surface water and seeps, sediment, surface and depositional soil, and subsurface soil, respectively. None of the PAHs, SVOCs, explosives, or CWM products was considered to be COPCs for the Site.

7.1.3 Metals

Detected metal concentrations were subjected to a multi-tiered statistical evaluation, described in Section 5.5 and Appendix E, to evaluate whether metals detected in site samples were the result of site-related activities or were indicative of naturally occurring conditions. Metal results that failed all three tiers were considered contaminants at the Site. The metals contaminants were then compared to the SSSLs. The metal contaminants that exceeded the groundskeeper or recreational SSSLs were considered COPCs at the Site. See Sections 5.5.1.4, 5.5.2.3, 5.5.3.3, 5.5.4.3, and 5.5.5.3 for details concerning the assessment of metal COPCs for groundwater, surface water and seeps, sediment, surface and depositional soil, and subsurface soil, respectively. Table 7-1 presents a summary of the metal COPCs that failed the multi-tiered statistical evaluation and exceeded the human health SSSLs for groundwater, surface water, and seeps. No metal contaminants exceeded SSSLs in sediment, surface soil, depositional soil, or subsurface soil at the Site.

7.2 Exposure Point Concentrations

Exposure point concentrations (EPCs), based on a statistical derivation of measured data, represent the chemical concentrations in environmental media that may come in contact with a receptor. The EPC is a single value that reflects a conservative estimate of average over the Site represented by the entire data set. The Training Area T-38 EPCs for each COPC were selected based on the lesser of the 95% upper confidence limit (95% UCL), which is an estimate of the concentration of each COPC averaged over the entire site, or the maximum detected concentration (MDC) for each COPC. The 95% UCL was calculated for data sets having five or more values and the MDC was used as the EPC for data sets having fewer than five values. EPCs were selected for each COPC identified in Section 7.1. The 95% UCLs for the COPCs were calculated using ProUCL®. This program was developed on behalf of the EPA to calculate 95% UCLs following EPA Guidance, and to accommodate parametric and nonparametric data sets (EPA, 2004). The Training Area T-38 EPC for each COPC was compared to the cancer and non-cancer SSSLs for each receptor (resident, groundskeeper, and recreational) as part of the risk analysis.

Table 7-2 presents the Training Area T-38 EPCs and the comparison of the EPCs to cancer and

non-cancer SSSLs for the COPCs in groundwater. Table 7-3 presents the Training Area T-38 EPCs and the comparison of the EPCs to cancer and non-cancer SSSLs for the COPCs in surface water and seeps. Table 7-4 presents the Training Area T-38 EPCs and the comparison of the EPCs to cancer and non-cancer SSSLs for the COPCs in subsurface soil. None of the Training Area T-38 EPC values for COPCs in sediment, surface soil, or depositional soil exceeded the SSSLs.

7.3 Cancer Risk and Non-Cancer Hazard

The EPCs for the cancer risk and non-cancer hazard constituents, identified in Section 7.2, were used to calculate the ILCR and non-cancer HI, respectively, for COPCs in each environmental medium. The ILCR and HI are ratios of concentration to risk. ILCRs and HIs were calculated for each COPC with a Training Area T-38 EPC that exceeded the SSSL. The ILCRs and HIs for the COPCs were summed to yield a total ILCR and total HI for a given receptor exposed to a given medium.

7.3.1 Incremental Lifetime Cancer Risk

For chemicals with carcinogenic effects, a concentration equivalent to a lifetime cancer risk of 1E-06 is used as the point of departure for determining remediation goals (EPA, 2001). Total ILCRs for a receptor below 1E-06 are considered to be negligible. Total ILCRs between 1E-06 and 1E-04 fall within the risk management range (EPA, 2001). Total ILCRs that exceed 1E-04 are considered to be unacceptable and require mitigation.

Table 7-5 presents the ILCRs for residents and groundskeepers exposed to groundwater. The total ILCRs for the resident (2.75E-02) and groundskeeper (4.88E-03) exposed to groundwater exceeded 1E-04 and are considered unacceptable.

Table 7-6 presents the ILCRs for recreational users exposed to surface water and seeps. The total ILCR (9.31E-05) for the recreational user exposed to surface water was within the risk management range.

Table 7-7 presents the ILCRs for residents, groundskeepers, and recreational users exposed to subsurface soil. The total ILCRs for the resident (9.97E-06) and groundskeeper (1.59E-06) exposed to subsurface soil were within the risk management range. Because the EPCs for the COPCs in subsurface soil did not exceed the recreational user SSSLs (Table 7-4), no constituents were considered cancer risks for the recreational user exposed to subsurface soil.

7.3.2 Non-Cancer Hazard Index

Total HI estimates for a receptor above 1 raises concern for potential non-cancer effects (EPA, 2001).

Table 7-5 presents the HIs for residents and groundskeepers exposed to groundwater. The total HIs for the resident (328) and groundskeeper (5.6) exposed to groundwater exceeded the limit of 1 and raises concern for potential non-cancer effects.

Table 7-6 presents the HIs for recreational users exposed to surface water and seeps. The total HI (2.97) for the recreational user exposed to surface water and seeps exceeded the limit of 1 and raises concern for potential non-cancer effects.

Table 7-7 presents the HIs for residents, groundskeepers, and recreational users exposed to subsurface soil. Because the EPCs for the COCs in subsurface soil did not exceed the SSSLs (Table 7-4), no constituents were considered non-cancer hazards for residents, groundskeepers, or recreational users exposed to subsurface soil.

Table 7-8 presents the total non-cancer hazard effects by target organ for groundwater. The total HIs for liver, kidney, heart, erythrocyte, central nervous system (CNS), and skin for the resident exposed to groundwater exceeded 1. The total HIs for liver, kidney, and heart for the groundskeeper exposed to groundwater exceeded 1.

Table 7-9 presents the total non-cancer hazard effects by target organ for surface water. The total HIs for liver and kidney for the recreational user exposed to surface water exceeded 1.

7.4 Constituents of Concern

For screening and comparison purposes, the receptor scenarios evaluated for groundwater at the Site were resident and groundskeeper. However, based on the proposed future land use for the Site, the ILCRs and HIs for the groundskeeper were evaluated to identify COCs in groundwater at the Site. As shown in Table 7-5, the cancer-based COCs for the groundskeeper in groundwater were identified as 1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, TCE, and vinyl chloride. Non-cancer COCs for the groundskeeper in groundwater were identified as 1,1,2,2-PCA, carbon tetrachloride, cis-1,2-DCE, TCE, antimony, and thallium.

As shown in Table 7-6, the cancer-based COCs for the recreational user in surface water were identified as 1,1,2,2-PCA and TCE. Non-cancer COCs for the recreational user in surface water were identified as TCE and thallium.

For screening and comparison purposes, the receptor scenarios evaluated for subsurface soil at the Site were resident, groundskeeper, and recreational user. However, based on the proposed future land use, the ILCRs and HIs for the groundskeeper and recreational user were evaluated to identify COCs in subsurface soil at the Site. The cancer-based COC for the groundskeeper was identified as 1,1,2,2-PCA in subsurface soil. No constituents were considered cancer risks for the recreational user exposed to subsurface soil. No constituents were considered non-cancer hazards for residents, groundskeepers, or recreational users exposed to subsurface soil.

Table 7-10 presents a summary of the COCs identified at the Site. No COCs were identified in sediment, surface soil, and depositional soil at the Site.

7.5 Uncertainty Analysis

Due to the complexity and individuality of each environmental risk assessment, a certain amount of uncertainty is common. The following includes a discussion on sources of uncertainty for this

risk assessment.

- Calculation of the EPC can be a source of either an over-estimate or under-estimate of exposure depending on the representativeness of supporting data. To reduce the level of uncertainty at Training Area T-38, groundwater, surface water, sediment, surface and depositional soils, and subsurface soil samples were collected at several locations throughout the Site, including the crest of Reservoir Ridge, locations midway down the slope of the Ridge, seep samples on all sides of the Ridge, points surrounding the base of Reservoir Ridge, areas offsite of Training Area T-38, and surface water samples collected from tributaries traversing Reservoir Ridge. Results from a total of 55 groundwater samples, 7 surface water samples, 4 seep samples, 4 sediment samples, 36 surface and depositional soil samples, and 49 subsurface soil samples were used for this risk assessment. This large number and wide array of sample locations and sample types is highly representative of the Site, thereby reducing the level of uncertainty.

- Groundwater, surface water, and seep sample results used in this assessment were collected during two separate sampling events, one in 2003 and one in 2005. To reduce the level of uncertainty, a majority of the locations sampled in 2003 were re-sampled in 2005 and only the most recent sample results were used in this risk assessment.

- Some metals that were ascertained to be naturally occurring during the metals statistical evaluations (Appendix E) had concentrations above SSSLs, which contribute to risk and are not related to Site activities. Naturally occurring metal concentrations such as these result in an overestimation of risk related to Site activities.

- Due to the limitations of the statistical analyses, a background analysis could not be completed for certain metals. These metals were automatically carried through to the end of the risk assessment and represent additional risk that may not be related to Site activities.

Acceptable levels of uncertainty in this risk assessment have been accomplished by mitigation of variables contributing to uncertainty. The estimation of ILCR is based primarily on COCs and media for which there are sufficient representative data and therefore the result is also representative of risk associated with Training Area T-38. The estimation of risk associated with non-carcinogenic threat is likely biased slightly high as a result of risk attributed by naturally occurring metals, and metals carried through the risk assessment without a completed Tier 3 analysis. Mitigation of non-carcinogenic risk beyond that which is concomitant with cancer risk is therefore not supported, however the cumulative risk estimates shown in Tables 7-5 and 7-6 would be substantially reduced through mitigation of the cancer risk.

7.6 Human Health Risk Assessment Conclusions

The groundwater at the Site presents an unacceptable cancer risk and an unacceptable non-cancer hazard to the groundskeeper.

The surface water and seeps at the Site is within the cancer risk management range but presents

an unacceptable non-cancer hazard to the recreational user.

The subsurface soil at the Site is within the cancer risk management range for the groundskeeper.

The data indicates that chlorinated VOCs in groundwater, particularly 1,1,2,2-PCA and TCE, are the risk drivers and are responsible for cancer risks and non-cancer hazards exceeding acceptable levels.

The estimation of risk associated with non-carcinogenic threat is likely biased slightly high as a result of risk attributed by naturally occurring metals, and metals carried through the risk assessment without a completed Tier 3 analysis. Mitigation of non-carcinogenic risk beyond that which is concomitant with cancer risk is therefore not supported, however the cumulative risk estimates shown in Tables 7-5 and 7-6 would be substantially reduced through mitigation of the cancer risk.

8.0 SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

In order to evaluate the potential for ecological risks posed by site-related constituents at the Site, an ecological risk assessment was conducted. This section discusses the environmental setting, exposure pathways, and ecological risk assessment performed as part of this RFI.

8.1 Environmental Setting and Terrestrial Habitat

The Site is currently fenced and posted. The Site, located in the north-central portion of McClellan, is approximately 150 acres in size and encompasses most of a topographic structure known as Reservoir Ridge. Training Area T-38 is fenced with an entrance gate in the northern section. Several buildings and structures are located within the fenced area, including general installation buildings, storage buildings, field latrines, and a mess shelter. A concrete pad is located in the central eastern portion of the Site.

Terrestrial habitat at the Site is mixed coniferous/deciduous forest characteristic of a typical mesophytic forest. Two small tributaries drain the northern portion of the parcel and flow north to join a larger, westward-flowing tributary of Cave Creek. This tributary cuts across the northern end of the parcel and joins Cave Creek 500 feet to the west. Drainage of the southern part of the parcel flows off the ridge from two minor tributaries, one flowing to the west and one to the south, that eventually drain into Cane Creek (Shaw, 2004). Four springs/seeps have been observed on the flanks of Reservoir Ridge; two are located on the tributaries draining the northern area of the Site, and two are located on tributaries draining the southern area of the Site. The area in the southeast-eastern corner of Training Area T-38 (the lower southeastern slopes of Reservoir Ridge) has been designated a wetland area (IT, 2002).

The canopy species characteristic of this area are tulip tree *(Liriodendron tulipifera),* sweetgum *(Liquidambar styraciflua),* black gum *(Nyssa sylvatica),* shortleaf pine *(Pinus echinata),* loblolly pine *(Pinus taeda),* white oak *(Quercus alba),* and northern red oak *(Quercus rubra).* The dominant understory species of this area are red maple *(Acer rubrum),* flowering dogwood *(Cornus florida),* witch hazel *(Hamamelis virginiana),* sweetgum *(Liquidambar styraciflua),* and sourwood *(Oxydendrum arboreum).* The shrub layer is dominated by mountain laurel *(Kalmia latifolia),* southern low blueberry *(Vaccinium pallidum),* southern wild raisin *(Viburnum nudum),* and yellowroot *(Xanthorhiza simplicissima).* Numerous muscadine grape *(Vitis rotundifolia)* vines, greenbriar *(Smilax rotundifolia)* and poison ivy *(Toxicodendron radicans)* are also present in this area.

Tributaries of Cave Creek flows along the northern end of the parcel. The substrate of Cave Creek is mostly bedrock with small areas of sand and gravel. The stream banks are approximately six feet high and the width of Cave Creek in this area is approximately two feet. The canopy above Cave Creek in this area is relatively high.

In general, the terrain at McClellan supports large numbers of amphibians and reptiles. Jacksonville State University has prepared a report titled *Amphibians and Reptiles of Fort McClellan, Calhoun County, Alabama* (Cline and Adams, 1997). The report indicated that surveys in 1997 found 16 species of toads and frogs, 12 species of salamanders, 5 species of

lizards, 7 species of turtles, and 17 species of snakes. Typical inhabitants of the area are copperhead *(Agkistrodon contortix),* king snake *(Lampropeltis getulus),* black racer *(Coluber constrictor),* fence lizard *(Sceloporour undulatus),* and six-lined racerunner *(Cnemidophorous sexlineatus).*

Terrestrial species that may inhabit the vicinity of the Site, include opossum, short-tailed shrew, raccoon, white-tail deer, red fox, coyote, gray squirrel, striped skunk, a number of species of mice and rats (e.g., white-footed mouse, eastern harvest mouse, cotton mouse, eastern woodrat, and hispid cotton rat), and eastern cottontail. Approximately 200 avian species reside at McClellan at least part of the year (ACOE, 1997). Common species expected to occur in the vicinity of the Site include northern cardinal *(Cardinalis cardinalis),* northern mockingbird *(Mimus polyglottus),* warblers *(Dendroica spp.),* indigo bunting *(Passerina cyanea),* red-eyed vireo *(Vireo olivaceus),* American crow *(Corvus brachyrhynchos),* bluejay *(Cyanocitta cristata),* several species of woodpeckers *(Melanerpes spp., Picoices spp.),* and Carolina chickadee *(Parus carolinensis).* Game birds present in the vicinity of the Site may include northern bobwhite *(Colinus virginianus),* mourning dove *(Zenaida macroura),* and eastern wild turkey *(Meleagris gallopavo).* A variety of raptors (e.g., red-tailed hawk, sharp-shinned hawk, barred owl, and great homed owl) could also use portions of this area for a hunting ground. Because of the presence of Cave Creek, piscivorous bird species may also be present in the vicinity of the Site. These piscivorous birds may include great blue heron *(Ardea herodias),* green-backed heron *(Butorides striatus),* and belted kingfisher *(Ceryle alcyon).*

Although shallow (less than one foot deep) and relatively narrow, Cave Creek has the potential to support a variety of amphibious species and some small fish species. Bullfrog *(Rana catesbeiana)* and leopard frog *(Rana sphenocephala)* are examples of amphibians that may be found in Cave Creek in the vicinity of the Site. Fish species that may be found in Cave Creek in the vicinity of the site include blacknose dace *(Rhinichthys atratulus),* creek chub *(Semotilus atromaculatus),* stoneroller *(Campostoma anomalum),* striped shiner *(Luxilus chrysocephalus),* and various darters *(Etheostoma spp.).*

The following species, listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), have been recorded on McClellan (IT, 2002):

- Gray Bat (*Myotis grisescens*)
- Blue Shiner (*Cyprinella caerulea*)
- Mohr's Barbara Buttons (*Marshallia mohril*)
- Tennessee Yellow-Eyed Grass (*Xyris tennessensis*)

None of these species have been observed at the Site (Garland, 1996). However, Cave Creek in the vicinity of the site provides low quality gray bat foraging habitat. Two major requirements for gray bat foraging habitat are contiguous forest cover and habitat for aquatic insects (one of the gray bat's preferred dietary items). These two requirements are met by Cave Creek in this area; therefore, gray bats may forage in this area.

8.2 Exposure Pathways

For exposures to occur, complete exposure pathways must exist between the contaminant and the receptor. A complete exposure pathway requires the following four components:

- A source mechanism for contaminant release
- A transport mechanism
- A point of environmental contact
- A route of uptake at the exposure point.

If any of these four components are absent, then a pathway is generally considered incomplete (EPA, 1989).

While constituents in soils may leach into groundwater, environmental receptors generally will not come into direct contact with constituents in groundwater since there is no direct exposure route. Receptors could potentially be exposed to groundwater via surface water pathways if groundwater discharges to surface water bodies, including seeps and streams, both of which have been identified at Training Area T-38.

Ecological receptors may be exposed to constituents in surface water or sediment via direct contact or through consumption of water. Aquatic organisms inhabiting contaminated waters would be in constant contact with COCs.

Chemicals present in the sediment may result from erosion or adsorption of water-borne constituents onto sediment particles. If sediments are present in an area that is periodically inundated with water, then previous exposure pathways for soils would be applicable during dry periods. At Training Area T-38, water-carrying drainage tracts exist during high precipitation events and remain dry during low periods of precipitation. Water overlying sediments prevents contaminants from either volatilizing or being carried by wind erosion. Exposure via dermal contact may occur, especially for benthic organisms and wading birds. Some aquatic organisms consume sediment and ingest organic material from the sediment. Inadvertent ingestion of sediments may also occur as the result of feeding on benthic organisms and plants.

Ecological receptors may be exposed to constituents in soils via direct and/or secondary exposure pathways. Direct exposure pathways include soil ingestion, dermal absorption, and inhalation of COCs adsorbed to fugitive dust. Significant exposure via dermal contact is limited to organic constituents, which are lipophilic and can penetrate epidermal barriers. Mammals are less susceptible to exposure via dermal contact with soils because their fur prevents skin from coming into direct contact with soil. However, soil ingestion may occur while grooming, preening, burrowing, or consuming plants, insects, or invertebrates that reside in soil.

Exposure via inhalation of fugitive dust is limited to contaminants present in surface soils at areas that are devoid of vegetation. The amount of vegetative cover, the inherent moisture content of the soil, and the frequency of soil disturbance play important roles in the amount of fugitive dust generated at a particular site. In forested areas, such as at the Site, fugitive dust generation is expected to be minimal.

Secondary exposure pathways involve constituents that are transferred through different trophic levels of the food chain and may be bioaccumulated. This may include constituents bioaccumulated from soil into plant tissues or into terrestrial species ingesting soils. These plants or animals may, in turn, be consumed by animals at higher trophic levels. Water-borne and sediment-borne COCs may bioaccumulate into aquatic organisms, aquatic plants, or animals which frequent surface waters and then be passed through the food chain to impact organisms at higher trophic levels.

8.3 Risk Assessment

The ecological risk assessment was performed based on the VOC results for surface water and seep samples collected during the 2005 RFI, and surface water, seep, sediment, surface soil, and depositional soil samples collected during the 2003 Supplemental RI (Shaw, 2004). Subsurface soils were also assessed, however samples with COPCs exceeding ESVs were found at depths greater than 10 feet bgs, and do not present a viable exposure pathway. Subsurface soil at Training Area T-38 is therefore not considered to present an ecological risk.

The screening-level ecological risk assessment for the Site consisted of the following steps, which are discussed in the following sections.

- Select the COPCs.
- Identify the exposure point concentrations for the COPCs.
- Calculate the screening-level hazard quotients and identify the COCs that may pose an ecological risk.
- Assess the COCs in relation to the environmental setting and habitat(s) in and around the Site.

8.4 Constituents of Potential Concern

The ESVs used in this ecological risk assessment were developed specifically for McClellan in conjunction with EPA Region IV (IT, 2000). These ESVs are conservative and are based on no-observed-adverse-effect-levels (NOAEL) when available. If a NOAEL-based ESV was not available, then the most health-protective value available from the scientific literature was identified as the ESV (IT, 2000). COPCs are selected by comparing the site-related chemicals to their respective ESVs and may contribute significantly to ecological risk at the Site.

8.4.1 VOCs

Detected VOCs, considered to be contaminants at the site, were compared to their respective ESVs (see Section 5.5). The VOC contaminants that exceeded the ESVs were considered COPCs at the Site. See Sections 5.5.2.1, 5.5.3.1, 5.5.4.1, and 5.5.5.1 for details concerning the assessment of VOC COPCs for surface water and seeps, sediment, surface and depositional soil, and subsurface soil, respectively. Only acetone, as identified in Table 8-1, exceeded the ESV for surface soil. No VOCs exceeded ESVs in surface water, seeps, and sediment.

8.4.2 SVOCs, Explosives, CWM Breakdown Products

Detected PAHs with concentrations above background concentrations (IT, 2000) were considered to be contaminants at the site. Detected non-PAH SVOCs, explosives, and CWM breakdown products were considered to be contaminants for the Site. The SVOCs, explosives, and CWM breakdown products contaminants were compared to their respective ESVs (see Section 5.5). None of the PAHs, SVOCs, explosives, or CWM products was considered to be COPCs for the Site.

8.4.3 Metals

Detected metal concentrations were subjected to a multi-tiered statistical evaluation, described in Section 5.5 and Appendix E, to evaluate whether metals detected in site samples were the result of site-related activities or were indicative of naturally occurring conditions. Metal results that failed all three tiers were considered contaminants at the Site. The metals contaminants were then compared to the ESVs. The metal contaminants that exceeded the ESVs were considered COPCs at the Site. See Sections 5.5.2.3, 5.5.3.3, 5.5.4.3, and 5.5.5.3 for details concerning the assessment of metal COPCs for surface water and seeps, sediment, surface and depositional soil, and subsurface soil, respectively. Table 8-1 presents a summary of the metal COPCs that failed the multi-tiered statistical evaluation and exceeded the ESVs for surface water, seeps, surface soil, and subsurface soil at the Site. No metal contaminants exceeded ESVs in sediment.

8.5 Exposure Point Concentrations

The Training Area T-38 EPCs for each COPC were selected based on the lesser of the 95% upper confidence limit (95% UCL), which is an estimate of the concentration of each COPC averaged over the entire site, or the maximum detected concentration (MDC) for each COPC. The 95% UCL was calculated for data sets having five or more values and the MDC was used as the EPC for data sets having fewer than five values. EPCs were selected for each COPC identified in Section 8.4. The 95% UCLs for the COPCs were calculated using ProUCL®. Table 8-2 presents the Training Area T-38 EPCs and the comparison of the EPCs to ESVs for the COPCs in surface water and seeps, surface and depositional soil, and subsurface soil at the Site.

8.6 Screening Level Hazard Quotients and Constituents of Concern

To assess whether the COPCs detected at the Site have the potential to pose adverse ecological risks, the COPCs were evaluated against the ESVs by calculating screening-level hazard quotients (HQs) for each environmental medium. An HQ was calculated by dividing the EPC by its corresponding ESV. HQs with values of one or less indicated that the COPC is not likely to pose adverse ecological risks. COPCs with an HQ value greater than one were identified as COCs that may pose adverse ecological risks to one or more receptors. Table 8-2 presents the calculated screening-level HQs and the COCs identified as potential ecological risks for surface water and seeps, surface soil, and subsurface soil at the Site.

The following COCs were identified as potential ecological risks at the Site:

- Beryllium, chromium, and thallium in surface water and seeps.
- Mercury and selenium in surface soil.

8.7 Uncertainty Analysis

Due to the complexity and individuality of each ecological risk assessment, a certain amount of uncertainty is common. The following includes a discussion on sources of uncertainty for this risk assessment.

- Calculation of the EPC can be a source of either an over-estimate or under-estimate of exposure depending on the representativeness of supporting data. To reduce the level of uncertainty at Training Area T-38, groundwater, surface water, sediment, surface and depositional soils, and subsurface soil samples were collected at several locations throughout the Site, including the crest of Reservoir Ridge, locations midway down the slope of the Ridge, seep samples on all sides of the Ridge, points surrounding the base of Reservoir Ridge, areas offsite of Training Area T-38, and surface water samples collected from tributaries traversing Reservoir Ridge. Results from a total of 55 groundwater samples, 7 surface water samples, 4 seep samples, 4 sediment samples, 36 surface and depositional soil samples, and 49 subsurface soil samples were used for this risk assessment. This large number and wide array of sample locations and sample types is highly representative of the Site, thereby reducing the level of uncertainty.

- Groundwater, surface water, and seep sample results used in this assessment were collected during two separate sampling events, one in 2003 and one in 2005. To reduce the level of uncertainty, a majority of the locations sampled in 2003 were re-sampled in 2005 and only the most recent sample results were used in this risk assessment.

- Some metals that were ascertained to be naturally occurring during the metals statistical evaluations (Appendix E) had concentrations above ESVs, which contribute to risk and are not related to Site activities. Naturally occurring metal concentrations such as these result in an overestimation of risk related to Site activities.

- Due to the limitations of the statistical analyses, a background analysis could not be completed for certain metals. These metals were automatically carried through to the end of the risk assessment and represent additional risk that may not be related to Site activities.

- Beryllium, chromium, and thallium were detected in only one of eight surface water or seep samples collected from the Site, and the detected concentration of thallium was less than the laboratory reporting limit (Table E4-4). Several of the mercury and selenium detections in surface and depositional soil were also less than the laboratory reporting limit (Table E4-8). These sporadic and low concentrations of metals at the Site are a source for uncertainty, and may overestimate the ecological risks posed by these metals.

- Temporal variation in habitat condition and species present at the Site can be a potential

source of uncertainty when inferring (a) the existence of potential (unknown) ecological receptor species, and (b) potential (unknown) exposure pathways.

Acceptable levels of uncertainty in this risk assessment have been accomplished by mitigation of variables contributing to uncertainty. The conservative approach taken for this ecological risk assessment is based primarily on COPCs and media for which there are sufficient representative data and therefore the result is also representative of risk associated with Training Area T-38. The estimation of ecological risk is likely biased slightly high as a result of risk attributed by naturally occurring metals, metals carried through the risk assessment without a completed background analysis, sporadic low metal concentrations, and conservative estimates of habitat condition and species present at the Site that may or may not be representative of actual ecological Site conditions.

8.8 Conclusions

The ecological risk assessment for the Site consisted of the identification of the COPCs for each medium at the site, identification of the EPC for each COPC, calculating HQs used to identify COCs, and assessing the COCs in relation to the environmental setting and habitat.

Subsurface soil samples with COPCs exceeding ESVs were collected at depths greater than 10 feet bgs, and do not present a viable exposure pathway. Subsurface soil at Training Area T-38 is therefore not considered to be an ecological risk at the Site

Beryllium, chromium, and thallium were identified as COCs in surface water and seeps. Because beryllium, chromium, and thallium were each detected in only a single sample and the resultant hazard quotients were less than ten (Table 8-1), these constituents most likely do not pose a significant ecological risk.

Mercury and selenium were identified as COCs in surface and depositional soil. The HQs for mercury and selenium in surface and depositional soil were only slightly above 1 (Table 8-1); the uncertainty surrounding the data is sufficient to eliminate these compounds from consideration as COCs.

The COCs detected at Training Area T-38 do not present a definite, well-defined ecological risk of sufficient magnitude to warrant remediation of any media.

9.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the results of the 2005 RFI for Training Area T-38 and presents the major conclusions and recommendations.

9.1 Conclusions

This RFI includes data collected from the 2003 RI and the 2005 RFI and encompasses surface water, seeps, sediments, surface and depositional soils, subsurface soils, and groundwater at Training Area T-38 and discusses the affect of training and decontamination activities related to human health and the environment.

VOC and metal contamination was identified in groundwater, surface water, surface and depositional soil, groundwater seeps, and subsurface soil at the Site. However, based on the estimated extent of the plume and nature of the contaminant, TCE is considered to be the driving factor for remediation or risk management decisions.

A risk assessment was performed using data collected during these investigations, and the risk to human health and ecological receptors was identified based on proposed future land use.

Cancer-based human health COCs for the groundskeeper were identified as 1,1,2,2-PCA, 1,1,2-TCA, carbon tetrachloride, PCE, TCE, and vinyl chloride in groundwater; and 1,1,2,2-PCA in subsurface soil. The estimation of ILCR is based primarily on COCs and media for which there are sufficient representative data and therefore the result is also representative of risk associated with Training Area T-38.

Non-cancer human health COCs for the groundskeeper were identified as 1,1,2,2-PCA, carbon tetrachloride, cis-1,2-DCE, TCE, antimony, and thallium in groundwater, and TCE and thallium in surface water. The estimation of risk associated with non-carcinogenic threat is likely biased slightly high as a result of risk attributed by naturally occurring metals, and metals carried through the risk assessment without a completed background analysis. Mitigation of non-carcinogenic risk beyond that which is concomitant with cancer risk is therefore not supported, however the cumulative risk estimates shown in Tables 7-5 and 7-6 would be substantially reduced through mitigation of the cancer risk.

An ecological risk assessment was conducted to evaluate the potential for ecological risks posed by site-related constituents at the Site. Beryllium, chromium, and thallium were identified as COCs in surface water and seeps, but with only a single sample detect each and with HQs less than ten, these constituents most likely do not pose a significant ecological risk.

Chromium, mercury, and selenium were identified as COCs in surface and depositional soil. The HQs for mercury and selenium in surface and depositional soil were only slightly above 1; the uncertainty surrounding the data is sufficient to eliminate these compounds from consideration as COCs. Although chromium was frequently detected in surface soil, the arithmetic mean concentration of samples from the Site (29 mg/kg) is less than the naturally occurring background concentration of chromium (37 mg/kg); therefore, chromium is most

likely not site-related.

9.2 Recommendations

The following recommendations are based on a thorough understanding of the data collected during this RFI, the risk assessment performed, and the proposed future land use for Training Area T-38.

- No further actions with respect to environmental data collection are required to adequately define the nature and extent of contamination at the Site.

- Groundwater and surface water contamination present risk to human health at levels sufficient to warrant either remediation or risk management decisions.

- Evaluation and implementation of appropriate remedial technologies performed in accordance with the appropriate requirements of both the ESCA and the CA is necessary to mitigate risk to human health and ecology. Remedies to be considered may include:

    - No action
    - Monitored natural attenuation
    - in-situ chemical remediation
    - Enhanced in-situ bioremediation
    - Reactive permeable barrier
    - Groundwater extraction and treatment

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TABLES

Table 4-1: Sample Designations and Analytical Parameters, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Sample Identification	Well Type	Sample Date	Analytical Parameters
Groundwater Samples			
CWM-186-MW03	residuum	6/16/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW05	residuum	6/16/05	VOCs
CWM-186-MW08	residuum	6/14/05	VOCs, Chromium VI
CWM-186-MW10	bedrock	6/13/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW14	bedrock	6/15/05	VOCs
CWM-186-MW15	bedrock	6/15/05	VOCs
CWM-186-MW16	transition	6/15/05	VOCs
CWM-186-MW18	bedrock	6/9/05	VOCs
CWM-186-MW19	bedrock	6/9/05	VOCs
CWM-186-MW20	bedrock	6/15/05	VOCs
CWM-186-MW21	bedrock	6/14/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW23	bedrock	6/10/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW24	bedrock	6/13/05	VOCs
CWM-186-MW25	bedrock	6/2/05	VOCs
CWM-186-MW26	residuum	6/2/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW28	bedrock	6/8/05	VOCs
CWM-186-MW29	bedrock	6/8/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW30	bedrock	6/14/05	VOCs, Chromium VI
CWM-186-MW32	residuum	6/3/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW34	bedrock	6/17/05	VOCs
CWM-186-MW35	bedrock	6/14/05	VOCs
CWM-186-MW37	bedrock	6/10/05	VOCs
CWM-186-MW39	residuum	6/6/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW40	residuum	6/7/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW45	residuum	6/6/05	VOCs
CWM-186-MW46	residuum	6/3/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW47	residuum	6/3/05	VOCs
CWM-186-MW48	residuum	6/3/05	VOCs
CWM-186-MW51	residuum	6/8/05	VOCs
CWM-186-MW52	residuum	6/7/05	VOCs
CWM-186-MW53	bedrock	6/2/05	VOCs
CWM-186-MW54	bedrock	6/9/05	VOCs
CWM-186-MW56	bedrock	6/16/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW57	bedrock	6/16/05	VOCs, Dissolved Hydrocarbons
CWM-186-MW58	transition	6/13/05	VOCs
CWM-186-MW59	bedrock	6/13/05	VOCs
Surface Water Samples			
CWM-186-SW07		6/17/05	VOCs
CWM-186-SW08		6/17/05	VOCs
CWM-186-SW09		6/17/05	VOCs
Seep Samples			
CWM-186-SEEP01-RFI		6/17/05	VOCs
CWM-186-SEEP02-RFI		6/17/05	VOCs
CWM-186-SEEP03-RFI		6/17/05	VOCs
CWM-186-SEEP04-RFI		6/17/05	VOCs

Notes:
VOCs = volatile organic compounds by SW8260B
Dissolved Hydrocarbons = methane/ethane/ethene by RSK-175
Chromium VI = hexavalent chromium by SW7199

Table 4-2: Monitoring Well Summary
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Well Type	Northing	Easting	Ground Surface Elevation (feet amsl)	Top of Casing Elevation (feet amsl)	Well Depth (feet bgs)	Mid-Screen Depth (feet bgs)	Mid-Screen Elevation (feet amsl)	Screen Length (feet)	Screen Interval (feet bgs)
Existing Wells										
CWM-186-MW01	residuum	1173843.06	674590.78	988.06	989.74	64.0	56.0	932.1	10	51 - 61
CWM-186-MW02	residuum	1173768.52	674983.77	986.34	988.10	80.0	70.0	916.3	10	65 - 75
CWM-186-MW03	residuum	1173596.49	675068.20	1002.07	1003.78	99.0	90.0	912.1	10	85 - 95
CWM-186-MW04	residuum	1173180.04	675080.96	1017.24	1018.64	100.2	95.0	922.2	10	90 - 100
CWM-186-MW05	residuum	1173267.16	674754.28	1041.84	1043.85	144.0	138.5	903.3	9	134 - 143
CWM-186-MW07	residuum	1175086.96	674944.99	842.22	843.68	139.9	129.6	712.6	10	124.64 - 134.64
CWM-186-MW08	residuum	1174915.48	675518.02	864.10	866.04	157.4	147.1	717.0	10	142.14 - 152.14
CWM-186-MW11	residuum	1171889.44	675906.52	888.55	890.73	43.0	35.0	853.6	10	30 - 40
CWM-186-MW26	residuum	1173806.67	674967.33	982.61	984.62	115.7	105.4	877.2	10	100.4 - 110.4
CWM-186-MW31	residuum	1173678.97	674706.32	998.82	1001.06	90.0	80.0	918.8	20	70 - 90
CWM-186-MW32	residuum	1173649.51	674723.57	1000.98	1003.00	90.0	80.0	921.0	20	70 - 90
CWM-186-MW39	residuum	1173902.62	674873.42	979.69	981.71	100.0	90.0	889.7	20	80 - 100
CWM-186-MW40	residuum	1173813.43	674837.01	987.57	988.95	79.6	69.6	918.0	20	59.6 - 79.6
CWM-186-MW43	residuum	1173648.32	674955.44	998.96	1001.48	120.0	110.0	889.0	20	100 - 120
CWM-186-MW44	residuum	1173584.37	674940.63	1005.30	1007.64	119.2	109.2	896.1	20	99.2 - 119.2
CWM-186-MW45	residuum	1173459.43	675035.51	1013.92	1016.11	155.7	143.2	870.7	15	135.7 - 150.7
CWM-186-MW46	residuum	1173352.15	674852.49	1030.93	1033.21	120.0	110.0	920.9	20	100 - 120
CWM-186-MW47	residuum	1173251.62	674983.45	1026.79	1028.58	128.0	118.0	908.8	20	108 - 128
CWM-186-MW48	residuum	1173094.51	674934.67	1028.34	1030.60	130.0	120.0	908.3	20	110 - 130
CWM-186-MW49	residuum	1173854.47	675004.66	979.22	981.45	97.6	87.6	891.6	20	77.6 - 97.6
CWM-186-MW50	residuum	1173666.56	675060.26	997.62	999.87	135.0	125.0	872.6	20	115 - 135
CWM-186-MW51	residuum	1173257.79	675172.80	1005.75	1007.89	131.0	121.0	884.8	20	111 - 131
CWM-186-MW52	residuum	1173109.60	675215.20	1001.35	1003.56	100.5	93.0	908.4	15	85.5 - 100.5
CWM-186-MW09	bedrock	1174184.32	975902.86	935.76	937.75	163.8	155.4	780.4	10	150.4 - 160.4
CWM-186-MW10	bedrock	1173302.56	675948.01	941.63	943.62	150.0	141.6	800.0	10	136.63 - 146.36
CWM-186-MW13	bedrock	1173532.76	673885.25	844.08	846.15	45.9	37.5	806.6	10	32.5 - 42.5
CWM-186-MW14	bedrock	1174867.55	673533.60	872.06	873.97	145.3	135.0	737.1	10	130 - 140
CWM-186-MW15	bedrock	1175067.08	674963.08	844.28	844.03	204.5	194.1	650.1	10	189.14 - 199.14
CWM-186-MW18	bedrock	1171871.49	675908.63	889.07	891.04	103.0	95.0	794.1	10	90 - 100
CWM-186-MW19	bedrock	1172298.64	674125.94	841.32	841.15	105.3	95.0	746.3	10	90 - 100
CWM-186-MW20	bedrock	1175333.83	674320.61	830.05	832.14	77.9	69.5	760.5	10	64.52 - 74.52

Table 4-2: Monitoring Well Summary
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Well Type	Northing	Easting	Ground Surface Elevation (feet amsl)	Top of Casing Elevation (feet amsl)	Well Depth (feet bgs)	Mid-Screen Depth (feet bgs)	Mid-Screen Elevation (feet amsl)	Screen Length (feet)	Screen Interval (feet bgs)
CWM-186-MW21	bedrock	1174908.10	675494.09	863.48	865.34	180.1	174.7	688.8	10	169.72 - 179.72
CWM-186-MW22	bedrock	1174889.02	675527.93	863.12	865.26	246.3	235.9	627.2	10	230.94 - 240.94
CWM-186-MW23	bedrock	1174201.30	675870.84	933.52	935.57	207.2	201.8	731.7	10	196.82 - 206.82
CWM-186-MW24	bedrock	1173177.75	675966.53	942.61	944.31	212.3	203.9	738.7	10	198.93 - 208.93
CWM-186-MW25	bedrock	1173882.90	674565.95	984.05	985.99	183.0	175.0	809.1	10	170 - 180
CWM-186-MW28	bedrock	1173536.04	673907.10	844.31	846.04	120.7	112.3	732.0	10	107.3 - 117.3
CWM-186-MW29	bedrock	1172833.45	675005.83	1017.23	1019.02	168.0	160.0	857.2	10	155 - 165
CWM-186-MW30	bedrock	1172810.16	675001.57	1017.35	1019.40	223.0	215.0	802.4	10	210 - 220
CWM-186-MW33	bedrock	1175486.91	675623.82	861.72	863.73	261.0	251.0	610.7	20	241 - 261
CWM-186-MW34	bedrock	1175481.03	675610.77	862.67	864.64	315.0	305.0	557.7	20	295 - 315
CWM-186-MW35	bedrock	1175011.20	676214.70	905.43	907.45	253.0	243.0	662.4	20	233 - 253
CWM-186-MW36	bedrock	1174996.64	676228.98	906.41	908.24	335.0	320.0	586.4	20	310 - 330
CWM-186-MW37	bedrock	1174407.13	676929.55	949.30	950.85	217.0	202.0	747.3	20	192 - 212
CWM-186-MW38	bedrock	1174397.79	676912.84	948.47	950.32	275.0	260.0	688.5	20	250 - 270
CWM-186-MW53	bedrock	1174013.89	675031.95	963.92	966.14	90.5	80.5	883.4	20	70.5 - 90.5
CWM-186-MW54	bedrock	1171486.98	675698.36	881.41	881.32	45.0	37.5	843.9	15	30 - 45
CWM-186-MW16	transition	1175068.52	674919.99	841.14	843.10	174.2	165.8	675.4	10	160.78 - 170.78
CWM-186-MW41	transition	1173733.29	674799.68	993.48	995.78	120.0	110.0	883.5	20	100 - 120
CWM-186-MW42	transition	1173801.12	674674.12	994.12	996.52	123.5	113.5	880.6	20	103.5 - 123.5
CWM-186-MW55	transition	1171529.76	675536.54	886.20	888.54	40.0	32.5	853.7	15	25 - 40
Wells Installed During 2005 RFI										
CWM-186-MW56	bedrock	1173997.96	675164.54	962.74	964.48	195.3	190.0	772.7	10	185 - 195
CWM-186-MW57	bedrock	1173998.40	675150.99	962.60	964.77	110.3	105.0	857.6	10	100 - 110
CWM-186-MW59	bedrock	1172262.98	675394.61	1004.13	1006.23	160.3	155.0	849.1	10	150 - 160
CWM-186-MW58	transition	1173455.09	675642.42	945.58	947.80	125.3	120.0	825.6	10	115 - 125

Notes:
amsl = above mean sea level (referenced to the North America Vertical Datum of 1988)
bgs = below ground surface

Table 5-1: Groundwater Elevations, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Well Type	Measurement Date	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Depth to Water (feet BTOC)	Groundwater Elevation (feet)
CWM-186-MW03	residuum	6/1/2005*	1002.07	1003.78	86.14	917.64
CWM-186-MW05	residuum	6/1/2005*	1041.84	1043.85	129.76	914.09
CWM-186-MW08	residuum	6/1/2005*	864.10	866.04	11.70	854.34
CWM-186-MW11	residuum	10/24/2005	888.55	890.73	16.41	874.32
CWM-186-MW26	residuum	6/1/2005*	982.61	984.62	58.34	926.28
CWM-186-MW32	residuum	6/1/2005*	1000.98	1003.00	68.52	934.48
CWM-186-MW39	residuum	6/1/2005*	979.69	981.71	48.96	932.75
CWM-186-MW40	residuum	6/1/2005*	987.57	988.95	55.67	933.28
CWM-186-MW45	residuum	6/1/2005*	1013.92	1016.11	102.90	913.21
CWM-186-MW46	residuum	6/1/2005*	1030.93	1033.21	118.54	914.67
CWM-186-MW47	residuum	6/1/2005*	1026.79	1028.58	114.42	914.16
CWM-186-MW48	residuum	6/1/2005*	1028.34	1030.60	96.13	934.47
CWM-186-MW51	residuum	6/1/2005*	1005.75	1007.89	94.62	913.27
CWM-186-MW52	residuum	6/1/2005*	1001.35	1003.56	82.17	921.39
CWM-186-MW09	bedrock	10/24/2005	935.76	937.75	49.06	888.69
CWM-186-MW10	bedrock	6/1/2005*	941.63	943.62	55.27	888.35
CWM-186-MW13	bedrock	10/24/2005	844.08	846.15	22.90	823.25
CWM-186-MW14	bedrock	6/1/2005*	872.06	873.97	46.85	827.12
CWM-186-MW15	bedrock	6/1/2005*	844.28	844.03	16.53	827.50
CWM-186-MW18	bedrock	6/1/2005*	889.07	891.04	12.85	878.19
CWM-186-MW18	bedrock	10/24/2005	889.07	891.04	16.91	874.13
CWM-186-MW19	bedrock	6/1/2005*	841.32	841.15	9.58	831.57
CWM-186-MW20	bedrock	6/1/2005*	830.05	832.14	11.64	820.50
CWM-186-MW21	bedrock	6/1/2005*	863.48	865.34	11.09	854.25
CWM-186-MW23	bedrock	6/1/2005*	933.52	935.57	45.08	890.49
CWM-186-MW23	bedrock	10/24/2005	933.52	935.57	46.89	888.68
CWM-186-MW24	bedrock	6/1/2005*	942.61	944.31	48.92	895.39
CWM-186-MW25	bedrock	6/1/2005*	984.05	985.99	75.37	910.62
CWM-186-MW25	bedrock	10/24/2005	984.05	985.99	79.01	906.98
CWM-186-MW28	bedrock	6/1/2005*	844.31	846.04	18.68	827.36
CWM-186-MW28	bedrock	10/24/2005	844.31	846.04	24.48	821.56
CWM-186-MW29	bedrock	6/1/2005*	1017.23	1019.02	131.79	887.23

Table 5-1: Groundwater Elevations, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Well Type	Measurement Date	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Depth to Water (feet BTOC)	Groundwater Elevation (feet)
CWM-186-MW30	bedrock	6/1/2005*	1017.35	1019.40	128.74	890.66
CWM-186-MW34	bedrock	6/1/2005*	862.67	864.64	24.04	840.60
CWM-186-MW35	bedrock	6/1/2005*	905.43	907.45	38.27	869.18
CWM-186-MW37	bedrock	6/1/2005*	949.30	950.85	36.75	914.10
CWM-186-MW53	bedrock	6/1/2005*	963.92	966.14	55.94	910.20
CWM-186-MW54	bedrock	6/1/2005*	881.41	881.32	17.13	864.19
CWM-186-MW56	bedrock	10/24/2005	962.74	964.48	57.39	907.09
CWM-186-MW57	bedrock	10/24/2005	962.60	964.77	56.79	907.98
CWM-186-MW59	bedrock	10/24/2005	1004.13	1006.23	125.47	880.76
CWM-186-MW16	transition	6/1/2005*	841.14	843.10	flowing**	>843.10
CWM-186-MW16	transition	10/24/2005	841.14	843.10	flowing**	>843.10
CWM-186-MW41	transition	10/24/2005	993.48	995.78	67.75	928.03
CWM-186-MW42	transition	10/24/2005	994.12	996.52	80.39	916.13
CWM-186-MW55	transition	10/24/2005	886.20	888.54	20.49	868.05
CWM-186-MW58	transition	10/24/2005	945.58	947.80	53.22	894.58

Notes:

BTOC - below top of casing

* Water levels were collected by Bhate Environmental Associates, Inc. on 5/31/2005 and 6/1/2005, but which date for each well was not specified.

** CWM-186-MW16 was a flowing (artesian) well during water-level collection

Table 5-2: Groundwater Table Hydraulic Gradients, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Upgradient Monitoring Well	Well Type	Groundwater Elevation 6/1/2005*	Downgradient Monitoring Well	Well Type	Groundwater Elevation 6/1/2005*	Groundwater Flow Direction	Horizontal Distance	Elevation Difference (feet)	Groundwater Table Hydraulic Gradient (feet per foot)
CWM-186-MW40	Residuum	933.28	CWM-186-MW08	Residuum	854.34	Northeast	1295	78.94	0.061
CWM-186-MW40	Residuum	933.28	CWM-186-MW14	Bedrock	827.12	Northwest	1676	106.16	0.063
CWM-186-MW40	Residuum	933.28	CWM-186-MW23	Bedrock	890.49	East	1104	42.79	0.039
CWM-186-MW40	Residuum	933.28	CWM-186-MW28	Bedrock	827.36	West	970	105.92	0.109
CWM-186-MW48	Residuum	934.48	CWM-186-MW10	Bedrock	884.35	East	1034	50.13	0.048
CWM-186-MW48	Residuum	934.48	CWM-186-MW19	Bedrock	831.57	Southwest	1135	102.91	0.091
CWM-186-MW48	Residuum	934.48	CWM-186-MW54	Bedrock	864.19	Southeast	1780	70.29	0.039
CWM-186-MW25	Bedrock	910.62	CWM-186-MW14	Bedrock	827.12	Northwest	1427	83.50	0.059
CWM-186-MW37	Bedrock	914.10	CWM-186-MW34	Bedrock	840.60	Northwest	1701	73.50	0.043
CWM-186-MW41	Transition	928.03	CWM-186-MW16	Transition	843.10**	Northeast	1341	84.93	0.063
CWM-186-MW41	Transition	928.03	CWM-186-MW58	Transition	894.58	Southeast	887	33.45	0.038

Notes:

Elevations in feet above mean sea level.

* Water levels were collected by Bhate Environmental Associates, Inc. on 5/31/2005 and 6/1/2005; date for each well was not specified.

** The groundwater elevation at CWM-186-MW16 was recorded higher than the ground elevation, therefore it is considered a flowing well, and the groundwater elevation may actually be greater than 843.10 feet, resulting in a slightly lower horizontal gradient.

Table 5-3: Groundwater Table Hydraulic Gradients, 2003 RI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Upgradient Monitoring Well	Well Type	Groundwater Elevation June 2003 *	Downgradient Monitoring Well	Well Type	Groundwater Elevation June 2003 *	Groundwater Flow Direction	Horizontal Distance	Elevation Difference (feet)	Groundwater Table Hydraulic Gradient (feet per foot)
CWM-186-MW40	Residuum	930.35	CWM-186-MW08	Residuum	854.62	Northeast	1295	75.73	0.058
CWM-186-MW40	Residuum	930.35	CWM-186-MW14	Bedrock	827.48	Northwest	1676	102.87	0.061
CWM-186-MW40	Residuum	930.35	CWM-186-MW23	Bedrock	890.49	East	1104	39.86	0.036
CWM-186-MW40	Residuum	930.35	CWM-186-MW28	Bedrock	828.20	West	970	102.15	0.105
CWM-186-MW48	Residuum	932.50	CWM-186-MW10	Bedrock	884.35	East	1034	48.15	0.047
CWM-186-MW48	Residuum	932.50	CWM-186-MW19	Bedrock	831.57	Southwest	1135	100.93	0.089
CWM-186-MW48	Residuum	932.50	CWM-186-MW54	Bedrock	865.96	Southeast	1780	66.54	0.037
CWM-186-MW25	Bedrock	911.07	CWM-186-MW14	Bedrock	827.48	Northwest	1427	83.59	0.059
CWM-186-MW37	Bedrock	914.39	CWM-186-MW34	Bedrock	843.53	Northwest	1701	70.86	0.042
CWM-186-MW41	Transition	924.40	CWM-186-MW16	Transition	843.1**	North-northeast	1341	81.30	0.061

Notes:
Elevations in feet above mean sea level.

* Source: *Training Area T-38 Report of Findings* (Shaw, 2004); horizontal hydraulic gradients calculated by MES.

** The groundwater elevation at CWM-186-MW16 was recorded higher than the ground elevation, therefore it is considered a flowing well, and the groundwater elevation may actually be greater than 843.10 feet, resulting in a slightly lower horizontal gradient.

Table 5-4: Vertical Hydraulic Gradients, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Cluster IDs	Well Completion Zone	Midpoint of Screen (feet bgs)	Groundwater Elevation	dH	dL	Vertical Hydraulic Gradient (feet per foot)
October 2005						
CWM-185-MW18	Bedrock	95	874.13	0.19	60	0.003
CWM-185-MW11	Residuum	35	874.32			
CWM-185-MW28	Deep Bedrock	112.3	821.56	1.69	74.8	0.023
CWM-185-MW13	Bedrock	37.5	823.25			
CWM-185-MW23	Deep Bedrock	201.8	888.68	0.01	46.4	0.0002
CWM-185-MW09	Bedrock	155.4	888.69			
CWM-185-MW56	Deep Bedrock	190	907.09	0.89	85	0.010
CWM-185-MW57	Bedrock	105	907.98			

Notes:
Elevations in feet above mean sea level.
bgs = feet below ground surface
dH = change in height of the water column (feet)
dL = change in length between screens (feet)

Table 5-5: Vertical Hydraulic Gradients, 2003 RI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Cluster IDs	Well Completion Zone	Midpoint of Screen (feet bgs)	Groundwater Elevation June 2003 *	dH	dL	Vertical Hydraulic Gradient (feet per foot) *
CWM-185-MW18	Bedrock	95	879.13	1.85	60	0.031
CWM-185-MW11	Residuum	35	880.98			
CWM-185-MW28	Deep Bedrock	112.3	828.20	1.8	74.8	0.024
CWM-185-MW13	Bedrock	37.5	830.00			
CWM-185-MW23	Deep Bedrock	201.8	890.49	0.01	46.4	0.0002
CWM-185-MW09	Bedrock	155.4	890.50			

Notes:
Elevations in feet above mean sea level.
bgs = feet below ground surface
dH = change in height of the water column (feet)
dL = change in length between screens (feet)

* Source: *Training Area T-38 Report of Findings* (Shaw, 2004); vertical hydraulic gradients calculated by MES.

Table 5-6: Groundwater Chemical and Physical Parameters, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Sample Date	Temperature (°C)	pH	Conductivity (mScm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Oxidation Reduction Potential (mV)
Residuum							
CWM-186-MW03	6/16/05	20.0	11.57	88.0	6.45	31	-19
CWM-186-MW05	6/16/05	19.1	4.62	2.7	8.40	97	227
CWM-186-MW08	6/14/05	17.8	6.29	10.3	6.29	254	101
CWM-186-MW26	6/2/05	19.2	5.39	9.0	0.00	287	98
CWM-186-MW32	6/3/05	20.1	4.45	3.0	4.14	457	323
CWM-186-MW39	6/6/05	21.5	5.75	7.3	3.86	154	234
CWM-186-MW40	6/7/05	18.8	5.37	34.8	0.49	80	167
CWM-186-MW45	6/6/05	20.4	4.50	2.8	7.09	282	269
CWM-186-MW46	6/3/05	20.2	5.66	4.5	3.95	999	200
CWM-186-MW47	6/3/05	21.0	4.46	2.4	7.61	999	222
CWM-186-MW48	6/3/05	20.9	4.25	2.4	7.01	224	301
CWM-186-MW51	6/8/05	21.0	4.00	2.5	2.92	175	292
CWM-186-MW52	6/7/05	19.7	4.32	2.2	7.56	87	292
Bedrock							
CWM-186-MW10	6/13/05	17.2	4.34	3.6	7.93	999	310
CWM-186-MW14	6/15/05	18.1	7.50	62.0	0.80	999	61
CWM-186-MW15	6/15/05	22.2	11.95	0.186	0.77	12	-296
CWM-186-MW18	6/9/05	17.1	7.13	13.0	5.86	999	131
CWM-186-MW19	6/9/05	19.2	7.71	32.4	0.00	108	-181
CWM-186-MW20	6/15/05	19.98	8.53	0.491	NM	90.5	NM
CWM-186-MW21	6/14/05	19.1	6.55	12.8	5.89	289	201
CWM-186-MW23	6/10/05	19.6	7.80	85.9	0.14	547	-209
CWM-186-MW24	6/13/05	19.1	9.43	19.2	0.08	235	-249
CWM-186-MW25	6/2/05	20.2	9.52	26.6	0.00	999	-154
CWM-186-MW28	6/8/05	19.4	7.16	66.9	0.00	82	-94
CWM-186-MW29	6/8/05	19.7	7.70	30.7	0.20	203	153
CWM-186-MW30	6/14/05	18.9	8.74	28.9	0.72	417	39
CWM-186-MW34	6/17/05	20.8	7.17	49.1	0.47	26	-177
CWM-186-MW35	6/14/05	18.9	4.96	4.0	7.82	276	269
CWM-186-MW37	6/10/05	19.0	5.42	7.8	3.84	999	155
CWM-186-MW53	6/2/05	19.1	6.14	15.5	2.15	999	168

Table 5-6: Groundwater Chemical and Physical Parameters, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Well Location	Sample Date	Temperature (°C)	pH	Conductivity (mScm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Oxidation Reduction Potential (mV)
CWM-186-MW54	6/9/05	20.0	6.81	17.2	0.09	541	-85
CWM-186-MW56	6/16/05	18.98	7.52	0.365	NM	111	NM
CWM-186-MW57	6/16/05	18.51	5.55	0.487	NM	25.9	NM
CWM-186-MW59	6/13/05	19.6	7.87	40.3	0.91	0	-68
Transition							
CWM-186-MW16	6/15/05	17.9	6.55	8.6	7.86	5	167
CWM-186-MW58	6/13/05	17.5	5.27	5.3	7.08	564	212

Notes:
°C = Degrees celsius
mg/L = milligrams per liter
mScm = millisiemens per centimeter
mV = millivolts
NM = Not measured
NTU = nephelometric turbidity units

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW03 6/16/2005 (RFI) (residuum)	CWM-186-MW05 6/16/2005 (RFI) (residuum)	CWM-186-MW08 6/14/2005 (RFI) (residuum)	CWM-186-MW26 6/2/2005 (RFI) (residuum)	CWM-186-MW32 6/3/2005 (RFI) (residuum)	CWM-186-MW39 6/6/2005 (RFI) (residuum)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	2.1 (JS)	0.39 J	5.9
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	20000	580	14000
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	25 (JS)	4.8	5.8
1,1-Dichloroethene	0.23 J	< 1.0	< 1.0	3.5 (JS)	< 1.0	0.46 J
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	0.73 J (JS)	< 1.0	< 1.0
Acetone	< 10	< 10	< 10	< 10	< 10	< 10 (UJC)
Benzene	< 1.0	< 1.0	< 1.0	0.48 J (JS)	< 1.0	0.22 J
Bromobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.36 J
Carbon Disulfide	< 1.0 (UJC)	< 1.0 (UJC)	< 1.0	< 1.0	< 1.0	0.33 J
Carbon Tetrachloride	20	< 1.0	0.3 J	< 1.0	< 1.0	1.2
Chlorobenzene	< 1.0	< 1.0	< 1.0	0.32 J (JS)	< 1.0	0.21 J
Chloroform	2.6	0.35 J	< 1.0	85 J	0.26 J	14
Chloromethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	6.4	< 1.0	< 1.0	1400	0.89 J	14
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2
Methylene Chloride	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	2.3	< 1.0	< 1.0	170 J	36	230 J
Trans-1,2-Dichloroethene	4.7	< 1.0	< 1.0	370	0.39 J	6.1
Trichloroethene	180	< 1.0	9.6	3300	510	3300
Vinyl Chloride	< 1.0	< 1.0	< 1.0	12 (JS)	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	< 1.5	--	--	61	< 1.5	1.5 J
Ethene	< 1.5	--	--	220	< 1.5	< 1.5
Methane	0.72 J	--	--	2.5	0.63 J	< 1.2
Metals (µg/L)						
Chromium VI	--	--	0.155 J	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW40 6/7/2005 (RFI) (residuum)	CWM-186-MW45 6/6/2005 (RFI) (residuum)	CWM-186-MW46 6/3/2005 (RFI) (residuum)	CWM-186-MW47 6/3/2005 (RFI) (residuum)	CWM-186-MW48 6/3/2005 (RFI) (residuum)	CWM-186-MW51 6/8/2005 (RFI) (residuum)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	8	< 1.0	0.28 J	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	25000	740	6000	240	670	350
1,1,2-Trichloroethane	27	3.9	1.8	< 1.0	0.25 J	0.5 J
1,1-Dichloroethene	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	0.68 J	< 1.0	< 1.0	< 1.0	< 1.0	0.41 J
Acetone	< 10 (UJC)	< 10 (UJC)	< 10	< 10	< 10	< 10
Benzene	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	0.22 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Disulfide	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Tetrachloride	0.24 J	16	6.8	55	< 1.0	2.9
Chlorobenzene	0.58 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	300 J	3.3	29	2.8	15	2.5
Chloromethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	440 J	0.59 J	28	< 1.0	0.21 J	< 1.0
Dibromochloromethane	0.46 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	0.84 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride	1.9 J	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	340 J	8.1	0.58 J	6.1	8.8	1.6
Trans-1,2-Dichloroethene	120 E (JX)	0.21 J	8.5	< 1.0	< 1.0	< 1.0
Trichloroethene	3700	210	430	100	140	64
Vinyl Chloride	3.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	42	--	< 1.5	--	--	--
Ethene	39	--	< 1.5	--	--	--
Methane	< 1.2	--	< 1.2	--	--	--
Metals (µg/L)						
Chromium VI	--	--	--	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW52 6/7/2005 (RFI) (residuum)	CWM-186-MW10 6/13/2005 (RFI) (bedrock)	CWM-186-MW14 6/15/2005 (RFI) (bedrock)	CWM-186-MW15 6/15/2005 (RFI) (bedrock)	CWM-186-MW18 6/9/2005 (RFI) (bedrock)	CWM-186-MW19 6/9/2005 (RFI) (bedrock)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	40	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 10	< 10	< 10	3400	< 10	< 10
Benzene	< 1.0	< 1.0	< 1.0	0.61 J	< 1.0	< 1.0
Bromobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Disulfide	< 1.0	< 1.0	0.27 J	0.49 J	< 1.0	< 1.0
Carbon Tetrachloride	31	< 1.0	< 1.0	< 1.0	2.9	< 1.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	2.3	< 1.0	< 1.0	< 1.0	0.66 J	< 1.0
Chloromethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	0.46 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	9.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	--	< 1.5	--	--	--	--
Ethene	--	< 1.5	--	--	--	--
Methane	--	1.4	--	--	--	--
Metals (µg/L)						
Chromium VI	--	--	--	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW20 6/15/2005 (RFI) (bedrock)	CWM-186-MW21 6/14/2005 (RFI) (bedrock)	CWM-186-MW23 6/10/2005 (RFI) (bedrock)	CWM-186-MW24 6/13/2005 (RFI) (bedrock)	CWM-186-MW25 6/2/2005 (RFI) (bedrock)	CWM-186-MW28 6/8/2005 (RFI) (bedrock)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	< 1.0	< 1.0	< 1.0	0.22 J	< 1.0	< 1.0
Bromobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Disulfide	< 1.0	< 1.0	< 1.0	0.23 J	0.54 J	< 1.0
Carbon Tetrachloride	< 1.0	0.25 J	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	< 1.0	0.3 J	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	14	1.1	0.21 J	0.31 J	< 1.0
Vinyl Chloride	< 1.0	< 1.0	0.21 J	< 1.0	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	--	< 1.5	12	--	--	--
Ethene	--	< 1.5	< 1.5	--	--	--
Methane	--	< 1.2	2900	--	--	--
Metals (µg/L)						
Chromium VI	--	--	--	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW29 6/8/2005 (RFI) (bedrock)	CWM-186-MW30 6/14/2005 (RFI) (bedrock)	CWM-186-MW34 6/17/2005 (RFI) (bedrock)	CWM-186-MW35 6/14/2005 (RFI) (bedrock)	CWM-186-MW37 6/10/2005 (RFI) (bedrock)	CWM-186-MW53 6/2/2005 (RFI) (bedrock)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4 (JS)
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5900
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.3 (JS)
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.65 J (JS)
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.3 (JS)
Acetone	< 10	< 10	9.8 J	< 10	< 10	< 10
Benzene	< 1.0	< 1.0	0.26 J	< 1.0	< 1.0	0.5 J (JS)
Bromobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Disulfide	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Tetrachloride	0.31 J	< 1.0	< 1.0	< 1.0	< 1.0	23 (JS)
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	40 (JS)
Chloromethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	120 J
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	62 J
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	54 J
Trichloroethene	3.7	< 1.0	< 1.0	1.6	< 1.0	2300
Vinyl Chloride	< 1.0	< 1.0	0.33 J	< 1.0	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	< 1.5	--	--	--	--	--
Ethene	< 1.5	--	--	--	--	--
Methane	0.68 J	--	--	--	--	--
Metals (µg/L)						
Chromium VI	--	< 0.2	--	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-MW54 6/9/2005 (RFI) (bedrock)	CWM-186-MW56 6/16/2005 (RFI) (bedrock)	CWM-186-MW57 6/16/2005 (RFI) (bedrock)	CWM-186-MW59 6/13/2005 (RFI) (bedrock)	CWM-186-MW16 6/15/2005 (RFI) (transition)	CWM-186-MW58 6/13/2005 (RFI) (transition)
VOC (µg/L)						
1,1,1,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.6
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetone	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbon Disulfide	< 1.0	< 1.0 (UJC)	< 1.0 (UJC)	< 1.0	< 1.0	< 1.0
Carbon Tetrachloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.2
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	< 1.0	< 1.0	0.26 J	< 1.0	< 1.0	0.65 J
Chloromethane	< 2.0	< 2.0	0.56 J	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methylene Chloride	< 2	< 2	< 2	< 2.0	< 2	< 2
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	< 1.0	2.6	< 1.0	< 1.0	1	10
Vinyl Chloride	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Hydrocarbons (µg/L)						
Ethane	--	< 1.5	0.78 J	--	--	--
Ethene	--	< 1.5	< 1.5	--	--	--
Methane	--	14	52	--	--	--
Metals (µg/L)						
Chromium VI	--	--	--	--	--	--

Table 5-7: Summary of Groundwater Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Notes:
-- = Not analyzed
< = The result was not detected at the concentration shown.
µg/L = microgram per liter
RFI = 2005 RCRA Facility Investigation
VOC = Volatile organic compound
Lab Flag:
J = Estimated value. The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
E = Result is above the maximum calibration range.
Validation Flag:
(JS) = Surrogate recovery was outside laboratory historical control limits.
(JX) = Result exceeded the calibration range of the instrument.
(UJC) = Analyte was analyzed for, but not detected. The reported quantitation limit is estimated because continuing calibration is outside method-specific control limits.

Table 5-8: Summary of Surface Water and Seep Detections, 2005 RFI
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	CWM-186-SEEP01-RFI 6/17/2005	CWM-186-SEEP02-RFI 6/17/2005	CWM-186-SEEP03-RFI 6/17/2005	CWM-186-SEEP04-RFI 6/17/2005
VOC (µg/L)				
1,1,2,2-Tetrachloroethane	2.3	< 1.0	66	< 1.0
1,1,2-Trichloroethane	0.47 J	< 1.0	0.3 J	< 1.0
Carbon Tetrachloride	1	< 1.0	0.38 J	< 1.0
Chloroform	1	< 1.0	0.21 J	< 1.0
Cis-1,2-Dichloroethene	0.53 J	< 1.0	0.5 J	< 1.0
Tetrachloroethene	0.34 J	< 1.0	0.21 J	< 1.0
Trichloroethene	130	1.1	13 (JM)	< 1.0

Parameter Name	CWM-186-SW07 6/17/2005	CWM-186-SW08 6/17/2005	CWM-186-SW09 6/17/2005
VOC (µg/L)			
1,1,2,2-Tetrachloroethane	< 1.0	3.8	< 1.0
Trichloroethene	< 1.0	0.3 J	< 1.0

Notes:
< = The result was not detected at the concentration shown.
µg/L = microgram per liter
RFI = 2005 RCRA Facility Investigation
VOC = Volatile organic compound
Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(JM) = The MS and MSD recoveries were outside laboratory historical control limits.

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW01 5/28/2003 (RI) (residuum)	CWM-186-MW02 6/4/2003 (RI) (residuum)	CWM-186-MW03 6/16/2005 (RFI) (residuum)	CWM-186-MW04 5/30/2003 (RI) (residuum)	CWM-186-MW05 6/16/2005 (RFI) (residuum)
1,1,1,2-Tetrachloroethane	1.57	10.2					
1,1,2,2-Tetrachloroethane	0.204	1.36	**190**	**170**		**190**	
1,1,2-Trichloroethane	0.715	4.85	1.1				
1,1-Dichloroethene	76.4 *	86.3 *			0.23 J		
1,2-Dichloroethane	0.448	3.08					
Acetone	156	1020					
Benzene	1.41	9.09					
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921					
Carbon tetrachloride	0.408	1.98		**7.7**	**20**		
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *	0.71 J (J)	**3.2**	**2.6**	0.4 J (J)	0.35 J
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1		**17**	6.4		
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6	**1.6**	**9.7**	**2.3**	0.61 J (J)	
Trans-1,2-Dichloroethene	30.7	195		6.2	4.7		
Trichloroethene	0.102 *	0.498 *	**22**	**100 (J)**	**180**	**33**	
Vinyl Chloride	0.0441 *	0.185 *					

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW08 6/14/2005 (RFI) (residuum)	CWM-186-MW11 4/16/2003 (RI) (residuum)	CWM-186-MW26 6/2/2005 (RFI) (residuum)	CWM-186-MW31 5/29/2003 (RI) (residuum)	CWM-186-MW32 6/3/2005 (RFI) (residuum)
1,1,1,2-Tetrachloroethane	1.57	10.2			**2.1 (JS)**		0.39 J
1,1,2,2-Tetrachloroethane	0.204	1.36			**20000**	**770**	**580**
1,1,2-Trichloroethane	0.715	4.85			**25 (JS)**	**2.6**	**4.8**
1,1-Dichloroethene	76.4 *	86.3 *			3.5 (JS)		
1,2-Dichloroethane	0.448	3.08			**0.73 J (JS)**		
Acetone	156	1020		**410 (J)**			
Benzene	1.41	9.09			0.48 J (JS)		
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921					
Carbon tetrachloride	0.408	1.98	0.3 J			**0.46 J (J)**	
Chlorobenzene	16.2	175			0.32 J (JS)		
Chloroform	1.16 *	45.3 *			**85 J**	**2.3**	0.26 J
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1			**1400**	0.27 J (J)	0.89 J
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6			**170 J**	**16**	**36**
Trans-1,2-Dichloroethene	30.7	195			**370**	0.21 J (J)	0.39 J
Trichloroethene	0.102 *	0.498 *	**9.6**		**3300**	**420 ****	**510**
Vinyl Chloride	0.0441 *	0.185 *			**12 (JS)**		

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW39 6/6/2005 (RFI) (residuum)	CWM-186-MW40 6/7/2005 (RFI) (residuum)	CWM-186-MW43 6/3/2003 (RI) (residuum)	CWM-186-MW44 6/3/2003 (RI) (residuum)	CWM-186-MW45 6/6/2005 (RFI) (residuum)
1,1,1,2-Tetrachloroethane	1.57	10.2	**5.9**	**8**			
1,1,2,2-Tetrachloroethane	0.204	1.36	**14000**	**25000**	**590**	**800**	**740**
1,1,2-Trichloroethane	0.715	4.85	**5.8**	**27**	**4.6**	**4.6**	**3.9**
1,1-Dichloroethene	76.4 *	86.3 *	0.46 J	1.9			
1,2-Dichloroethane	0.448	3.08		**0.68 J**			
Acetone	156	1020					
Benzene	1.41	9.09	0.22 J	1			
Bromobenzene	9.13	181		0.22 J			
Bromodichloromethane	1.08	4.5	0.36 J	**1.9**			
Carbon disulfide	151	921	0.33 J				
Carbon tetrachloride	0.408	1.98	**1.2**	0.24 J	**2.8**	**67**	**16**
Chlorobenzene	16.2	175	0.21 J	0.58 J			
Chloroform	1.16 *	45.3 *	**14**	**300 J**	**5.3**	**3.2**	**3.3**
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1	14	**440 J**	**44**	11	0.59 J
Dibromochloromethane	0.792	3.35		0.46 J			
Hexachlorobutadiene	0.307	1.94	**1.2**	**0.84 J**			
Methylene chloride	7.85	37.5		1.9 J			
Tetrachloroethene	1.02 *	4.6	**230 J**	**340 J**	**4.6**	**10**	**8.1**
Trans-1,2-Dichloroethene	30.7	195	6.1	**120 E (JX)**	15	11	0.21 J
Trichloroethene	0.102 *	0.498 *	**3300**	**3700**	**130 (J)**	**310 (J)**	**210**
Vinyl Chloride	0.0441 *	0.185 *		**3.4**			

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW46 6/3/2005 (RFI) (residuum)	CWM-186-MW47 6/3/2005 (RFI) (residuum)	CWM-186-MW48 6/3/2005 (RFI) (residuum)	CWM-186-MW49 6/6/2003 (RI) (residuum)	CWM-186-MW50 6/5/2003 (RI) (residuum)
1,1,1,2-Tetrachloroethane	1.57	10.2	0.28 J				
1,1,2,2-Tetrachloroethane	0.204	1.36	**6000**	**240**	**670**	**270**	**170**
1,1,2-Trichloroethane	0.715	4.85	**1.8**		0.25 J	0.25 J (J)	0.45 J (J)
1,1-Dichloroethene	76.4 *	86.3 *					
1,2-Dichloroethane	0.448	3.08					
Acetone	156	1020					
Benzene	1.41	9.09					
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921					
Carbon tetrachloride	0.408	1.98	**6.8**	**55**		**6.3**	**1.2**
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *	**29**	**2.8**	**15**	**3.3**	**1.4**
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1	**28**		0.21 J	15	3.4
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6	0.58 J	**6.1**	**8.8**	**4.4**	**2.7**
Trans-1,2-Dichloroethene	30.7	195	8.5			4.9	1.3
Trichloroethene	0.102 *	0.498 *	**430**	**100**	**140**	**92**	**160**
Vinyl Chloride	0.0441 *	0.185 *					

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW51 6/8/2005 (RFI) (residuum)	CWM-186-MW52 6/7/2005 (RFI) (residuum)	CWM-186-MW09 5/19/2003 (RI) (bedrock)	CWM-186-MW14 6/15/2005 (RFI) (bedrock)	CWM-186-MW15 6/15/2005 (RFI) (bedrock)
1,1,1,2-Tetrachloroethane	1.57	10.2					
1,1,2,2-Tetrachloroethane	0.204	1.36	**350**	**40**			
1,1,2-Trichloroethane	0.715	4.85	0.5 J				
1,1-Dichloroethene	76.4 *	86.3 *					
1,2-Dichloroethane	0.448	3.08	0.41 J				
Acetone	156	1020					**3400**
Benzene	1.41	9.09					0.61 J
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921			0.4 J (J)	0.27 J	0.49 J
Carbon tetrachloride	0.408	1.98	**2.9**	**31**			
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *	**2.5**	**2.3**			
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1					
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6	**1.6**	0.46 J			
Trans-1,2-Dichloroethene	30.7	195					
Trichloroethene	0.102 *	0.498 *	**64**	**9.8**	**5.7**		
Vinyl Chloride	0.0441 *	0.185 *					

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW18 6/9/2005 (RFI) (bedrock)	CWM-186-MW21 6/14/2005 (RFI) (bedrock)	CWM-186-MW23 6/10/2005 (RFI) (bedrock)	CWM-186-MW24 6/13/2005 (RFI) (bedrock)	CWM-186-MW25 6/2/2005 (RFI) (bedrock)
1,1,1,2-Tetrachloroethane	1.57	10.2					
1,1,2,2-Tetrachloroethane	0.204	1.36					
1,1,2-Trichloroethane	0.715	4.85					
1,1-Dichloroethene	76.4 *	86.3 *					
1,2-Dichloroethane	0.448	3.08					
Acetone	156	1020					
Benzene	1.41	9.09				0.22 J	
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921				0.23 J	0.54 J
Carbon tetrachloride	0.408	1.98	**2.9**	0.25 J			
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *	0.66 J				
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1		0.3 J			
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6					
Trans-1,2-Dichloroethene	30.7	195					
Trichloroethene	0.102 *	0.498 *		**14**	**1.1**	**0.21 J**	**0.31 J**
Vinyl Chloride	0.0441 *	0.185 *			**0.21 J**		

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW29 6/8/2005 (RFI) (bedrock)	CWM-186-MW34 6/17/2005 (RFI) (bedrock)	CWM-186-MW35 6/14/2005 (RFI) (bedrock)	CWM-186-MW36 5/13/2003 (RI) (bedrock)	CWM-186-MW53 6/2/2005 (RFI) (bedrock)
1,1,1,2-Tetrachloroethane	1.57	10.2					**2.4 (JS)**
1,1,2,2-Tetrachloroethane	0.204	1.36					**5900**
1,1,2-Trichloroethane	0.715	4.85					**8.3 (JS)**
1,1-Dichloroethene	76.4 *	86.3 *					0.65 J (JS)
1,2-Dichloroethane	0.448	3.08					**2.3 (JS)**
Acetone	156	1020		9.8 J		27 (J)	
Benzene	1.41	9.09		0.26 J			0.5 J (JS)
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921					
Carbon tetrachloride	0.408	1.98	0.31 J				**23 (JS)**
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *					**40 (JS)**
Chloromethane	3.93	21.6					
Cis-1,2-Dichloroethene	15.5	99.1					**120 J**
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6					**62 J**
Trans-1,2-Dichloroethene	30.7	195					**54 J**
Trichloroethene	0.102 *	0.498 *	**3.7**		**1.6**		**2300**
Vinyl Chloride	0.0441 *	0.185 *		**0.33 J**			

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW56 6/16/2005 (RFI) (bedrock)	CWM-186-MW57 6/16/2005 (RFI) (bedrock)	CWM-186-MW16 6/15/2005 (RFI) (transition)	CWM-186-MW41 6/3/2003 (RI) (transition)	CWM-186-MW42 5/30/2003 (RI) (transition)
1,1,1,2-Tetrachloroethane	1.57	10.2					
1,1,2,2-Tetrachloroethane	0.204	1.36				**320**	**900**
1,1,2-Trichloroethane	0.715	4.85				**1.4**	**7.9**
1,1-Dichloroethene	76.4 *	86.3 *					
1,2-Dichloroethane	0.448	3.08					
Acetone	156	1020					
Benzene	1.41	9.09					
Bromobenzene	9.13	181					
Bromodichloromethane	1.08	4.5					
Carbon disulfide	151	921					
Carbon tetrachloride	0.408	1.98				0.26 J (J)	
Chlorobenzene	16.2	175					
Chloroform	1.16 *	45.3 *		0.26 J		**1.7**	**4.3**
Chloromethane	3.93	21.6		0.56 J			
Cis-1,2-Dichloroethene	15.5	99.1				1.5	0.7 J (J)
Dibromochloromethane	0.792	3.35					
Hexachlorobutadiene	0.307	1.94					
Methylene chloride	7.85	37.5					
Tetrachloroethene	1.02 *	4.6				**2**	**6.1**
Trans-1,2-Dichloroethene	30.7	195				0.51 J (J)	0.26 J (J)
Trichloroethene	0.102 *	0.498 *	**2.6**		**1**	**110 (J)**	**610 ****
Vinyl Chloride	0.0441 *	0.185 *					

Table 5-9: Groundwater VOC Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW58 6/13/2005 (RFI) (transition)
1,1,1,2-Tetrachloroethane	1.57	10.2	
1,1,2,2-Tetrachloroethane	0.204	1.36	**9.6**
1,1,2-Trichloroethane	0.715	4.85	
1,1-Dichloroethene	76.4 *	86.3 *	
1,2-Dichloroethane	0.448	3.08	
Acetone	156	1020	
Benzene	1.41	9.09	
Bromobenzene	9.13	181	
Bromodichloromethane	1.08	4.5	
Carbon disulfide	151	921	
Carbon tetrachloride	0.408	1.98	**4.2**
Chlorobenzene	16.2	175	
Chloroform	1.16 *	45.3 *	0.65 J
Chloromethane	3.93	21.6	
Cis-1,2-Dichloroethene	15.5	99.1	
Dibromochloromethane	0.792	3.35	
Hexachlorobutadiene	0.307	1.94	
Methylene chloride	7.85	37.5	
Tetrachloroethene	1.02 *	4.6	
Trans-1,2-Dichloroethene	30.7	195	
Trichloroethene	0.102 *	0.498 *	**10**
Vinyl Chloride	0.0441 *	0.185 *	

Notes:
µg/L = micrograms per liter
SSSL = Site-Specific Screening Level
VOC = Volatile organic compound
RI = 2001 to 2003 Remedial Investigation performed by Shaw (2004).
RFI = 2005 RCRA Facility Investigation.

* SSSL shown was updated from the IT developed SSSL (IT, 2000) due to revisions in toxicity values.
** Result was not reported by Shaw; for purposes of determining nature and extent, the result from the diluted analysis from the "Validation Qualifier Data Entry Verification" table (Shaw, 2004) is shown (see Section 5.5.1 of RFI for further details).

Lab Flag:
E = Result is above the maximum calibration range.
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.
(JS) = Surrogate recovery was outside laboratory historical control limits.
(JX) = Result exceeded the calibration range of the instrument.

Value exceeds the groundskeeper SSSL.
Value exceeds the residential SSSL.

Table 5-10: Groundwater SVOC, Explosive, and CWM Breakdown Product Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Groundskeeper SSSL	CWM-186-MW03 6/7/2001 (RI) (residuum)	CWM-186-MW08 5/14/2001 (RI) (residuum)	CWM-186-MW31 3/22/2002 (RI) (residuum)	CWM-186-MW15 5/18/2001 (RI) (bedrock)	CWM-186-MW23 5/31/2001 (RI) (bedrock)
SVOCs (µg/L)							
Benzo(ghi)perylene	8.19	21.5					
Phenol	931	5990	2.2 J (J)				
Explosives (µg/L)							
1,3,5-Trinitrobenzene	46.9	305			0.25 J (J)		
1,3-Dinitrobenzene	0.156	1.01			0.14 J (J)		
2-Nitrotoluene	15.3	96.9				0.69 P	0.75
3-Nitrotoluene	15.3	96.9			1.3 (J)		
p-Nitrotoluene	15.3	96.3			1.2 (J)		
RDX	0.669	2.86			0.44 P (J)		
Tetryl	15.6	102			0.97 (J)		
CWM Breakdown (µg/L)							
1,4-Dithiane	15.6	102		0.82 J (J)			
Thiodiglycol	62.6	409					

Parameter Name	Residential SSSL	Groundskeeper SSSL	CWM-186-MW24 5/31/2001 (RI) (bedrock)	CWM-186-MW25 6/28/2001 (RI) (bedrock)	CWM-186-MW29 6/19/2001 (RI) (bedrock)	CWM-186-MW30 7/2/2001 (RI) (bedrock)
SVOCs (µg/L)						
Benzo(ghi)perylene	8.19	21.5			0.81 J (J)	
Phenol	931	5990	2.1 J (J)			
Explosives (µg/L)						
1,3,5-Trinitrobenzene	46.9	305				
1,3-Dinitrobenzene	0.156	1.01				
2-Nitrotoluene	15.3	96.9	0.38 J (J)			
3-Nitrotoluene	15.3	96.9				
p-Nitrotoluene	15.3	96.3				
RDX	0.669	2.86				
Tetryl	15.6	102				
CWM Breakdown (µg/L)						
1,4-Dithiane	15.6	102				
Thiodiglycol	62.6	409		14		9.9 J (J)

Table 5-10: Groundwater SVOC, Explosive, and CWM Breakdown Product Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Notes:
µg/L = micrograms per liter
SSSL = Site-Specific Screening Level
RI = 2001 to 2002 Remedial Investigation performed by Shaw (2004).

Lab Flag:
J = Reported value is an estimated concentration.
P = Percent difference between columns was outside criteria.
Validation Flag:
(J) = Reported value is an estimated concentration.

Table 5-11: Groundwater Metal Contaminants Compared to SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Metals (mg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW01 6/22/2001 (RI) (residuum)	CWM-186-MW03 6/7/2001 (RI) (residuum)	CWM-186-MW07 5/15/2001 (RI) (residuum)	CWM-186-MW08 5/14/2001 (RI) (residuum)	CWM-186-MW08 6/14/2005 (RFI) (residuum)	CWM-186-MW23 5/31/2001 (RI) (bedrock)
Antimony	0.000626	0.00393			**0.0601 J (J)**			
Chromium	0.00469*	0.0283*		0.0043 B (J)		**0.0595**		**0.0182**
Mercury	0.000469	0.0029	0.000435 J (J)					
Thallium	0.000102	0.000662						
Chromium VI	0.00469	0.0283					0.000155 J	

Metals (mg/L)	Residential SSSL	Groundskeeper SSSL	CWM-186-MW24 5/31/2001 (RI) (bedrock)	CWM-186-MW29 6/19/2001 (RI) (bedrock)	CWM-186-MW30 7/2/2001 (RI) (bedrock)	CWM-186-MW35 3/11/2002 (RI) (bedrock)	CWM-186-MW16 5/10/2001 (RI) (transition)
Antimony	0.000626	0.00393					**0.0358 J (J)**
Chromium	0.00469*	0.0283*	**0.00497 J (J)**	0.0046 B (J)	**0.0199**		
Mercury	0.000469	0.0029					
Thallium	0.000102	0.000662				**0.00802 J (J)**	
Chromium VI	0.00469	0.0283					

Notes:
mg/L = milligrams per liter
SSSL = Site-Specific Screening Level
RI = 2001 to 2002 Remedial Investigation performed by Shaw (2004).
RFI = 2005 RCRA Facility Investigation.
* Chromium sample results were compared to the more stringent chromium VI SSSL.

Lab Flag:
B = Result is greater than the method detection limit, but less than the reporting limit (for metals only).
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.

Value exceeds the groundskeeper SSSL.
Value exceeds the residential SSSL.

Table 5-12: Surface Water and Seep VOC Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

VOCs (µg/L)	Recreational SSSL	ESV	CWM-186-SEEP01-RI 7/10/2003 (RI)	CWM-186-SEEP01-RFI 6/17/2005 (RFI)	CWM-186-SEEP02-RI 7/10/2003 (RI)	CWM-186-SEEP02-RFI 6/17/2005 (RFI)
1,1,2,2-Tetrachloroethane	5.01	240	1.1	2.3	3.8	
1,1,2-Trichloroethane	18.2	940		0.47 J		
Carbon disulfide	1300	84			0.63 J (J)	
Carbon Tetrachloride	6.97	352	0.49 J (J)	1		
Chloroform	147*	289	0.41 J (J)	1		
Cis-1,2-Dichloroethene	149	11600	0.31 J (J)	0.53 J	0.25 J (J)	
Styrene	2190	56				
Tetrachloroethene	15.36*	84		0.34 J		
Trans-1,2-Dichloroethene	287	1350				
Trichloroethene	1.49*	21900	51	130	0.85 J (J)	1.1

VOCs (µg/L)	Recreational SSSL	ESV	CWM-186-SEEP03-RI 7/10/2003 (RI)	CWM-186-SEEP03-RFI 6/17/2005 (RFI)	CWM-186-SEEP04-RI 7/10/2003 (RI)
1,1,2,2-Tetrachloroethane	5.01	240	150	66	
1,1,2-Trichloroethane	18.2	940	0.53 J (J)	0.3 J	
Carbon disulfide	1300	84			
Carbon Tetrachloride	6.97	352	0.82 J (J)	0.38 J	
Chloroform	147*	289		0.21 J	
Cis-1,2-Dichloroethene	149	11600	4	0.5 J	
Styrene	2190	56	0.39 J (J)		0.26 J (J)
Tetrachloroethene	15.36*	84	0.74 J (J)	0.21 J	
Trans-1,2-Dichloroethene	287	1350	1.4		
Trichloroethene	1.49*	21900	9.5	13 (JM)	

VOCs (µg/L)	Recreational SSSL	ESV	CWM-186-SW/SD06 3/5/2001 (RI)	CWM-186-SW08 6/17/2005 (RFI)
1,1,2,2-Tetrachloroethane	5.01	240		3.8
Trichloroethene	1.49*	21900	1.5 J (J)	0.3 J

Notes:
ESV = Ecological Screening Value
µg/L = micrograms per liter

Table 5-12: Surface Water and Seep VOC Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)
* SSSL shown was updated from the IT developed SSSL (IT, 2000) due to revisions in toxicity values.
VOC = Volatile organic compound
RI = 2001 to 2003 Remedial Investigation performed by Shaw (2004)
RFI = 2005 RCRA Facility Investigation
Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.
(JM) = The MS and MSD recoveries were outside laboratory historical control limits.

Value exceeds the SSSL.

Table 5-13: Surface Water and Seep Metal Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Metals (mg/L)	Recreational SSSL	ESV	CWM-186-SEEP01-RI 5/21/2001 (RI)	CWM-186-SEEP03-RI 5/22/2001 (RI)	CWM-186-SW/SD06 3/5/2001 (RI)
Beryllium	0.0175	0.00053		**0.00216**	
Chromium	0.0408	0.011			**0.0908**
Thallium	0.00102	0.004	**0.00586 J (J)**		

Notes:
ESV = Ecological Screening Value
mg/L = milligrams per liter
SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)
RI = 2001 to 2003 Remedial Investigation performed by Shaw (2004).
Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.

Value exceeds the SSSL.
Value exceeds ESV.

Table 5-14: Sediment Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Recreational SSSL	ESV	CWM-186-SW/SD01 1/18/2001 (RI)	CWM-186-SW/SD02 1/18/2001 (RI)	CWM-186-SW/SD03 3/7/2001 (RI)	CWM-186-SW/SD06 3/5/2001 (RI)
VOCs (µg/kg)						
2-Butanone (MEK)	6.23E+08	137	11 J (J)	13 J (J)	17 J (J)	
Acetone	1.03E+08	453	110 (J)	130 (J)	310 (J)	39 (J)
p-Isopropyltoluene	2.08E+08	--			3.1 J (J)	
Toluene	2.11E+08	670	0.69 J (J)	0.6 J (J)	1.9 J (J)	
CWM Breakdown (µg/kg)						
Thiodiglycol	4.16E+07	--	37 J (J)	30 J (J)		
Metals (mg/kg)						
Beryllium	150	--	1.25 J (J)	0.853 J (J)		

Notes:
-- = Information either not available or not applicable
ESV = Ecological Screening Value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)
RI = 2001 Remedial Investigation performed by Shaw (2004).
Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-DEP01 (0-1 feet) 1/17/2001 (RI)	CWM-186-DEP03 (0-1 feet) 3/7/2001 (RI)	CWM-186-DEP04 (0-1 feet) 3/8/2001 (RI)	CWM-186-GP01 (0-1 feet) 10/16/2002 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100		61 (J)		
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04	5.2 J (J)	17 J (J)	34	
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	45	290 (J)	530 (J)	350 (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50			1.4 J (J)	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-GP02 (0-1 feet) 11/12/2002 (RI)	CWM-186-GP03 (0-1 feet) 11/13/2002 (RI)	CWM-186-GP04 (0-1 feet) 11/7/2002 (RI)	CWM-186-GP05 (0-1 feet) 10/18/2002 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04		37 (J)		
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	80 (J)	550 E (J)	200 (J)	220 (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				5.8
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100	3.1 J (J)			
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-GP07 (0-1 feet) 11/6/2002 (RI)	CWM-186-GP08 (0-1 feet) 10/29/2002 (RI)	CWM-186-GP09 (0-1 feet) 2/6/2003 (RI)	CWM-186-GP10 (0-1 feet) 11/11/2002 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	160 (J)	130 (J)	97 (J)	85 (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				5.1 J (J)
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-GP11 (0-1 feet) 11/11/2002 (RI)	CWM-186-GP15 (0-1 feet) 11/13/2002 (RI)	CWM-186-GP16 (0-2 feet) 2/27/2003 (RI)	CWM-186-MW07 (0-1 feet) 4/4/2001 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100		13 (J)		
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				160
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	110 (J)	44 (J)	140 (J)	1900
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94			4.3 J (J)	
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				2.2 J (J)
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				23 (J)
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10		1.6 J (J)		
Toluene	1.55E+06	1.24E+08	1.96E+07	50				0.75 J (J)
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				840 P (J)
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--		320		
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1			**0.379**	
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50			**229**	

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-MW08 (0-1 feet) 4/6/2001 (RI)	CWM-186-MW09 (0-1 feet) 4/4/2001 (RI)	CWM-186-MW10 (0-1 feet) 4/4/2001 (RI)	CWM-186-MW11 (0-1 feet) 4/4/2001 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04	62 (J)	50	15 J (J)	350 J (J)
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	620 J (J)	1400	180	**3800**
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				7.9 (J)
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				5 J (J)
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	68			
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50	1.2 J (J)	1.1 J (J)		
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-MW12 (0-2 feet) 4/4/2001 (RI)	CWM-186-MW13 (0-1 feet) 4/4/2001 (RI)	CWM-186-MW25 (0-1 feet) 4/6/2001 (RI)	CWM-186-MW26 (0-1 feet) 4/6/2001 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04		28	20 J (J)	
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	6 J (J)	250	380 (J)	150 (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000	1.2 J (J)	1.7 J (J)	1.3 J (J)	1.2 J (J)
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--		3.7 J (J)	1.2 J (J)	
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50			2.2 J (J)	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100			3.1 J (J)	3.3 J (J)
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--	470 P (J)			
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-MW29 (0-1 feet) 4/6/2001 (RI)	CWM-186-MW31 (0-2 feet) 1/29/2002 (RI)	CWM-186-MW32 (0-1 feet) 1/29/2002 (RI)	CWM-186-MW39 (0-1 feet) 11/26/2002 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	420 (J)	78 (J)	180 (J)	450 E (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10	1.7 J (J)			
Toluene	1.55E+06	1.24E+08	1.96E+07	50	1.4 J (J)		2.5 J (J)	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-MW40 (0-1 feet) 11/22/2002 (RI)	CWM-186-MW41 (0-1 feet) 10/21/2002 (RI)	CWM-186-MW42 (0-1 feet) 10/22/2002 (RI)	CWM-186-MW45 (0-1 feet) 10/16/2002 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100	3.7 J (J)			
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04		32	15 J (J)	
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	390 (J)	300 J (J)	240 (J)	230 (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	1.4 J (J)			
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50	3 J (J)			
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100			2.6 J (J)	
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6		**3**		
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81				
Zinc	2340	1.88E+05	3.06E+04	50				

Table 5-15: Surface and Depositional Soil Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Grounds-keeper SSSL	ESV	CWM-186-MW46 (0-1 feet) 11/21/2002 (RI)	CWM-186-MW47 (0-1 feet) 11/11/2002 (RI)	CWM-186-MW48 (0-1 feet) 11/18/2002 (RI)	CWM-186-MW55 (0-2 feet) 2/28/2003 (RI)
VOCs (µg/kg)								
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04	19 J (J)			
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	320 (J)	29 (J)	280 (J)	19 J (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Ethylbenzene	7.77E+05	6.18E+07	1.01E+07	50				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	2.3 J (J)			
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				1.6 J (J)
Explosives (µg/kg)								
2,4-Dinitrotoluene	927	6.37E+04	4190	1280				
3-Nitrotoluene	7.77E+04	6.17E+06	1.02E+06	--				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				
Metals (mg/kg)								
Cadmium	6.25	343	22.7	1.6				
Mercury	2.33	184	28.5	0.1				
Selenium	39.1	3150	511	0.81			**3.41**	
Zinc	2340	1.88E+05	3.06E+04	50				

Notes:

ESV = Ecological Screening Value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
RI = 2001-2003 Remedial Investigation performed by Shaw (2004).
SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)
-- = Information either not available or not applicable

Lab Flag:

J = Laboratory flag: Reported value is an estimated concentration.
E = Laboratory flag: Result is above the maximum calibration range.

Validation Flag:

(J) = Validation flag: Reported value is an estimated concentration.

Value exceeds ESV.

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP01 (11-13 feet) 10/16/2002 (RI)	CWM-186-GP02 (10-12 feet) 11/12/2002 (RI)	CWM-186-GP02 (50-52 feet) 11/11/2002 (RI)	CWM-186-GP03 (10-11.2 feet) 11/13/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100			28	
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	310 (J)	17 J (J)		31 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1			**5.6**	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100	4.1 J (J)			
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP03 (15-17 feet) 11/13/2002 (RI)	CWM-186-GP04 (81-82 feet) 11/8/2002 (RI)	CWM-186-GP06 (10-12 feet) 10/30/2002 (RI)	CWM-186-GP07 (4-5 feet) 11/7/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100		**110**		
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	94 (J)			260 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06			3.1 J (J)	
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	8.4			
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50	2.2 J (J)			
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1		**21**		
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP08 (10-12 feet) 10/29/2002 (RI)	CWM-186-GP09 (4-6 feet) 2/6/2003 (RI)	CWM-186-GP10 (10-12 feet) 11/12/2002 (RI)	CWM-186-GP10 (50-51.6 feet) 11/12/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				25
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100			16	***19000***
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				34
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				6.9
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				16
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500		100 (J)		19 J (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				**160**
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				**3400**
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				4.2 J (J)
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	1.5 J (J)			
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				**170**
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				**1100 J (J)**
Trichloroethene	787	3.70E+06	6780	1				***5700***
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				5.1 J (J)
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP11 (10-12 feet) 11/13/2002 (RI)	CWM-186-GP12 (10-12 feet) 11/11/2002 (RI)	CWM-186-GP14 (6-8 feet) 11/14/2002 (RI)	CWM-186-GP14 (45-46.8 feet) 11/14/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				12
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100			5.5	***30000***
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				60
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				15
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	12 J (J)	19 J (J)	35 (J)	
Benzene	2.17E+04	1.49E+06	9.62E+04	50				1.2 J (J)
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				**130**
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				44
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				**100**
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				15
Trichloroethene	787	3.70E+06	6780	1				***5600***
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP15 (10-12 feet) 11/13/2002 (RI)	CWM-186-GP15 (20-20.6 feet) 11/13/2002 (RI)	CWM-186-GP15 (30-32 feet) 11/14/2002 (RI)	CWM-186-GP15 (65-67 feet) 11/14/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100			41	4 J (J)
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100	4.9 J (J)	***4000***	***120000***	***10000***
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100			63	14
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100			1.8 J (J)	
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400			27	2.5 J (J)
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	68 (J)	110 (J)	60 (J)	79 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50			3 J (J)	
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94			11	
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1		**2.1 J (J)**	**160**	**17**
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100			4.1 J (J)	1.7 J (J)
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10		**18**	**670**	**17**
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1		**56**	***10000***	***1600***
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--	27 J (J)			

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP16 (10-12 feet) 2/27/2003 (RI)	CWM-186-MW06 (10-12 feet) 4/9/2001 (RI)	CWM-186-MW07 (2-4 feet) 4/4/2001 (RI)	CWM-186-MW09 (2-4 feet) 4/4/2001 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04			12 J (J)	
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	17 J (J)		140	45
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1				
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100		1.4 J (J)		
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW10 (2-4 feet) 4/4/2001 (RI)	CWM-186-MW11 (4-6 feet) 4/4/2001 (RI)	CWM-186-MW12 (3-5 feet) 4/4/2001 (RI)	CWM-186-MW13 (4-6 feet) 4/4/2001 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100				
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500		40	27	12 J (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94			2.4 J (J)	
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000	1.5 J (J)	1.5 J (J)	1.6 J (J)	1.1 J (J)
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1				
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW29 (4-5 feet) 4/6/2001 (RI)	CWM-186-MW31 (53-55 feet) 2/19/2002 (RI)	CWM-186-MW31 (84-86 feet) 2/19/2002 (RI)	CWM-186-MW31 (8-9 feet) 1/29/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100		11	**110**	
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	17 J (J)			31 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1		**4.6 J (J)**	**22**	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW32 (11-12 feet) 1/29/2002 (RI)	CWM-186-MW32 (57-59 feet) 2/12/2002 (RI)	CWM-186-MW32 (88-89 feet) 2/13/2002 (RI)	CWM-186-MW39 (10-11.2 feet) 11/26/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100		11	**120**	
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	50			120 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50		2.6 J (J)		
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1			**4.5 J (J)**	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW39 (50-52 feet) 11/26/2002 (RI)	CWM-186-MW40 (10-11.5 feet) 11/22/2002 (RI)	CWM-186-MW40 (55-57 feet) 11/22/2002 (RI)	CWM-186-MW40 (60-80 feet) 2/14/2003 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100			4.6 J (J)	
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100	**880**	4.8 J (J)	***20000***	**580 (J)**
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100			9.6	1.4 J (J)
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				10 J (J)
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	21 J (J)	28 (J)	29 (J)	180 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1			**33**	**2.8 J (J)**
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100			1.7 J (J)	8.5
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10	3.5 J (J)		**56**	9.5
Toluene	1.55E+06	1.24E+08	1.96E+07	50				1.2 J (J)
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				2.4 J (J)
Trichloroethene	787	3.70E+06	6780	1	**100**		***1600***	**230 (J)**
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100	13	1.5 J (J)	7.3	
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW41 (10-11.8 feet) 10/21/2002 (RI)	CWM-186-MW42 (10-12 feet) 10/22/2002 (RI)	CWM-186-MW43 (10-11 feet) 12/4/2002 (RI)	CWM-186-MW46 (10-12 feet) 11/21/2002 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100			**350**	
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100			1.9 J (J)	
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05				
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	16 J (J)	16 J (J)	17 J (J)	31 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100			2.2 J (J)	
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--				
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50				
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1			**2 J (J)**	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW46 (60-61.2 feet) 11/21/2002 (RI)	CWM-186-MW48 (12-13 feet) 11/18/2002 (RI)	CWM-186-MW49 (30-31.4 feet) 11/6/2002 (RI)	CWM-186-MW54 (3-4 feet) 2/10/2003 (RI)
VOCs (µg/kg)								
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100				
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100	3.2 J (J)			21
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100				
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100				
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400				
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04				
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05	4.6 J (J)			
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	41 (J)	150 (J)	23 (J)	11 J (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50				
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94				
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06				
Chloroform	7.77E+04	6.19E+06	3.70E+05	1				
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100				
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000				
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--		2.1 J (J)		
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10				
Toluene	1.55E+06	1.24E+08	1.96E+07	50		1.4 J (J)		
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100				
Trichloroethene	787	3.70E+06	6780	1	**2.5 J (J)**			
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100				11
Vinyl chloride	370	2.28E+04	1897	10				
CWM Breakdown (µg/kg)								
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--				

Table 5-16: Subsurface Soil VOC and CWM Breakdown Product Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Parameter Name	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-MW55 (10-12 feet) 2/28/2003 (RI)
VOCs (µg/kg)					
1,1,1,2-Tetrachloroethane	2.41E+04	1.65E+06	1.07E+05	100	
1,1,2,2-Tetrachloroethane	3.13E+03	2.15E+05	1.39E+04	100	
1,1,2-Trichloroethane	1.11E+04	7.60E+05	4.90E+04	100	
1,1-Dichloroethene	3.89E+05	7.22E+04	5.00E+06	100	
1,2-Dichloroethane	6930	4.76E+05	3.07E+04	400	
2-Butanone (MEK)	4.66E+06	3.70E+08	5.86E+07	8.96E+04	
4-Methyl-2-pentanone (MIBK)	6.21E+05	4.94E+07	7.53E+06	4.43E+05	
Acetone	7.76E+05	6.16E+07	1.02E+07	2500	430 (J)
Benzene	2.17E+04	1.49E+06	9.62E+04	50	
Carbon disulfide	7.77E+05	6.17E+07	1.01E+07	94	
Carbon tetrachloride	4830	3.31E+05	2.17E+04	1.00E+06	
Chloroform	7.77E+04	6.19E+06	3.70E+05	1	
Cis-1,2-Dichloroethene	7.77E+04	6.19E+06	1.02E+06	100	
Methylene chloride	8.41E+04	5.77E+06	3.78E+05	2000	
p-Isopropyltoluene	1.55E+06	1.23E+08	2.03E+07	--	4.1 J (J)
Tetrachloroethene	1.07E+04	8.33E+05	5.43E+04	10	
Toluene	1.55E+06	1.24E+08	1.96E+07	50	2 J (J)
Trans-1,2-Dichloroethene	1.55E+05	1.24E+07	2.03E+06	100	
Trichloroethene	787	3.70E+06	6780	1	
Trichlorofluoromethane	2.33E+06	1.85E+08	2.96E+07	100	
Vinyl chloride	370	2.28E+04	1897	10	
CWM Breakdown (µg/kg)					
Thiodiglycol	3.11E+05	2.47E+07	3.57E+06	--	

Notes:

-- = Information either not available or not applicable

ESV = Ecological Screening Value

RI = 2001-2003 Remedial Investigation performed by Shaw (2004).

SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)

J = Laboratory flag: Reported value is an estimated concentration.

(J) = Validation flag: Reported value is an estimated concentration.

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

Value exceeds the recreational or groundskeeper SSSL.

Value exceeds the residential SSSL.

Value exceeds ESV.

Table 5-17: Subsurface Soil Metal Contaminants Compared to SSSLs and ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Metals (mg/kg)	Residential SSSL	Recreational SSSL	Groundskeeper SSSL	ESV	CWM-186-GP05 (10-11.5 feet) 10/18/2002 (RI)	CWM-186-MW45 (11-13 feet) 10/16/2002 (RI)	CWM-186-MW53 (10-12 feet) 10/29/2002 (RI)
Potassium	--	--	--	--		7410	9400 (J)
Selenium	39.1	3150	511	0.81	**5.15**		

Notes:
ESV = Ecological Screening Value
mg/kg = milligrams per kilogram
SSSL = Site-Specific Screening Level (most restrictive between cancer and non-cancer SSSL is shown)
RI = 2001-2003 Remedial Investigation performed by Shaw (2004).
(J) = Validation flag: Reported value is an estimated concentration.
-- = Information either not available or not applicable

Value exceeds ESV.

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW01 (residuum)	CWM-186-MW02 (residuum)	CWM-186-MW03 (residuum)	CWM-186-MW04 (residuum)	CWM-186-MW07 (residuum)	CWM-186-MW08 (residuum)	CWM-186-MW11 (residuum)
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane							
1,1,2,2-Tetrachloroethane	190	170		190			
1,1,2-Trichloroethane							
1,2-Dichloroethane							
Acetone							410 (J)
Bromodichloromethane							
Carbon tetrachloride		7.7	20				
Chloroform		3.2	2.6				
Cis-1,2-Dichloroethene		17					
Hexachlorobutadiene							
Tetrachloroethene	1.6	9.7	2.3				
Trans-1,2-Dichloroethene							
Trichloroethene	22	100 (J)	180	33		9.6	
Vinyl Chloride							
Metals (mg/L)							
Antimony					0.0601 J (J)		
Chromium						0.0595	
Thallium							

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW26 (residuum)	CWM-186-MW31 (residuum)	CWM-186-MW32 (residuum)	CWM-186-MW39 (residuum)	CWM-186-MW40 (residuum)	CWM-186-MW43 (residuum)	CWM-186-MW44 (residuum)
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane	2.1 (JS)			5.9	8		
1,1,2,2-Tetrachloroethane	20000	770	580	14000	25000	590	800
1,1,2-Trichloroethane	25 (JS)	2.6	4.8	5.8	27	4.6	4.6
1,2-Dichloroethane	0.73 J (JS)				0.68 J		
Acetone							
Bromodichloromethane					1.9		
Carbon tetrachloride		0.46 J (J)		1.2		2.8	67
Chloroform	85 J	2.3		14	300 J	5.3	3.2
Cis-1,2-Dichloroethene	1400				440 J	44	
Hexachlorobutadiene				1.2	0.84 J		
Tetrachloroethene	170 J	16	36	230 J	340 J	4.6	10
Trans-1,2-Dichloroethene	370				120 E (JX)		
Trichloroethene	3300	420 **	510	3300	3700	130 (J)	310 (J)
Vinyl Chloride	12 (JS)				3.4		
Metals (mg/L)							
Antimony							
Chromium							
Thallium							

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW45 (residuum)	CWM-186-MW46 (residuum)	CWM-186-MW47 (residuum)	CWM-186-MW48 (residuum)	CWM-186-MW49 (residuum)	CWM-186-MW50 (residuum)	CWM-186-MW51 (residuum)
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane							
1,1,2,2-Tetrachloroethane	740	6000	240	670	270	170	350
1,1,2-Trichloroethane	3.9	1.8					
1,2-Dichloroethane							
Acetone							
Bromodichloromethane							
Carbon tetrachloride	16	6.8	55		6.3	1.2	2.9
Chloroform	3.3	29	2.8	15	3.3	1.4	2.5
Cis-1,2-Dichloroethene		28					
Hexachlorobutadiene							
Tetrachloroethene	8.1		6.1	8.8	4.4	2.7	1.6
Trans-1,2-Dichloroethene							
Trichloroethene	210	430	100	140	92	160	64
Vinyl Chloride							
Metals (mg/L)							
Antimony							
Chromium							
Thallium							

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW52 (residuum)	CWM-186-MW09 (bedrock)	CWM-186-MW15 (bedrock)	CWM-186-MW18 (bedrock)	CWM-186-MW21 (bedrock)	CWM-186-MW23 (bedrock)	CWM-186-MW24 (bedrock)
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane							
1,1,2,2-Tetrachloroethane	40						
1,1,2-Trichloroethane							
1,2-Dichloroethane							
Acetone			3400				
Bromodichloromethane							
Carbon tetrachloride	31			2.9			
Chloroform	2.3						
Cis-1,2-Dichloroethene							
Hexachlorobutadiene							
Tetrachloroethene							
Trans-1,2-Dichloroethene							
Trichloroethene	9.8	5.7			14	1.1	0.21 J
Vinyl Chloride						0.21 J	
Metals (mg/L)							
Antimony							
Chromium						0.0182	0.00497 J (J)
Thallium							

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW25 (bedrock)	CWM-186-MW29 (bedrock)	CWM-186-MW30 (bedrock)	CWM-186-MW34 (bedrock)	CWM-186-MW35 (bedrock)	CWM-186-MW53 (bedrock)	CWM-186-MW56 (bedrock)
VOCs (µg/L)							
1,1,1,2-Tetrachloroethane						2.4 (JS)	
1,1,2,2-Tetrachloroethane						5900	
1,1,2-Trichloroethane						8.3 (JS)	
1,2-Dichloroethane						2.3 (JS)	
Acetone							
Bromodichloromethane							
Carbon tetrachloride						23 (JS)	
Chloroform						40 (JS)	
Cis-1,2-Dichloroethene						120 J	
Hexachlorobutadiene							
Tetrachloroethene						62 J	
Trans-1,2-Dichloroethene						54 J	
Trichloroethene	0.31 J	3.7			1.6	2300	2.6
Vinyl Chloride				0.33 J			
Metals (mg/L)							
Antimony							
Chromium			0.0199				
Thallium					0.00802 J (J)		

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Groundwater COPCs	CWM-186-MW16 (transition)	CWM-186-MW41 (transition)	CWM-186-MW42 (transition)	CWM-186-MW58 (transition)
VOCs (µg/L)				
1,1,1,2-Tetrachloroethane				
1,1,2,2-Tetrachloroethane		320	900	9.6
1,1,2-Trichloroethane		1.4	7.9	
1,2-Dichloroethane				
Acetone				
Bromodichloromethane				
Carbon tetrachloride				4.2
Chloroform		1.7	4.3	
Cis-1,2-Dichloroethene				
Hexachlorobutadiene				
Tetrachloroethene		2	6.1	
Trans-1,2-Dichloroethene				
Trichloroethene	1	110 (J)	610 **	10
Vinyl Chloride				
Metals (mg/L)				
Antimony	0.0358 J (J)			
Chromium				
Thallium				

Table 7-1: Summary of Constituents of Potential Concern Exceeding SSSLs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Surface Water and Seep COPCs	CWM-186-SEEP01-RI	CWM-186-SEEP01-RFI	CWM-186-SEEP03-RI	CWM-186-SEEP03-RFI	CWM-186-SW/SD06
VOCs (µg/L)					
1,1,2,2-Tetrachloroethane			150	66	
Trichloroethene	51	130	9.5	13 (JM)	1.5 J (J)
Metals (mg/L)					
Chromium					0.0908
Thallium	0.00586 J (J)				

Subsurface Soil COPCs	CWM-186-GP10 (50-51.6 feet)	CWM-186-GP14 (45-46.8 feet)	CWM-186-GP15 (20-20.6 feet)	CWM-186-GP15 (30-32 feet)	CWM-186-GP15 (65-67 feet)	CWM-186-MW40 (55-57 feet)
VOCs (µg/kg)						
1,1,2,2-Tetrachloroethane	19000	30000	4000	120000	10000	20000
Trichloroethene	5700	5600		10000	1600	1600

Notes:
COPC = Constituent of potential concern
SSSL = Site-Specific Screening Level
VOC = Volatile organic compound
RI = 2001 to 2003 Remedial Investigation performed by Shaw (2004).
RFI = 2005 RCRA Facility Investigation.
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
mg/L = milligrams per liter

** Result was not reported by Shaw; for purposes of determining nature and extent, the result from the diluted analysis from the "Validation Qualifier Data Entry Verification" table (Shaw, 2004) is shown (see Section 5.5.1 of RFI for further details).

Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.
(JM) = The MS and MSD recoveries were outside laboratory historical control limits.
(JS) = Surrogate recovery was outside laboratory historical control limits.

Table 7-2: Comparison of EPCs to Cancer and Non-Cancer SSSLs for Constituents of Potential Concern in Groundwater
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

				Residential SSSL				Groundskeeper SSSL			
COPC	MDC	95% UCL	EPC	cancer	EPC > SSSL	non-cancer	EPC > SSSL	cancer	EPC > SSSL	non-cancer	EPC > SSSL
VOCs (µg/L)											
1,1,1,2-Tetrachloroethane	8	1.54	1.54	1.57	No	45.6	No	10.2	No	283	No
1,1,2,2-Tetrachloroethane	25000	2748	2748	0.204	Yes	92.1	Yes	1.36	Yes	582	Yes
1,1,2-Trichloroethane	27	6.4	6.4	0.715	Yes	6.18	Yes	4.85	Yes	39.5	No
1,2-Dichloroethane	2.3	0.60	0.60	0.448	Yes	4.88	No	3.08	No	300	No
Acetone	3400	462	462	--	--	156	Yes	--	--	1020	No
Bromodichloromethane	1.9	0.57	0.57	1.08	No	31	No	4.5	No	199	No
Carbon Tetrachloride	67	15.5	15.5	0.408	Yes	1.05	Yes	1.98	Yes	6.43	Yes
Chloroform	300	45.1	45.1	1.16*	Yes	15.4*	Yes	45.3*	No	98.6	No
Cis-1,2-Dichloroethene	1400	204	204	--	--	15.5	Yes	--	--	99.1	Yes
Hexachlorobutadiene	1.2	0.54	0.54	0.84	No	0.307	Yes	3.48	No	1.94	No
Tetrachloroethene	340	66.7	66.7	1.02*	Yes	14.6*	Yes	4.6*	Yes	85.4	No
Trans-1,2-Dichloroethene	370	55.4	55.4	--	--	30.7	Yes	--	--	195	No
Trichloroethene	3700	1410	1410	0.102*	Yes	0.459*	Yes	0.498*	Yes	57.2	Yes
Vinyl Chloride	12	1.7	1.7	0.0441*	Yes	4.64*	No	0.185*	Yes	--	--
Metals (mg/L)											
Antimony	0.0601	0.053	0.053	--	--	0.000626	Yes	--	--	0.00393	Yes
Chromium	0.0595	0.0164	0.0164	--	--	2.35	No	--	--	14.2	No
Thallium	0.00802	0.0055	0.0055	--	--	0.000102	Yes	--	--	0.000662	Yes

Notes:
% = percent
> = greater than
µg/L = micrograms per liter
mg/L = milligrams per liter
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
MDC = Maximum Detected Concentration
SSSL = Site-Specific Screening Level
UCL = Upper confidence limit
VOC = Volatile organic compound
* SSSL shown was updated from the IT developed SSSL (IT, 2000) due to revisions in toxicity values.
-- = Not applicable

Table 7-3: Comparison of EPCs to Cancer and Non-Cancer SSSLs for Constituents of Potential Concern in Surface Water and Seeps
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

				Recreational SSSL			
COPC	MDC	95% UCL	EPC	cancer	EPC > SSSL	non-cancer	EPC > SSSL
VOCs (µg/L)							
1,1,2,2-Tetrachloroethane	150	120	120	5.01	Yes	859	No
Trichloroethene	130	103	103	1.49*	Yes	4.2*	Yes
Metals (mg/L)							
Chromium	0.0908	0.0827	0.0827	--	--	20.4	No
Thallium	0.00586	0.0053	0.0053	--	--	0.00102	Yes

Notes:
% = percent
> = greater than
µg/L = micrograms per liter
mg/L = milligrams per liter
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
MDC = Maximum Detected Concentration
SSSL = Site-Specific Screening Level
UCL = Upper confidence limit
VOC = Volatile organic compound
* SSSL shown was updated from the IT developed SSSL (IT, 2000) due to revisions in toxicity values.
-- = Not applicable

Table 7-4: Comparison of EPCs to Cancer and Non-Cancer SSSLs for Constituents of Potential Concern in Subsurface Soil
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

				Residential SSSL				Recreational SSSL				Groundskeeper SSSL			
COPC	MDC	95% UCL	EPC	cancer	EPC > SSSL	non-cancer	EPC > SSSL	cancer	EPC > SSSL	non-cancer	EPC > SSSL	cancer	EPC > SSSL	non-cancer	EPC > SSSL
VOCs (µg/kg)															
1,1,2,2-Tetrachloroethane	120000	22048	22048	3130	Yes	4.65E+05	No	2.15E+05	No	3.68E+07	No	13900	Yes	6.09E+06	No
Trichloroethene	10000	2299	2299	787	Yes	2332	No	3930000	No	3700000	No	6780	No	30484	No

Notes:
% = percent
> = greater than
µg/kg = micrograms per kilogram
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
MDC = Maximum Detected Concentration
SSSL = Site-Specific Screening Level
UCL = Upper confidence limit

Table 7-5: Cancer Risk and Non-Cancer Hazard Measurements for Receptors Exposed to Groundwater
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

COPC	EPC	Resident		Groundskeeper	
		cancer ILCR	noncancer HI	cancer ILCR	noncancer HI
VOCs (µg/L)					
1,1,1,2-Tetrachloroethane	1.54	--	--	--	--
1,1,2,2-Tetrachloroethane	2748	1.35E-02	2.98	2.02E-03	0.472
1,1,2-Trichloroethane	6.4	8.95E-06	0.104	1.32E-06	--
1,2-Dichloroethane	0.60	1.34E-06	--	--	--
Acetone	462	--	0.296	--	--
Bromodichloromethane	0.57	--	--	--	--
Carbon Tetrachloride	15.5	3.80E-05	1.48	7.83E-06	0.241
Chloroform	45.1	3.89E-05	0.293	--	--
Cis-1,2-Dichloroethene	204	--	1.32	--	0.206
Hexachlorobutadiene	0.54	--	0.176	--	--
Tetrachloroethene	66.7	6.54E-05	0.457	1.45E-05	--
Trans-1,2-Dichloroethene	55.4	--	0.180	--	--
Trichloroethene	1410	1.38E-02	307.2	2.83E-03	2.47
Vinyl Chloride	1.7	3.85E-05	--	9.19E-06	--
Metals (mg/L)					
Antimony	0.053	--	8.47	--	1.35
Thallium	0.0055	--	5.39	--	0.831
Total ILCR / HI		**2.75E-02**	**328**	**4.88E-03**	**5.6**

Notes:
µg/L = micrograms per liter
mg/L = milligrams per liter
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent upper confidence limit or maximum detected concentration)
HI = Hazard index
ILCR = Incremental lifetime cancer risk
VOC = Volatile organic compound
-- = Not applicable

Table 7-6: Cancer Risk and Non-Cancer Hazard Measurements for Receptor Exposed to Surface Water and Seeps
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

COPC	EPC	Recreational	
		cancer ILCR	noncancer HI
VOCs (µg/L)			
1,1,2,2-Tetrachloroethane	120	2.40E-05	--
Trichloroethene	103	6.91E-05	2.452
Metals (mg/L)			
Chromium	0.0827	--	--
Thallium	0.0053	--	0.520
Total ILCR / HI		**9.31E-05**	**2.97**

Notes:
µg/L = micrograms per liter
mg/L = milligrams per liter
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent upper confidence limit or maximum detected concentration)
HI = Hazard index
ILCR = Incremental lifetime cancer risk
VOC = Volatile organic compound
-- = Not applicable

Table 7-7: Cancer Risk and Non-Cancer Hazard Measurements for Receptors Exposed to Subsurface Soil
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

		Resident		Recreational		Groundskeeper	
COPC	**EPC**	**cancer ILCR**	**noncancer HI**	**cancer ILCR**	**noncancer HI**	**cancer ILCR**	**noncancer HI**
VOCs (µg/kg)							
1,1,2,2-Tetrachloroethane	22048	7.04E-06	--	--	--	1.59E-06	--
Trichloroethene	2299	2.92E-06	--	--	--	--	--
Total ILCR / HI		**9.97E-06**	**--**	**--**	**--**	**1.59E-06**	**--**

Notes:
µg/kg = micrograms per kilogram
COPC = Constituent of potential concern
EPC = Exposure point concentration (the lesser value of the 95 percent upper confidence limit or maximum detected concentration)
HI = Hazard index
ILCR = Incremental lifetime cancer risk
VOC = Volatile organic compound
-- = Not applicable

Table 7-8: Separation of Non-Cancer Hazard by Target Organ for Receptors Exposed to Groundwater
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

	Resident Target Organ Hazard								Groundskeeper Target Organ Hazard							
COPC	**Liver**	**Kidney**	**Heart**	**Erythrocyte**	**CNS**	**Skin**	**Immune System**	**Nasal Epithelium**	**Liver**	**Kidney**	**Heart**	**Erythrocyte**	**CNS**	**Skin**	**Immune System**	**Nasal Epithelium**
1,1,2,2-Tetrachloroethane	2.98	--	--	--	--	--	--	--	0.472	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	0.104	--	--	--	--	--	--	--	--	--
Acetone	0.296	0.296	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	1.48	--	--	--	--	--	--	--	0.241	--	--	--	--	--	--	--
Chloroform	0.293	0.293	--	--	--	--	--	0.293	--	--	--	--	--	--	--	--
Cis-1,2-Dichloroethene	--	--	--	1.32	--	--	--	--	--	--	--	0.206	--	--	--	--
Tetrachloroethene	0.457	0.457	--	--	0.457	--	--	--	--	--	--	--	--	--	--	--
Trans-1,2-Dichloroethene	0.180	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	307.2	307.2	--	--	--	--	--	--	2.47	2.47	--	--	--	--	--	--
Antimony	--	--	8.47	--	--	--	--	--	--	--	1.35	--	--	--	--	--
Thallium	5.39	--	--	--	5.39	5.39	--	--	0.831	--	--	--	0.831	0.831	--	--
Total HI	**318**	**308**	**8.47**	**1.32**	**5.85**	**5.39**	**0.104**	**0.293**	**4.01**	**2.47**	**1.35**	**0.206**	**0.831**	**0.831**	**--**	**--**

Notes:
COPC = Constituent of potential concern
CNS = central nervous system
HI = Hazard index
-- = Not applicable

Table 7-9: Separation of Non-Cancer Hazard by Target Organ for the Recreational User Exposed to Surface Water
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

COPC	Recreational Target Organ Hazard			
	Liver	**Kidney**	**CNS**	**Skin**
Trichloroethene	2.45	2.45	--	--
Thallium	0.52	--	0.52	0.52
Total HI	**2.97**	**2.45**	**0.52**	**0.52**

Notes:
COPC = Constituent of potential concern
CNS = central nervous system
HI = Hazard index
-- = Not applicable

Table 7-10: Summary of Constituents of Concern
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

COCs	Cancer Risk	Non-Cancer Hazard
Groundwater		
1,1,2,2-Tetrachloroethane	X	X
1,1,2-Trichloroethane	X	
Carbon Tetrachloride	X	X
Cis-1,2-Dichloroethene		X
Tetrachloroethene	X	
Trichloroethene	X	X
Vinyl Chloride	X	
Antimony		X
Thallium		X
Surface Water and Seeps		
1,1,2,2-Tetrachloroethane	X	
Trichloroethene	X	X
Thallium		X
Subsurface Soil		
1,1,2,2-Tetrachloroethane	X	

Notes:
COC = Constituent of concern

Table 8-1: Summary of Constituents of Potential Concern Exceeding ESVs
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

Surface Water and Seep COPCs	CWM-186-SEEP01-RI	CWM-186-SEEP03-RI	CWM-186-SW/SD06
Metals (mg/L)			
Beryllium		0.00216	
Chromium			0.0908
Thallium	0.00586 J (J)		

Surface Soil COPCs	CWM-186-GP16 (0-2 feet)	CWM-186-MW11 (0-1 feet)	CWM-186-MW41 (0-1 feet)	CWM-186-MW47 (0-1 feet)	CWM-186-MW48 (0-1 feet)
VOCs (µg/kg)					
Acetone		3800			
Metals (mg/kg)					
Cadmium			3		
Mercury	0.379				
Selenium					3.41
Zinc	229				

Notes:
COPC = Constituent of potential concern
ESV = Ecological Screening Value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
VOC = Volatile organic compound
RI = 2001 to 2003 Remedial Investigation performed by Shaw (2004).

Lab Flag:
J = Reported value is an estimated concentration.
Validation Flag:
(J) = Reported value is an estimated concentration.

Table 8-2: Constituents of Ecological Concern
Training Area T-38, Parcel 186(6)
McClellan, Anniston, Alabama

COPCs	MDC	95% UCL	EPC	ESV	HQ	COC (HQ>1)
Surface Water and Seeps						
Metals (mg/L)						
Beryllium	0.00216	0.0016	0.0016	0.00053	3.0	Yes
Chromium	0.0908	0.0827	0.0827	0.011	7.5	Yes
Thallium	0.00586	0.0053	0.0053	0.004	1.3	Yes
Surface Soil						
VOCs (µg/kg)						
Acetone	3800	551	551	2500	0.2	No
Metals (mg/kg)						
Cadmium	3	0.69	0.69	1.6	0.43	No
Mercury	0.379	0.124	0.124	0.1	1.2	Yes
Selenium	3.41	1.0	1.0	0.81	1.2	Yes
Zinc	229	46.7	46.7	50	0.9	No
Subsurface Soil						
VOCs (µg/kg)						
1,1,2,2-Tetrachloroethane	120000	22048	22048	100	220	Yes
Chloroform	160	26.9	26.9	1	27	Yes
Cis-1,2-Dichloroethene	3400	279	279	100	2.8	Yes
Tetrachloroethene	670	83.7	83.7	10	8.4	Yes
Trans-1,2-Dichloroethene	1100	92.1	92.1	100	0.9	No
Trichloroethene	10000	2299	2299	1	2299	Yes
Metals (mg/kg)						
Selenium	5.15	2.29	2.29	0.81	2.8	Yes

Notes:
% = percent
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
COPC = Constituent of potential concern
EPC = Exposure point concentration
ESV = Ecological Screening Value
HQ = Hazard quotient
MDC = Maximum Detected Concentration
UCL = Upper confidence limit
VOCs = Volatile organic compounds