Final
Resource Conservation Recovery Act Facility Investigation
Small Weapons Repair Shop, Parcel 66(7)
McClellan
Anniston, Alabama

Prepared for:

Anniston Calhoun County Fort McClellan Development Joint Powers Authority,
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°F	Degrees Fahrenheit
ADEM	Alabama Department of Environmental Management
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
CDTF	Chemical Defense Training Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFDP	Center for Domestic Preparedness
COEC	Constituent of ecological concern
COPC	Constituent of potential concern
COPEC	Constituents of potential ecological concern
COC	Constituent of concern
DO	Dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DQS	Data Quality Summary
DRMO	Defense Reutilization and Marketing Office
EBS	Environmental Baseline Study
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
FFS	Focused Feasibility Study
FOSET	Finding of Suitability for Early Transfer
FOST	Finding of Suitability for Transfer
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
µg/kg	micrograms per kilogram

µg/L	micrograms per liter
mg/kg	milligrams per kilogram
ml	milliliters
msl	mean sea level
NFA	No Further Action
NOAEL	no-observed-adverse-effect-levels
ORP	Oxidation-reduction potential
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
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
SI	Site investigation
SINA	Special interest natural areas
SLERA	Screening-level ecological risk assessment
SRA	Streamlined human health risk assessment
SSSL	Site-Specific Screening Level
SVOC	Semivolatile Organic Compound
TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TRADOC	Training and Doctrine Command
USFWS	U.S. Fish and Wildlife Service
UCL	Upper confidence limit
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
WRS	Wilcoxon Rank Sum

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) between the JPA and the Alabama Department of Environmental Management (ADEM).

The Small Weapons Repair Shop Parcel 66(7) is currently a vacant parcel that was formerly used by the Army for weapons repair and maintenance. Parcel 66(7) was originally investigated as part of a site investigation (SI) and remedial investigation (RI) performed on behalf of the Army by IT Corporation (IT). During these investigations, chlorinated volatile organic compounds (VOCs) were detected in groundwater at concentrations exceeding human health site-specific screening levels. ADEM's comments to the RI and a Focused Feasibility Study (FFS) prepared for Parcel 66(7) by IT indicated that additional characterization was required. This Recovery Act (RCRA) Facility Investigation (RFI) Report presents descriptions of the environmental investigation conducted between March and May 2004 by Matrix Environmental Services, LLC (MES) on behalf of the JPA, as well as summaries of environmental investigations performed prior to March 2004.

The 2004 RFI activities consisted of: the installation of eight monitoring wells; groundwater level measurements; the sampling, analysis, and data quality review of 18 groundwater samples, 7 surface soil samples, and 11 subsurface soil samples; evaluation of nature and extent of contamination; evaluation of fate and transport; and human health and ecological risk assessments.

Groundwater in the residuum zone appears to flow radially away from a groundwater elevation high located beneath Building 335. An apparent groundwater divide with an east-west trending axis is centered under Parcel 66(7). Groundwater in the bedrock zone on the northern end of Parcel 66(7) flows to the north and groundwater in the bedrock zone on the southern portion of Parcel 66(7) flows to the west. The relatively shallow occurrence of groundwater and the localized groundwater mound appears to be due to the lack of a roof on the Small Weapons Repair Shop building and a concrete floor that is not as impermeable as the surrounding paved areas. This groundwater mound also increases the magnitude of both horizontal and vertical gradients in the immediate area. The higher horizontal gradients occur close to the center of the mounded area and generally decrease as the distance from the groundwater mound increases. Vertical gradients are generally downward in this area. In nearly all cases the horizontal gradient is slightly greater or nearly the same as the vertical gradient indicating that groundwater movement is approximately either slightly more strongly horizontal or nearly equal in the vertical and horizontal directions.

Groundwater and soil samples collected during the 2004 RFI were analyzed for volatiles and metals. Several metals and VOCs were detected in one or more of the surface and subsurface soil samples, and one or more of the groundwater samples. To evaluate the nature and extent of contamination at the site, the VOC and metal results were assessed to identify the constituents of potential concern (COPCs). To evaluate which VOCs and metals were constituents of concern (COCs) for the site, the VOC and metal COPCs were compared to site-specific screening levels (SSSLs) and ecological screening values (ESVs). Barium and vinyl chloride exceeded the human health SSSLs in surface soil. Cobalt, nickel, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene (TCE), and vinyl chloride exceeded the human health SSSLs in groundwater collected from residuum wells. 1,1-Dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, TCE, and vinyl chloride exceeded the human health SSSLs in groundwater collected from transition wells. Acetone and vinyl chloride exceeded the human health SSSLs in groundwater collected from bedrock wells. Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride exceeded the ESVs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, TCE, and vinyl chloride exceeded the ESVs in subsurface soil.

The highest concentration of total VOCs in the residuum and transition groundwater zones are near the southern and western walls of Building 335, near the sanitary sewer system where it was suspected that TCE was disposed during routine operations. In the bedrock groundwater zone, the highest total VOC concentration was at sample well PPMP-66-MW10, located off-site and north of Parcel 66(7). The highest total VOC concentration was attributed to the anomalous acetone detection and is not considered site-related. The total VOC concentrations in the bedrock wells on-site, in the vicinity of Building 335 were either low (5 µg/L or less) or non-detect. Total metals concentrations in the residuum and transition groundwater bearing zones groundwater are highest in the western portion of Parcel 66(7).

Important conclusions regarding nature and extent are as follows:

- Groundwater gradients are relatively low at most locations and moderate gradients are localized and limited to the area immediately surrounding Building 335. Observed gradients are also consistent with results from previous investigations.
- Shallow soil VOC contamination exceeding both SSSL and ESV values is comprised of chlorinated solvents and is limited to one sample location.
- Shallow soil metals contamination includes barium in excess of SSSL and barium and selenium in excess of ESV.
- No subsurface soil VOC contamination exceeded SSSL values.
- Subsurface soil VOC contamination exceeding ESV is limited to three chlorinated solvent compounds.
- Subsurface soil metals contamination is limited to two metals exceeding ESVs at one location each.
- No subsurface soil metals exceeded SSSL values.
- Bedrock groundwater VOC contamination exceeding SSSLs is limited to vinyl chloride in a single well in the immediate vicinity of Building 335.
- Transition zone groundwater VOC contamination exceeding SSSLs is limited to 2 wells in the immediate vicinity of Building 335.
- Residuum groundwater VOC contamination exceeding SSSLs is limited to 3 locations in the

immediate vicinity of Building 335.

- Groundwater contamination downgradient of Parcel 66(7) is limited to acetone in bedrock groundwater. The concentration detected exceeds the SSSL but is not clearly associated with Parcel 66(7).
- Groundwater metals contamination exceeding SSSLs are limited to cobalt and nickel at a single location in the residuum.
- No groundwater metals contamination exceeded SSSL values in either transition zone or bedrock groundwater.

The contaminants observed in groundwater and soils at Parcel 66 have not migrated a great distance from the suspected location of release. In the case of metals this is consistent with the natural behavior of metals in a natural environment. With respect to groundwater this conclusion is consistent with the evaluation of groundwater contaminant travel velocities developed by the Army (IT, 2002). The calculated VOC contaminant velocities for residuum groundwater reported by the Army ranged from 0.25 to 0.56 feet per year with the maximum value attributed to vinyl chloride (IT, 2002). These low values are the result of relatively low gradients and low hydraulic conductivity values obtained by the Army (IT, 2002) combined with the natural tendency for the movement of organic compounds to be retarded by the soil matrix.

Given the consistent and corroborative nature of the data collected during this RFI and previous investigations, and the limited number and defined extent of COCs, this RFI has been successful in defining both the nature and extent of environmental contamination at Parcel 66(7).

Based on the evaluation of the soil and groundwater data, the most likely fate and transport pathway is the leaching of contaminants within subsurface soils and movement to the residuum aquifer system. The highest concentrations of metals in surface soil and subsurface soil samples were on the north side and south side of Building 335. Generally, metal concentrations in the soil samples increased slightly (or were similar) with depth. The metal constituents in the surface and subsurface soil samples were primarily aluminum, calcium, iron, magnesium, and potassium, which are common elements in soils. Metals in soil may migrate vertically due to the acidic nature of the rainwater in the area, which would increase the solubility of metals. However, because the site is covered by asphalt the potential for vertical migration of the metal contaminants by infiltration of surface precipitation is significantly reduced. The highest concentrations of VOCs detected in the surface soil and subsurface soil were on the southwest corner of Building 335. The highest concentrations of VOCs in groundwater were located on the south side of Building 335. The VOCs detected in the groundwater samples at Parcel 66(7) were primarily chlorinated hydrocarbons. Because chlorinated hydrocarbons tend to be moderately soluble in water, the most likely fate and transport process for organic constituents detected at Parcel 66(7) is aqueous solubility. Review of the VOC analytical data would indicate that infiltration from surface soil to subsurface soil to groundwater is a potential route of contaminant migration for VOCs in soils at Parcel 66(7). However, because the site is covered by asphalt the potential for vertical migration of the contaminants by infiltration is significantly reduced. In addition, the low hydraulic conductivity of subsurface soils, relatively low hydraulic gradient and the degree of VOC adsorption to soils combine to create very low migration rates for contaminants at Parcel 66(7).

A human health risk assessment was performed to evaluate the potential threat to human health from exposure to environmental media at Parcel 66(7). Three receptor scenarios were evaluated based on future land use: resident, construction worker, and groundskeeper. The human health risk assessment at Parcel 66(7) consisted of identifying the constituents of concern (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. EPCs (representing the chemical concentrations in environmental media that may come in contact with a receptor) were selected based on the 95 percent upper confidence level or the maximum detected concentration. The EPC for each COC was compared to the cancer and non-cancer site-specific screening levels (SSSLs) for each receptor. The EPCs were used to calculate the cancer ILCR and non-cancer HI for each COC in each environmental medium. The ILCRs and HIs for the COCs were summed to yield a total ILCR and total HI for a given receptor exposed to a given medium. Total cancer ILCRs that exceeded 1E-04 were considered to be unacceptable. Total HI estimates above 1 raised concern for potential non-cancer effects. Based on the cancer risk, the groundwater at Parcel 66(7) presents an unacceptable risk to the resident and groundskeeper, and an acceptable risk to the construction worker. The groundwater at Parcel 66(7) presents an unacceptable non-cancer hazard to the resident, construction worker, and groundskeeper. The surface soil at Parcel 66(7) presents an acceptable cancer risk to the resident and groundskeeper, and poses a negligible cancer risk to the construction worker. No COCs were considered non-cancer hazards to the resident, construction worker, or groundskeeper exposed to surface soil and subsurface soil.

An ecological risk assessment was conducted to evaluate the potential for ecological risks posed by site-related constituents at Parcel 66(7). The ecological risk assessment for Parcel 66(7) consisted of identifying the COCs, identifying the EPCs for the COCs, calculating the screening-level hazard quotients, identify the constituents of ecological concern (COECs), and assessing the COECs in relation to the environmental setting and habitat(s) in and around Parcel 66(7). Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride were identified as COECs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, TCE, and vinyl chloride were identified as COECs in subsurface soil at Parcel 66(7). The site and the area immediately surrounding the site is entirely paved with asphalt, therefore, ecological habitat at Parcel 66(7) is very limited. Because Parcel 66(7) is completely covered by asphalt there are no surface soil or groundwater exposure pathways for ecological receptors. Because there are no complete exposure pathways for ecological receptors, it is concluded that the COECs in the soil at Parcel 66(7) did not pose a risk to the ecosystem.

Based on the results of this RFI along with previous investigations no further actions with respect to environmental data collection are required to define the nature and extent of contamination at Parcel 66(7).

Groundwater and surface soil 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 oxidation, enhanced in-situ bioremediation and groundwater extraction and treatment.

1.0 INTRODUCTION

Matrix Environmental Services, LLC (MES) has prepared this Final Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) Report to summarize environmental investigations at the Small Weapons Repair Shop, Parcel 66(7) (Parcel 66[7]) within McClellan, Anniston, Alabama (McClellan) formerly known as Fort McClellan. Figure 1-1 shows a site map of McClellan. Figure 1-2 shows a site location map of Parcel 66(7).

This report was written on behalf of the Anniston-Calhoun County Fort McClellan Development Joint Powers Authority (JPA). The JPA has assumed from the U.S. Department of the Army (Army) the responsibility for environmental closure of certain sites at McClellan. 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) 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 Parcel 66(7) and Justification for Environmental Investigation

Parcel 66(7) is currently a vacant parcel that was formerly used by the Army for weapons repair and maintenance. Proposed future land use of this parcel is light industrial and business park as proposed in the Re-Use Plan (November 1997 as amended by EDC Application of March 2000).

During a previously completed remedial investigation (RI) performed on behalf of the Army by IT Corporation (IT) (IT, 2002a), five chlorinated volatile organic compounds (VOCs) were detected in groundwater at concentrations exceeding human health site-specific screening levels: 1,1-dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride. A Focused Feasibility Study (FFS) was prepared for Parcel 66(7) by IT (2002b). ADEM’s comments to the RI (IT, 2002a) and FFS (IT, 2002b) indicated that additional characterization was required. The deed transferring ownership of the early transfer properties from the army to the JPA includes a restriction which prohibits consumptive or other use of groundwater or direct contact with groundwater at Parcel 66(7). The CA between the JPA and ADEM specifies that a RFI will be performed for Parcel 66(7). This RFI presents descriptions of the JPA’s environmental investigation conducted between March and May 2004, as well as summaries of environmental investigations performed prior to March 2004.

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. McClellan is approximately 60 miles northeast of Birmingham, 75 miles northwest of Auburn, 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 due 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. It was then designated as a demobilization center. Between 1919 and 1929, Camp McClellan served as a training area for active army units and other civilian elements. Camp McClellan was re-designated as Fort McClellan in 1929 and continued to serve as a training area.

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 McClellan to Talladega National Forest. This corridor provided 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 then reactivated in 1979 and was closed at the time of base closure in 1999 (Environmental Science & Engineering, Inc. [ESE], 1998). The CDTF offered advanced training in all phases of chemical, biological, and radiological warfare to personnel from all branches of the military.

In 1995, the U.S. Department of Defense announced that Fort McClellan would close by October 1999. The Base Realignment and Closure (BRAC) commission recommended closure of Fort McClellan, except for minimum essential land and facilities for a Reserve Component Enclave and essential facilities needed to provide support for the chemical demilitarization operation at Anniston Army Depot. Subsequently, the U.S. Department of Justice (DOJ) requested a transfer of some facilities and training area to their authority 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 that was 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). Subsequently, 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 an ESCA and the CA that describe the responsibilities of all parties in completing the investigation and remediation of HTRW sites at McClellan.

1.3 Purpose and Objectives

The purpose of this RFI report is to summarize environmental sampling data from previous investigations and to present analytical results for the March to May 2004 field activities. Objectives for the March to May 2004 field activities and this RFI included:

(1) Further define vertical and horizontal extent of groundwater contamination.
(2) Obtain additional information regarding chemical constituents in surface and subsurface soil.
(3) 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 parcel. Section 3.0 presents a summary of previous environmental investigations. Section 4.0 describes the activities conducted during the March to May 2004 investigation and Section 5.0 presents the results of the March to May 2004 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 the summary, conclusions, and recommendations. Section 10.0 provides the references cited in this report.

Additional supporting information is provided in Appendices included with this report, as follows:

Appendix A	Monitoring Well Installation Documentation Forms for 2004 RFI Wells
	A1: Boring Logs for 2004 RFI Wells
	A2: Well Completion Data for 2004 RFI Wells
	A3: Well Development Forms for 2004 RFI Wells
Appendix B	Field Documentation Forms
	B1: Monitoring Well Sample Collection Forms
	B2: Chain of Custody Forms
Appendix C	Analytical Data for 2004 RFI on CD-ROM
Appendix D	*Data Quality Summary: Small Weapons Repair Shop, Parcel 66(7), Training Area T-6 (Naylor Field), Parcel 183(6) and Cane Creek Training Area, Parcel 510(7)*
Appendix E	Statistical Comparison of Site and Background Data for Metals, Small Weapons Repair Shop, Parcel 66(7)
Appendix F	Historical VOC Analytical Data for Groundwater

2.0 SITE DESCRIPTION AND PHYSICAL SETTING

2.1 Site Description and History of Parcel 66(7)

Parcel 66(7) consists of approximately 1.15 acres and is located in the central portion of McClellan at the intersection of Waverly Road and Fremont Road. Two buildings (Buildings 335 and 336) are located within the Parcel 66(7) boundary. Building 335 formerly housed the Small Weapons Repair Shop where weapons used for training exercises were stored, disassembled, and cleaned using various solvents. It is reported that the main part of Building 335 was used primarily for Tank Repair (IT, 2002a). Virtually all of Parcel 66(7) and the area surrounding the parcel are covered with asphalt or concrete pavement; only a narrow strip along the northern and western boundary is covered with grass. A 6-foot-high chain-link fence surrounds Parcel 66(7) and the adjacent parking lot. Drainage ditches border the site along Waverly Road to the north and Freemont Road to the west.

The Small Weapons Repair Shop was built in 1941 although it is not known when operations began at this location. The operation was moved to the Consolidated Maintenance Facility (Building 350) in approximately 1991. Building 335 was maintained by the Alabama National Guard for boiler plant storage, but it is currently empty and in poor repair (ESE, 1998). Currently, there is no roof on Building 335, and precipitation falls directly onto the concrete floor. There are numerous cracks in the concrete floor and an extensive floor drain system. In the Small Weapons Repair Shop, weapons were disassembled and cleaned using various solutions and solvents. Historically, weapons were brought to the repair shop at Building 335, degreased with 1,1,1-trichloroethane (TCA) in a vapor degreaser, and then stripped with caustic solution, using small vats approximately 14 inches wide by 36 inches long by 20 inches deep. Bluing/parkerizing (described below) operations were also conducted at the shop.

Fluids used during the weapons cleaning process are as follows (ESE, 1998):

- Rinse Tank, Acid Cycle – Contained water for rinsing weapons after treatment in a phosphate-coating compound (parkerizing) tank and discharged to the sanitary sewer.

- Preservative Oil Tank, Acid Cycle – Contained cutting fluid used to treat weapons after treatment with sodium dichromate. The waste oil was turned over to the Defense Reutilization and Marketing Office (DRMO).

- Rinse Tank, Plating Cycle – Contained water used to rinse weapons after treatment in black oxide (bluing) and discharged to the sanitary sewer.

- Preservative Oil, Plating Cycle – Contained cutting fluids used to treat weapons after rinse in the water tank. The waste oil was turned over to the DRMO.

It has also been reported that during weapons refinishing activities, trichloroethene (TCE) was used in the initial step as a degreasing agent for small weapons parts (IT, 2002a). A 110-gallon vat of heated TCE was used for a 10 to 15 minute period to degrease the parts. The vat was drained infrequently (as seldom as once every 3 years). Typically the vat's contents would be pumped into drums for disposal. The vat contained a 1½ -inch steel discharge line located at the bottom of the vat controlled by a gate valve. The potential existed for the contents of the vat to discharge directly to the ground outside Building 335. In addition, during the refinishing process the rinsing cycle involved the continuous overflow of water from a 400-gallon vat directly into the sanitary sewer system (IT, 2002a).

In December 1985, approximately 30 gallons of cutting fluid were released from Building 335 and drained into nearby Cane Creek near Berman Road. The cutting fluid emulsified with the water in the creek and changed the color of the water to milky white for approximately 400 yards downstream of the discharge. A few days after the release there was no evidence of emulsified oils except for a slight sheen on the water. The constituents of the cutting fluid are not listed as hazardous waste under RCRA. The results from subsequent environmental analyses performed to document the spill indicated that this fluid did not exhibit any characteristics based on corrosivity or the extraction procedure toxicity that would qualify it as a hazardous waste. This spill was therefore, classified as an oil spill (IT, 2002a). The Fort McClellan Fire Department responded to the cutting fluid spill. The Directorate of Engineering and Housing, U.S. Environmental Protection Agency (EPA), U.S. Army Training and Doctrine Command (TRADOC), and ADEM were notified of the spill. TRADOC and EPA were satisfied that Fort McClellan had implemented appropriate spill response procedures. ADEM responded a week later with approval. Additional documentation on this spill was not identified (IT, 2002a).

Building 336, an inactive boiler plant, is located just east of Building 335. Building 336 was used to store paints. Open paint cans were observed during the IT site visit in June 1998. However, since then the paint cans have been removed (IT, 2002a). There is no other information available concerning the dates of operation or past activities at Building 336.

2.2 Geology

The geology of McClellan is discussed in the following sections. Information contained in these sections is adapted from previous work performed by IT (IT, 2002a).

2.2.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian. Figure 2-1 shows the geologic map of the area that includes Parcel 66(7).

The majority of Calhoun County, including McClellan, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province) where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted with major structures and faults striking in a northeast-southwest direction. Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock, referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group comprises the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984), but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran Formation is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish-gray siltstone and mudstone. Massive to laminated greenish-gray and black mudstone makes up the Nichols Formation, with thin interbeds of siltstone and very fine-grained sandstone (Osbourne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite, and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone which are locally interbedded with the coarse, clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of McClellan belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish-gray or pale yellowish-gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on Ft McClellan (Osborne and Szabo, 1984). The character of the Shady Dolomite in the McClellan vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of McClellan, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish-red-purple mudstone, shale, siltstone, and greenish-red and light gray sandstone, with locally occurring limestone and dolomite. The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of McClellan (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weathers to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone consists of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped together as undifferentiated at McClellan and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at McClellan and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites and limestones and are mapped as one, undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish-gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomitic mudstone, and glauconitic limestone (Osbourne, et al., 1988). This unit locally occurs in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish-gray to grayish-red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile, brown to black shale with thin intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on McClellan, to the Ordovician Athens Shale on the basis of fossil data.

The Pennsylvania Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty clay shale and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). In Calhoun County, the Parkwood Formation is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovazal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The 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 trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence comprising the Eden thrust sheet is exposed at McClellan through an eroded "window" or "fenster" in the overlying thrust sheet. 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). The McClellan window is framed on the northwest by the Rome Formation, north by the Conasauga Formation, northeast, east, and southwest by the Shady Dolomite, and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the McClellan window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the McClellan window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the McClellan window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. The trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three-quarters of Pelham Range is located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks. It is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). 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 (approximately 5 to 20 miles wide) northeast-to-southwest-trending linear zone of complex structure (approximately 90 miles in length) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

2.2.2 Site-Specific Geology

Parcel 66(7) is located within the eroded geologic “window” in the uppermost structural thrust sheet at McClellan. The geologic unit exposed at this parcel is the Mississippian/Ordovician Floyd and Athens Shale, undifferentiated (Figure 2-1). The Floyd Shale consists of thin-bedded, fissile brown to black shale with thin intercalated limestone layers and interbedded sandstone. Athens Shale is comprised of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989).

Two geologic cross sections were constructed from hollow-stem auger and bedrock coring data collected during the RI at Parcel 66(7) (IT, 2002a). The locations of the geologic cross sections are shown on Figure 2-2, and the cross sections are presented on Figures 2-3 and 2-4. The geologic data collected show that the upper part of the residuum consists of brown to brownish-gray to yellowish-orange silty-clay and clay, with occasional intervals of highly weathered shale. This sequence extends from the ground surface to approximate depths of around 10 to 13 feet below ground surface (bgs). Underlying this interval, and described as the lower portion of the residuum or transition zone, is a variable thickness of highly weathered light gray to black shale that extends to a maximum depth of approximately 30 feet bgs. The base of the residuum is defined where auger refusal was encountered.

Competent bedrock underlying the transition zone consists of moderately hard, slightly weathered, fractured, dark gray to black shale (Figures 2-3 and 2-4). Some of the fractures in the shale were filled with quartz and/or dolomite. The description of the bedrock encountered during rock coring and drilling activities is consistent with the mapped undifferentiated Floyd and Athens Shale.

2.3 Soil

The soil types of McClellan are discussed in the following sections. Information contained in these sections is adapted from previous work performed by IT (2002a).

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 at Parcel 66(7) is the Rarden silty clay loam. This soil type is found on the uplands and is usually developed from the residuum of shale, fine-grained sandstone, or limestone. The surface soil ranges from dark brown to yellowish-brown in color. The subsoil consists of silt clay to clay that ranges from strong brown to yellowish-brown. The runoff and infiltration of this soil are considered medium. The permeability of this soil is slow, the capacity for available moisture and organic matter content are low (USDA, 1961).

2.4 Hydrogeology

The hydrogeology of McClellan is discussed in the following sections. Information contained in these sections is adapted from previous work performed by IT (IT, 2002a).

2.4.1 Regional Hydrogeology

The hydrogeology of Calhoun County has been investigated by the Geologic Survey of Alabama (Moser and DeJarnette, 1992), the U.S. Geological Survey (USGS) in cooperation with the General Services Administration (Warman and Causey, 1962), and ADEM (Planert and Pritchette, 1989). Groundwater in the vicinity of McClellan occurs in residuum derived from bedrock decomposition along fault zones within fractured bedrock and from the development of karst frameworks. Groundwater flow direction is generally toward major surface water features. Figure 2-5 provides the regional potentiometric groundwater map indicating the general direction for groundwater flow near Parcel 66(7). 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 5 miles southwest of Anniston and discharges from the brecciated zone of the Jacksonville Fault (Warman and Causey, 1962).

Shallow groundwater at McClellan occurs principally in the residuum developed from Cambrian sedimentary and carbonate bedrock units of the Weisner Formation, 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 (msl) at McClellan to about 600 feet above msl 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 the Main Post on McClellan northwest toward the city of Weaver. 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.

Shallow groundwater occurs in weathered residuum/transition derived from the bedrock and thin sediment deposits that are very similar to the decomposed rock. The shallow groundwater more closely follows the local topography.

2.4.2 Site-Specific Hydrogeology

Groundwater levels were measured in the monitoring wells at Parcel 66(7) as part of the 2002 RI (IT, 2002a) and 2004 RFI (MES, 2004a). These groundwater levels are discussed in the following sections.

2.4.2.1 2002 RI Groundwater Levels

Static groundwater levels were measured in the permanent residuum and bedrock monitoring wells at Parcel 66(7) and the surrounding area on January 7, and 8, 2002 (IT, 2002a). Regional groundwater flow in the vicinity of Parcel 66(7) is from east to west. IT reported that groundwater flow across the area appeared to be influenced by a topographic high located to the west of the site that has created a local groundwater divide in the vicinity of Parcel 66(7) (Figure 2-5). However, based on the January 2002 groundwater elevations from residuum monitoring wells and on topography, it is possible that infiltration of precipitation through the roof-less Building 335 floor drains and foundation cracks has resulted in the localized mounding of groundwater.

Groundwater elevation maps for Parcel 66(7) were constructed for both the residuum (Figure

2-6) and bedrock (Figure 2-7) water-bearing zones. In the residuum, the axis of a groundwater divide is located just to the west of building 335. Groundwater flow in the northern portion of the site is to the north towards Cave Creek; groundwater flow in the southwestern part of the parcel is to the south towards Cane Creek (Figures 2-5 and 2-6). Based on the January 2002 groundwater elevation data, groundwater flow in the bedrock water-bearing zone is similar to the groundwater flow regime in the residuum water-bearing zone. The position of the divide in the deeper bedrock aquifer, however, has shifted slightly to the east.

The horizontal hydraulic gradients of the residuum and bedrock water-bearing zones are low, indicating a relatively flat water table. An arithmetic mean value of less than 0.01 feet per foot in the residuum and only slightly above 0.01 feet per foot in the bedrock were obtained from the January 2002 data (shown in Table 3-1 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* [IT, 2002a]).

2.4.2.2 2004 RFI Groundwater Levels

Groundwater levels were measured in the residuum, transition, and bedrock monitoring wells at Parcel 66(7) on October 18, 2004. The 2004 RFI groundwater levels are presented and discussed in Section 5.1.

2.4.3 Surface Hydrogeology

The entire central portion of McClellan is drained by 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, 2004b).

Parcel 66(7) is located on a local topographical divide and is mostly overlain by asphalt or concrete; only small areas along the northern and western boundaries are covered by grass. Surface runoff from the site collects in man-made ditches located along the northern and western boundaries of the parcel. Runoff from the northern and eastern portions of the parcel collects in a ditch along the northern boundary and eventually empties into Cave Creek. Runoff from the southern and western portions of the parcel collects in a ditch along the western boundary of the parcel and eventually empties into Cane Creek (IT, 2002a).

2.5 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 at McClellan are generally located in topographical depressions near streams and in valleys along creek floodplains. The indicator plant species that assist in defining a wetland include water oaks, sweet gum, bulrush, needlerush, and cattail. Wetland communities found on McClellan are the Marcheta Hill Orchard Seep, Cane Creek Seep, South Branch of Cane Creek, and 200 acres west of the airstrip that comprise the tributary to Victoria Creek. Parcel 66(7) is not located within a designated wetland area. Nearly all of Parcel 66(7) and areas immediately surrounding Parcel 66(7) are covered with asphalt. The closest designated wetland area is approximately 3,000 feet north of the site, along Cave Creek (IT, 2002a).

2.6 Sensitive Habitats

An Endangered Species Management Plan (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
- Freerick 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.

Parcel 66(7) is not located within a SINA. The closest SINA is approximately 1.6 miles southeast of the site (IT, 2002a).

2.7 Threatened and Endangered Species

Two species of fauna listed by the U.S. Fish and Wildlife Service (USFWS) as endangered or threatened have been recorded on McClellan. They are the gray bat (*Myotis grisescens*), which uses the Cane Creek Corridor as a foraging habitat, and the blue shiner, a medium-sized minnow (*Cyprinella caerulea*), located within the Choccolocco Creek watershed. An additional endangered species, the red-cockaded woodpecker, historically has inhabited McClellan. Because there is no surface water body in the immediate vicinity of Parcel 66(7), the gray bat and blue shiner are not present at the site. The red-cockaded woodpecker has not been observed at McClellan in the recent past (IT, 2002a).

2.8 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 sometimes cause serious local floods. Snow accumulation is generally 1 inch or less. Temperature extremes are 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 to high during the warmer part of the year.

2.9 Floodplains

The Federal Emergency Management Agency has identified “Special Flood Hazard Areas”. The Special Flood Hazard Areas are 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. Parcel 66(7) is not within a recognized floodplain.

3.0 PREVIOUS INVESTIGATIONS

This section describes previous investigations performed at Parcel 66(7) including:

- 1998 Environmental Baseline Study (ESE, 1998)
- 1999 Site Investigation (IT, 2002a)
- 2002 Remedial Investigation (IT, 2002a)

3.1 1998 Environmental Baseline Study

The 1998 Environmental Baseline Study (EBS) was performed by ESE to document existing environmental conditions at McClellan (ESE, 1998). The EBS provided a baseline depiction of McClellan properties by identifying and categorizing the properties into the following 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 U.S. Department of Defense (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.
- Visual site inspections were conducted to verify conditions of specific property parcels.

Parcel 66(7) was identified as a Category 7 CERFA site in the EBS, indicating that the parcel had not been evaluated and/or required additional evaluation to determine its environmental condition. Subsequent investigation of Parcel 66(7) was performed with the completion of the SI and RI (IT, 2002a).

3.2 1999 Site Investigation

Parcel 66(7) was investigated as part of the site investigation (SI) conducted for the Former Ordnance Motor Repair Area, Parcel 75(7). Sampling for the SI at Parcel 66(7) was performed as specified in the Former Ordnance Motor Repair Area SI work plan (IT 1998). Field activities for the SI were started in January 1999 and were completed in March 1999. The 1999 SI was performed by IT and consisted of the following activities (IT, 2002a):

- Installed 3 temporary wells (14 to 19.5 feet bgs) at locations selected by the site geologist.
- Collected 3 surface soil samples from the borings and submitted for analysis of metals, VOCs, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and herbicides.
- Collected 3 subsurface soil samples from the borings and submitted for analysis of metals, VOCs, SVOCs, PCBs, pesticides, and herbicides.
- Collected 3 groundwater samples from the temporary wells and submitted for analysis of metals, VOCs, SVOCs, PCBs, pesticides, and herbicides.

The results of the chemical analysis of samples collected at Parcel 66(7) for the SI indicated that metals, VOCs, SVOCs, and pesticides were detected in the site media. To evaluate the nature and extent of contamination at the site, the analytical results were compared to human health site-specific screening levels (SSSLs), ecological screening values (ESVs), and background screening values for McClellan. The SSSLs and ESVs were developed by IT as part of the human health and ecological risk evaluations associated with site investigations being performed 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 IT 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).

Three surface soil samples were collected for chemical analysis at Parcel 66(7) (as part of the SI at Parcel 75[7]) at well locations PPMP-75-GP01, PPMP-75-GP02, and PPMP-75-GP03. The sample locations are shown in Figure 2-1 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Surface soil samples were collected from the upper one foot of soil. Analytical results for the surface soil samples were compared to SSSLs, ESVs, and metals background screening values, as presented in Table 4-1 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Nineteen metals were detected in the surface soil samples collected at the site. Eleven metals were detected at concentrations exceeding the ESVs; six of these also exceeded their respective background screening values. The integrated statistical and geochemical evaluation of metals concentrations in soils performed by IT (2002a) concluded that the metals that exceeded ESVs in surface soil samples were probably naturally occurring. Twelve PAHs were detected in the surface soil samples. Four PAH compounds were detected at concentrations exceeding SSSLs; three of these also exceeded their respective background screening values. Four PAH compounds were detected at concentrations exceeding ESVs; one of these also exceeded the background screening value. Three pesticides were detected in surface soil samples collected at the site at concentrations above the method detection limit (MDL) but below the reporting limit (RL). One pesticide result (endrin) exceeded the ESV. Six VOCs were detected in surface soil samples collected at Parcel 66(7) at concentrations less than the SSSLs and ESVs. Herbicides and PCBs were not detected in the surface soil samples collected at the site.

Three subsurface soil samples were collected for chemical analysis at Parcel 66(7) at well locations PPMP-75-GP01, PPMP-75-GP02, and PPMP-75-GP03. Subsurface soil samples were collected at depths greater than one foot bgs. Analytical results for the subsurface soil samples were compared to SSSLs and metals background screening values, as presented in Table 4-2 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Twenty metals were detected in the subsurface soil samples collected at the site. Four metals were detected at concentrations exceeding the SSSLs; one of these (aluminum) also exceeded the background screening value. The integrated statistical and geochemical evaluation of metals concentrations in soils performed by IT (2002a) concluded that the metals that exceeded SSSLs in subsurface soil samples were probably naturally occurring. Six VOCs were detected in subsurface soil samples at concentrations less than the SSSLs. Four of these VOCs (acetone, bromomethane, methylene chloride, and 2-butanone) were attributed to laboratory contamination. The two VOCs (cis-1,2-dichloroethene and trans-1,2-dichloroethene) not affected by laboratory contamination were detected in only one subsurface soil sample (PPMP-75-GP01). One SVOC (bis[2-ethylhexyl]phthalate) was detected in one subsurface soil sample (PPMP-75-GP03) below the SSSL. Herbicides, pesticides, and PCBs were not detected in the subsurface soil samples collected at the site.

Three groundwater samples were collected at Parcel 66(7) during the SI (locations PPMP-75-GP01, PPMP-75-GP02, and PPMP-75-GP03) and analyzed for metals, VOCs, SVOCs, pesticides, herbicides, and PCBs. Analytical results for the groundwater samples were compared to SSSLs and metals background screening values, as presented in Table 4-3 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Nine metals were detected in groundwater samples collected for the SI. Two metals (iron and manganese) were detected at concentrations exceeding the SSSLs in two of the samples; one of these (manganese) also exceeded the background screening value in one sample (PPMP-75-GP01). Seven VOCs were detected in one of the groundwater samples collected for the SI (PPMP-75-GP01). Three of these VOCs (1,1-dichloroethene, cis-1,2-dichloroethene, and vinyl chloride) had concentrations exceeding SSSLs. SVOCs, herbicides, pesticides, and PCBs were not detected in the groundwater samples collected for the SI.

The results of the SI were not reported in a stand-alone report, but prompted additional investigation of Parcel 66(7) during the 2002 RI (IT, 2002a) discussed in the following section.

3.3 2002 Remedial Investigation

The RI, performed by IT (2002a), was conducted to evaluate elevated concentrations of constituents in groundwater. During the RI the following activities were performed:

- Installed ten residuum groundwater monitoring wells.
- Installed six bedrock groundwater monitoring wells.
- Logged soil and bedrock core samples to identify the appropriate placement of the monitoring well screen interval and to provide site-specific geologic and hydrogeologic information.
- Abandoned the three temporary monitoring wells installed during the 1999 SI.
- Collected groundwater samples from 16 monitoring wells (10 residuum and 6 bedrock) and submitted samples for analysis of VOCs.
- Performed slug tests at six wells to estimate hydraulic conductivity in the saturated residuum and bedrock at the site.

Sixteen groundwater samples were collected at Parcel 66(7) during the RI and analyzed for VOCs. The sample locations are shown in Figure 2-1 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Analytical results for the groundwater samples were compared to SSSLs, as presented in Table 4-3 of the *Remedial Investigation Report Small Weapons Repair Shop, Parcel 66(7)* (IT, 2002a). Twelve VOCs were detected in one or more of the residuum and bedrock groundwater monitoring wells. Two of these VOCs (chloroform and three of the four methylene chloride results) were attributed to laboratory contamination. Five of these VOCs (1,1-dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, TCE, and vinyl chloride) had concentrations exceeding SSSLs in two residuum groundwater monitoring wells (PPMP-66-MW02 and PPMP-66-MW06).

Conclusions from the RI indicated that vertical extent of VOCs in groundwater was restricted to the lower portion of the residuum consisting of weathered shale and that the horizontal extent of contamination in residuum groundwater was defined. The RI also concluded that VOCs were not present in the deeper competent bedrock.

Results of a streamlined human health risk assessment (SRA) performed for the RI to evaluate the potential risk to human health revealed that the concentrations of chlorinated solvents in groundwater posed an unacceptable risk to human health if the groundwater is developed as a potable water source. The PAHs in soil (collected during the SI) were consistent with anthropogenic background and it was concluded that they did not represent a significant site-related risk to human health.

A screening-level ecological risk assessment (SLERA) was performed to assess the potential risk to ecological receptors from exposure to environmental media at Parcel 66(7). The SLERA concluded that none of the constituents of potential ecological concern (COPEC) presented a threat to terrestrial ecosystems at the site (IT, 2002a).

Based on the results of the RI, further investigation of the groundwater contamination at Parcel 66(7) was recommended. A Focused Feasibility Study (FFS) was prepared for Parcel 66(7) by IT (2002b) based on information collected during the RI. ADEM reviewed the RI (IT, 2002a) and FFS (IT, 2002b) and recommended in their comments that additional characterization of Parcel 66(7) was needed (MES, 2003). The 2004 RCRA facility investigation of Parcel 66(7) was conducted in March to May 2004 to further characterize Parcel 66(7). Section 4.0 presents descriptions of the 2004 RFI.

4.0 2004 RCRA FACILITY INVESTIGATION

This section describes the activities performed for the 2004 RFI. Objectives of the 2004 RFI were to (1) further define vertical and horizontal extent of groundwater contamination and (2) obtain additional information regarding chemical constituents in surface and subsurface soil. To help meet the objectives of the 2004 RFI the following field activities were conducted:

- Installed eight monitoring wells: two in bedrock, two in the residuum, and four in the transition zone.
- Collected groundwater samples from five existing residuum wells and analyzed for VOCs and total and dissolved metals.
- Collected groundwater samples from five of the existing bedrock wells and analyzed for VOCs.
- Collected groundwater samples from two new residuum wells and four new transition wells and analyzed for VOCs and total and dissolved metals.
- Collected groundwater samples from two new bedrock wells and analyzed for VOCs.
- Collected surface soil samples from three direct push soil borings, one residuum well location, one bedrock well location, and two transition well locations, and analyzed for VOCs and metals.
- Collected subsurface soil samples from three direct push soil borings, one residuum well location, one bedrock well location, and three transition well locations, and analyzed for VOCs and metals.

Groundwater and soil samples collected during the 2004 RFI were analyzed for VOCs by Method SW8260B Gas Chromatography/Mass Spectrometry, Metals by Method SW6010B Inductively Coupled Plasma Atomic Emission Spectrometry, and Mercury by Methods SW7470A (waters) and SW7471A (soils) Cold Vapor Atomic Absorption.

Table 4-1 presents the groundwater and soil sample designations and analytical parameters for the 2004 RFI. Figure 4-1 shows the groundwater sample locations for the 2004 RFI. Figure 4-2 shows the soil sample locations for the 2004 RFI.

4.1 Monitoring Well Installation

Monitoring wells were installed within Parcel 66(7) to further evaluate groundwater quality and hydrogeology. Monitoring wells were completed in each of three hydrostratigraphic units at up to four separate locations within Parcel 66(7).

Bhate Environmental Associates, Inc. (Bhate) and Boart Longyear installed eight wells at Parcel 66(7) including two residuum wells, four transition wells, and two bedrock wells. The soil borings for these wells were drilled using a Gus Pech GP24-300RS drilling rig utilizing rotosonic capabilities. Continuous soil samples and bedrock samples were obtained from each soil boring. Drilling methods were consistent with methods presented in the *Installation-Wide Sampling and Analysis Plan* (*SAP*) (MES, 2004b). Well installation followed procedures presented in Appendix C of the *SAP* (MES, 2004b).

During drilling, field screening was performed for the presence of VOCs using a YSI photo ionization detector (PID). With the exception of soil boring PPMP-66-MW23, VOCs were not detected during PID field screening. For PPMP-66-MW23, VOCs were detected to a depth of 18 feet at a maximum concentration of 1.4 parts per million.

Lithologic sampling was performed concurrently when advancing borings for monitoring well construction. Generally, continuous sampling was performed in residuum from ground surface to 12 feet bgs. From 12 feet bgs to the bottom of the borehole, samples were collected at 5-foot intervals. At bedrock well locations where primary and secondary structures were suspected that may influence groundwater and contaminant movement, continuous bedrock sampling was performed.

Monitoring wells were constructed within the drill casing. The drill casing was pulled back as the sand pack was tremied into the borehole annular space. The filter pack consisted of a 20/40 gradational sand. The sand pack was placed from the bottom of the borehole to approximately 2 feet above the screen. A 2- to 5-foot-thick bentonite pellet seal and Type 1 portland cement grout with bentonite was emplaced from the top of the sand to within approximately 2 feet of the ground surface. The wells were finished with flush mount surface completions. Following installation, the wells were surveyed for both horizontal and vertical control the week of August 9, 2004 by SAIN Associates, Inc, an Alabama licensed surveyor.

Table 4-2 presents the well coordinates and elevations, and summarizes the construction details of the 2004 RFI wells installed at the site. Boring logs, well completion data, and well development forms for the 2004 RFI wells are provided in Appendices A1, A2, and A3, respectively. Please note that the prefix for wells SWR-66-MW-17 through SWR-66-MW-24 (as shown on the boring logs) were changed from “SWR” to “PPMP” and are shown as PPMP-66-MW-17 through PPMP-66-MW-24 on the tables, figures, and analytical data in this RFI report.

4.2 Groundwater Sampling

Groundwater samples were collected during one round of sampling conducted in May 2004 from five existing residuum monitoring wells, five existing bedrock monitoring wells, and from the monitoring wells installed during this RFI. The monitoring wells installed during this RFI included two residuum monitoring wells, four transition monitoring wells, and two bedrock monitoring wells. The purpose of the May 2004 groundwater monitoring was to obtain additional data to evaluate nature and extent of contamination and to develop information to support remedial alternatives for Parcel 66(7).

Groundwater samples were collected during May 2004 in accordance with methodology presented in the *SAP* (MES, 2004b). Before groundwater samples were collected, water levels were measured to the nearest hundredth of a foot using a Solinst™ water level indicator and total well depth was measured and recorded.

Groundwater samples were collected using low-flow sampling procedures. Low flow groundwater sampling (LFS) is a technique to 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 level in the well. For Parcel 66(7) groundwater samples, a submersible pump (Grundfos Redi Flo 2 or equivalent) 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 YSI Model 6820 Water Quality Meter (or equivalent). Measurements of chemical and physical parameters were used to indicate when groundwater quality had stabilized and sampling could begin. Chemical and physical parameters included pH, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), turbidity, and temperature. Pumping rate, water level and volume of groundwater removed were also recorded. Typically, pumping rates were less than 100 milliliters (ml) per minute. The monitoring well sample collection logs are provided in Appendix B1.

Groundwater samples were collected from the well pump outlet after it was identified that the chemical and physical parameters had stabilized. Laboratory-supplied sample bottles were filled in the order of decreasing analyte volatility (i.e., VOC bottles were filled first, followed by the next most volatile analytes, etc.). Sample containers were labeled, placed in a chilled cooler and shipped under chain-of-custody procedures to EMAX Laboratories, Torrance, CA. Groundwater samples collected for dissolved metals were filtered in the field to remove sediment. Figure 4-1 shows the groundwater sampling locations. Table 4-1 presents groundwater sample designations and analytical parameters. The chain of custody forms for the groundwater samples collected for the 2004 RFI are provided in Appendix B2.

4.3 Soil Sampling

Surface soil samples (0-1 foot bgs) were collected from seven locations, and eleven subsurface soil samples (greater than 1 foot bgs) were collected from eight soil boring locations. Soil sampling was performed following the methodology presented in the *SAP* (MES, 2004b). Surface soil samples, defined as depths between 0 and 1 foot, were collected using a split-spoon sampler, hand auger, spoon, trowel, or scoop. Soil borings drilled for subsurface soil samples greater than 1-foot depth were advanced using hollow-stem augers or direct-push sampling probes. Soil sampling equipment that came into contact with samples or sampling surfaces was constructed of stainless-steel, borosilicate glass, or Teflon®. A detailed lithologic log was recorded for each borehole constructed by the on-site geologist (Appendix A). Surface and subsurface soil samples were collected at sample location SWR-66-SB02 (shown on Figure 4-2) adjacent to an existing sanitary sewer (manhole) to assess whether chemicals had been disposed at this location. The remaining soil sampling locations were collected as samples of opportunity where evidence of soil contamination existed based on visual observation and VOC screening.

For soil samples collected for VOC analysis, immediately upon opening the sleeve (or other soil sampling device), the contained soil was screened using a Photovac® or YSI® photoionization detector (PID). If the field geologist measured a soil sample interval that displayed elevated readings exceeding background, those readings were recorded on the HTRW Boring Log. The geologist collected the soil VOC sample from this interval using a series of three 5-gram EnCore® sample collection devices. Figure 4-2 shows the locations of the soil samples. Table 4-1 shows the soil sample designations, sample depths, and analytical parameters. The chain of custody forms for the soil samples collected for the 2004 RFI are provided in Appendix B2.

4.4 Management of Investigative Derived Waste

Investigative derived waste (IDW) was managed and disposed as described in the *SAP* (MES, 2004b). The liquid IDW generated during the groundwater sampling was collected in 55-gallon drums at the site. The drums were stored at 1160B Town Center Drive, Building 1698. IDW fluids were transferred to a 5,000 gallon polyethylene tank and sampled for VOCs, PCBs, and metals. Following approval of the City of Anniston Water Department, the IDW fluids were discharged to the sanitary sewer.

The solid IDW was transferred to 20 cubic yard rolloffs and sampled for VOCs, PCBs, and Lead. Following approval from ADEM, the solid IDW were transferred to the Sand Valley Landfill (Subtitle D landfill) located in Collinsville, Alabama, by Allied Waste Industries, Inc.

4.5 Data Quality Review

MES reviewed the analytical data for the groundwater and soil samples collected in May 2004. The data quality review was performed in accordance with the *Quality Assurance Plan (QAP)* (MES, 2004c) 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; these metals were not considered further in the evaluation. Metals with MDCs that exceeded the background screening criterion were then evaluated under Tier 2.

- **Tier 2:** The Tier 2 evaluation included the: (a) the Slippage test, (b) the Wilcoxon Rank Sum (WRS) test, (c) Box Plots, and (d) the Hot Measurement Test, which was performed when the WRS test could not be performed due to a large number (>50 percent) of non-detects. Metals that failed The Tier 2 evaluation were then evaluated under Tier 3.

- **Tier 3:** Tier 3 was the final evaluation to identify site metals with anomalous elevated concentrations. This evaluation is based on natural association between a trace element and one or more specific soil-forming minerals that concentrate the trace element. Trace elements that appeared anomalously high relative to the major associated element were considered to be present due to site related activities.

Metal results that failed all three tiers were considered to be constituents of potential concern (COPCs). Detected VOCs were considered to be COPCs. To evaluate which metals and VOCs were constituents of concern (COCs) for the site, the metal and VOC COPCs were compared to residential SSSLs, construction worker SSSLs, groundskeeper SSSLs, and ESVs (IT, 2000).

5.0 RESULTS OF 2004 RFI AND NATURE AND EXTENT

This section discusses the results of the 2004 RFI at Parcel 66(7) and presents the nature and extent of contamination based on metal and VOC results for soil and groundwater samples collected during the 2004 RFI and 2002 RI. As discussed in Section 2.1 of this RFI and in the IT RI (IT, 2002a) the primary sources of contamination at Parcel 66(7) were probable releases from operations at the Small Weapons Repair Shop located in a portion of Building 335. Weapons were disassembled and cleaned using various solutions and solvents. Historically, weapons were brought to the repair shop, degreased with TCA or TCE and then “stripped” with a caustic solution. Other chlorinated solvents may have been used. Rinse water, possibly with small amounts of TCE, continuously overflowed to the sanitary sewer system during routine operations. In addition, the potential existed for the discharge of TCE directly to the ground outside Building 335 (IT, 2002a).

5.1 Groundwater Levels

Groundwater levels were measured in the residuum, transition, and bedrock monitoring wells at Parcel 66(7) on October 18, 2004 and are presented in Table 5-1. Based on the October 2004 groundwater data, groundwater elevation maps for the residuum wells (Figure 5-1), bedrock wells (Figure 5-2), and transition wells (Figure 5-3) for Parcel 66(7) were constructed.

Groundwater is encountered at this site at unusually shallow depths. In all cases the observed depth to water is less than 10 feet below ground surface and in many locations groundwater is encountered at less than 4 feet below ground surface (Table 5-1). Groundwater in the residuum zone appears to flow radially away from a groundwater elevation high located beneath Building 335 (Figure 5-1). This apparent groundwater mound creates a flow divide with an east-west trending axis centered under Parcel 66(7). Groundwater flow in the bedrock and transition zones is also affected by the groundwater mound and flows to the north in the bedrock zone (Figure 5-2) and in a north-westerly direction in the transition zone (Figure 5-3). These flow directions are expected to be local since the regional groundwater flow direction at McClellan in both residuum and bedrock is northwesterly. Groundwater flow from Parcel 66(7) is expected to revert to regional trends a relatively short distance from Parcel 66(7).

The explanation for the relatively shallow occurrence of groundwater and the localized groundwater mound appears to be the lack of a roof on Building 335. All of Parcel 66(7) is paved and much of the surrounding area is either drainage ditch or paved area. This combination of relatively impermeable surface and surface water conveyance minimizes the amount of rainfall recharge that can reach the groundwater in this area. Rainfall is carried rapidly away from the site either as sheet flow across large paved areas or channel flow in the ditches and storm water system. Building 335 represents approximately 8,000 square feet of area that is not as impermeable as the surrounding paved areas. Although the Building 335 floor is concrete there are numerous cracks and spalled areas in addition to an extensive floor drain system. These conditions combined with the tendency for the Building 335 walls to trap and pond rainfall entering through the largely absent roof creates ideal conditions for increased groundwater recharge. This explanation is further supported by the coincidence of the Building 335 footprint with the observed groundwater mound.

In addition to affecting the horizontal direction of groundwater flow this groundwater mound also increases the magnitude of both horizontal and vertical gradients in the immediate area. Horizontal and vertical groundwater gradients are presented in Tables 5-2 and 5-3 respectively.

Horizontal gradients range from a high of 0.019 ft/ft to a low of 0.008 ft/ft. The higher horizontal gradients occur close to the center of the mounded area and generally decrease as the distance from the groundwater mound increases.

Similarly the vertical gradients are affected by the groundwater mound. Vertical gradients are generally downward in this area which is likely the result of the observed groundwater mound. Also because the monitor wells have been installed in three zones; the shallow residuum, the intermediate depth transition zone and the deeper bedrock zone, vertical gradients can be evaluated in three intervals.

Gradients in the shallow interval between the residuum and the transition zone are variable depending on location with respect to the groundwater mound and the surface drainage features surrounding Parcel 66(7). The highest vertical gradient observed at Parcel 66(7) occurs in this zone in the well pair located nearest the groundwater mound (PPMP-66-MW18 and PPMP-66-MW17). This is a direct result of the recharge that is creating the groundwater mound and reflects the vertical movement of groundwater in this location in response to the excess recharge. One well pair located at the western edge of Parcel 66(7) (PPMP-66-MW16 and PPMP-66-MW22) adjacent to the storm water drainage ditch shows a slightly upward gradient. This is likely the result of the shallow well, PPMP-66-MW16 being influenced by the drainage ditch. The groundwater is relatively near the surface and the ditch is sufficiently deep that groundwater elevations in the shallow zone near the ditch are likely depressed by groundwater discharge to the ditch. Vertical gradients in this zone in areas not overly influenced by surface water features or the groundwater mound tend to be only slightly downward.

One well pair (PPMP-66-MW24 and PPMP-66-MW12) is available to evaluate the vertical gradient between the transition zone and the bedrock zone. This pair indicates a moderate downward gradient of the same magnitude as the gradient in shallow zone at this location.

In the interval between the residuum wells and the bedrock zone wells the vertical gradients range from a high of 0.035 ft/ft downward (well pair PPMP-66-MW04 and PPMP-66-MW10) to 0.004 ft/ft upward (well pair PPMP-66-MW05 and PPMP-66-MW20). Upward gradients are observed at two locations in this zone. One location is the most southerly of the well pairs (PPMP-66-MW03 and PPMP-66-MW09) and although upward the magnitude of the gradient is so small as to be insignificant. The other upward gradient occurs at a well pair just north of Building 335 (PPMP-66-MW05 and PPMP-66-MW20) and is significant in magnitude. This may be the result of preferential flow pathway in the transition zone or unusually poor permeability in the residuum. In any case this condition appears to be localized because comparison between another well pair immediately adjacent (PPMP-66-MW05 and PPMP-66-MW11) indicates a very strong downward gradient.

Comparison of vertical gradient to horizontal gradients provides an overall evaluation of actual groundwater flow direction in the area around Parcel 66(7). In nearly all cases the horizontal gradient is slightly greater or nearly the same as the vertical gradient indicating that groundwater movement is approximately either slightly more strongly horizontal or nearly equal in the vertical and horizontal directions. The exception to this condition is at PPMP-66-MW05 where the downward vertical gradient is stronger than the horizontal gradient by a factor of nearly two. At this location the groundwater will move downward 2 feet for every foot of horizontal movement.

5.2 Analytical Data and Data Quality Review

The analytical data for the 2004 RFI samples are provided in electronic format on a CD-ROM in Appendix C. MES reviewed the analytical data in accordance with the quality assurance plan *QAP* (MES, 2004c). The results of the data quality review for the groundwater and soil samples collected during the 2004 RFI are presented in the *Data Quality Summary* (*DQS*) in Appendix D. Because the sampling and laboratory analysis for Parcel 66(7) occurred simultaneously with Training Area T-6, (Naylor Field) Parcel 183(6) and Cane Creek Training Area, Parcel 510(7), the *DQS* in Appendix D includes the data review for samples collected from Parcels 66(7), 183(6) and 510(7).

Based on the data quality review, the precision and accuracy of the data were acceptable for their intended use. The sampling procedures and locations selected for this investigation represented the overall site conditions and the comparability objective for the project was fulfilled. Of the 7,279 investigative and field duplicate sample results, only 68 results were rejected based on the data review. Therefore, a completeness of 99 percent was calculated for this investigation, which exceeded the project goal of 95 percent. 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 Groundwater Field Parameter Results

Measurements of chemical and physical parameters were used to indicate when groundwater quality had stabilized and sampling could begin. Chemical and physical parameters included pH, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), turbidity, and temperature. The chemical and physical parameters for the groundwater samples are summarized in Table 5-4. No problems were indicated based on the field parameter results.

5.4 Summary of Analytical Results

This section describes the analytical results for metals and VOCs detected in the 2004 RFI samples.

5.4.1 Surface Soil Analytical Results

During the 2004 RFI seven surface soil samples were collected from native soil and base material encountered under the asphalt paving covering most of Parcel 66(7). The surface soil samples were collected at 0 to 1 foot bgs in locations where surface staining was evident or VOCs were detected during field screening procedures. The surface soil samples were analyzed for VOCs and metals and the results of these analyses are discussed in the following subsections.

5.4.1.1 VOCs in Surface Soil

The analytical results for VOCs detected in the 2004 RFI surface soils are presented in Table 5-5. Eleven VOCs were detected in the surface soil samples at Parcel 66(7). The VOC detections were generally limited to sample SWR-66-SB02, including cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride with concentrations of 6,800 micrograms per kilogram (µg/kg), 1,400 µg/kg, and 2,300 µg/kg, respectively. Only acetone and carbon disulfide were detected in sample SWR-66-SB03. Only acetone was detected in the remaining five surface soil samples. Acetone concentrations in surface soil are highest in the sample (SWR-66-SB-20) collected near the north facing wall of Building 335, and in the sample (SWR-66-SB-22) west of Building 335.

5.4.1.2 Metals in Surface Soil

The analytical results for metals detected in the 2004 RFI surface soils are presented in Table 5-6. To aid in visualizing the extent of contamination, the historical surface soil metals results from the 1999 SI (locations PPMP-75-GP01 to PPMP-75-GP03) are also presented in Table 5-6. Twenty-two of the 23 metals were detected in one or more of the surface soil samples. Only cadmium was not detected in any of the surface soil samples.

5.4.2 Subsurface Soil Analytical Results

During the 2004 RFI, eleven subsurface soil samples were collected from Parcel 66(7). The subsurface soil samples were collected at depths ranging from 3 feet bgs to 15 feet bgs at locations where soil staining or field screening results indicated the presence of VOCs. The subsurface soil samples were analyzed for VOCs and metals and the results of these analyses are discussed in the following subsections.

5.4.2.1 VOCs in Subsurface Soil

The analytical results for VOCs detected in the 2004 RFI subsurface soils are presented in Table 5-7. Thirteen VOCs were detected in the subsurface soil samples at Parcel 66(7). The VOCs were principally detected in subsurface soil sample SWR-66-SB02 (6.5 to 7.5 feet bgs), including TCE with a concentration of 14,000 µg/kg. Only one VOC was detected in subsurface soil samples SWR-66-SB-18 (3 to 3.5 feet bgs), PPMP-66-MW23 (13.5 to 14 feet bgs), SWR-66-SB-24 (3 to 3.5 feet bgs and 15 to 15.5 feet bgs). Only two VOCs were detected in subsurface soil samples SWR-66-SB-22 (3 to 3.5 feet bgs and 15 to 15.5 feet bgs). No VOCs were detected in subsurface soil sample SWR-66-SB-20 (3 to 3.5 feet bgs). Three or more VOCs were detected in the remaining three subsurface soil samples, SWR-66-SB01 (6.5 to 7.5 feet bgs) and SWR-66-SB03 (5 to 6 and 8 to 9 feet bgs).

5.4.2.2 Metals in Subsurface Soil

The analytical results for metals detected in the 2004 RFI subsurface soils are presented in Table 5-8. To aid in visualizing the extent of contamination, the historical subsurface soil metals results from the 1999 SI (locations PPMP-75-GP01 to PPMP-75-GP03) are also presented in Table 5-8. Each of the 23 metals was detected in one or more of the subsurface soil samples. Metals including antimony, cadmium, mercury, selenium, silver, and thallium were sporadically detected at concentrations above the MDL but below the RL (with the exception of selenium in the 1999 SI samples which had concentrations above the RL). The remaining metals were detected in each of the subsurface soil samples.

5.4.3 Groundwater Analytical Results

Groundwater samples were collected from seven residuum monitoring wells (five existing and two installed during the 2004 RFI), seven bedrock monitoring wells (five existing and two installed during the 2004 RFI), and four transition monitoring wells installed during the 2004 RFI. Based on the previous investigations performed at Parcel 66(7), it appeared that the groundwater flow and subsequently the TCE plume were moving in a northerly direction. Based on this and the analytical results from the 2002 RI, it was deemed unnecessary to collect samples from five of the existing residuum wells (PPMP-MW01, -MW03, -MW04, -MW07, and -MW14) and one of the existing bedrock wells (PPMP-MW09) during the 2004 RFI.

The groundwater samples collected during the 2004 RFI were analyzed for VOCs, total metals, and dissolved metals. The results of these analyses are discussed in the following subsections.

5.4.3.1 VOCs in Groundwater

The analytical results for VOCs detected in the 2004 RFI groundwater samples are presented in Table 5-9. Seventeen VOCs were detected in the groundwater samples at Parcel 66(7). The VOCs were principally detected in groundwater samples PPMP-66-MW02, PPMP-66-MW06, and PPMP-66-MW24. Samples PPMP-66-MW06 and PPMP-66-MW24 had TCE concentrations of 13,000 micrograms per liter (µg/L) and 5,000 µg/L, respectively. Two to six VOCs were detected in samples PPMP-66-MW10, PPMP-66-MW12, PPMP-66-MW17, PPMP-66-MW21, and PPMP-66-MW23. Only one VOC was detected in samples PPMP-66-MW05, PPMP-66-MW15, PPMP-66-MW16, and PPMP-66-MW19. No VOCs were detected in the remaining six groundwater samples.

Appendix F presents historical analytical results for VOCs detected in groundwater (Table F1). Also included in Appendix F are figures showing the VOC concentrations over time for groundwater wells that had high concentrations of VOC contaminants (Figure F1 for PPMP-66-MW02, Figure F2 for PPMP-66-MW06, and Figure F3 for PPMP-66-MW12).

5.4.3.2 Metals in Groundwater

The analytical results for metals detected in the 2004 RFI groundwater samples are presented in Table 5-10. Eleven of the 23 dissolved metals were detected in one or more of the groundwater samples. Fifteen of the 23 total metals were detected in one or more of the groundwater samples.

5.5 Nature and Extent of Contamination

To evaluate the nature and extent of contamination at the site, the VOC and metal results were assessed to identify the constituents of potential concern (COPCs). Detected VOCs were considered to be COPCs. To evaluate the metal COPCs, 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 4-6. Metal results that failed all three tiers were considered to be COPCs. A detailed description of the statistical evaluation for the 2004 RFI metal results is discussed in Appendix E. To evaluate which VOCs and metals were constituents of concern (COCs) for the site, the VOC and metal COPCs were compared to residential SSSLs, construction worker SSSLs, groundskeeper SSSLs, and ESVs (IT 2000).

5.5.1 Surface Soil

This section describes the evaluation of VOC and metal COCs in surface soil at Parcel 66(7).

5.5.1.1 VOCs in Surface Soil

Eleven VOCs were detected in the surface soil samples and are considered to be COPCs for surface soil at Parcel 66(7). The VOC COPCs were compared to residential, construction worker, and groundskeeper SSSLs, and ESVs as presented in Table 5-11. VOC COPCs exceeding either SSSLs or ESVs were considered to be COCs for the site. Only vinyl chloride exceeded the residential and groundskeeper SSSLs in surface soil; no VOCs exceeded the construction worker SSSLs. Four VOCs, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride, exceeded the ESVs in surface soil. The VOCs that exceeded SSSLs and ESVs were from surface soil sample SWR-66-SB02. Figure 5-4 shows the sample location and VOC COC concentrations exceeding the residential and groundskeeper SSSLs in surface soil. Figure 5-5 shows the sample location and VOC COC concentrations exceeding the ESVs in surface soil.

5.5.1.2 Metals in Surface Soil

The metals results from the 1999 SI and 2004 RFI surface soils were included in the statistical evaluation of metals at the site (Appendix E). Based on the statistical evaluation, the following metal results were identified as site related and are considered to be COPCs in surface soil at Parcel 66(7):

- Barium for sample SWR-66-SB-24 (0-1 feet), with a concentration of 788 milligrams per kilogram (mg/kg).
- Selenium for samples PPMP-75-GP02 (0-1 feet), PPMP-75-GP03 (0-1 feet), and SWR-66-SB-18 (0-1 feet), with concentrations of 1.6 mg/kg, 1.4 mg/kg, and 1.28 mg/kg, respectively.
- Silver for samples SWR-66-SB-20 (0-1 feet) and SWR-66-SB-22 (0-1 feet), with

concentrations of 1.55 mg/kg and 0.777 mg/kg, respectively.

Calcium and magnesium concentrations in surface soil also failed the three-tiered statistical evaluation (Appendix E). However, calcium and magnesium are considered macronutrients with minimal human or ecological toxicity. Most organisms have mechanisms designed to regulate nutrient fluxes within their systems, therefore, these nutrients are generally toxic only at very high concentrations. Macronutrients were considered COCs only if they were present in site samples at concentrations greater than ten times the background screening criterion. Because the calcium and magnesium concentrations in surface soil were less than ten times the background screening criterion, calcium and magnesium were not considered COCs for the site.

The metal COPCs in surface soil were compared to residential SSSLs, construction worker SSSLs, groundskeeper SSSLs, and ESVs as presented in Table 5-12. Metal COPCs exceeding either SSSLs or ESVs were considered to be COCs for the site. Barium exceeded the residential, construction worker, and groundskeeper SSSLs in surface soil. Barium and selenium exceeded the ESVs in surface soil. Figure 5-6 shows the sample location and metal COC concentration exceeding SSSLs in surface soil. Figure 5-7 shows the sample locations and metal COC concentrations exceeding ESVs in surface soil.

5.5.2 Subsurface Soil

This section describes the evaluation of VOC and metal COCs in subsurface soil at Parcel 66(7).

5.5.2.1 VOCs in Subsurface Soil

Thirteen VOCs were detected in the subsurface soil samples and are considered to be COPCs for subsurface soil at Parcel 66(7). The VOC COPCs were compared to residential SSSLs, construction worker SSSLs, groundskeeper SSSLs, and ESVs as presented in Table 5-13. VOC COPCs exceeding either SSSLs or ESVs were considered to be COCs for the site. No VOCs exceeded the residential, construction worker, or groundskeeper SSSLs in subsurface soil. Three VOCs, TCE, cis-1,2-dichloroethene, and vinyl chloride, exceeded the ESVs in subsurface soil. Figure 5-8 shows the sample locations and VOC COCs concentrations exceeding ESVs in subsurface soil.

5.5.2.2 Metals in Subsurface Soil

The metal results from the 1999 SI and 2004 RFI subsurface soils were included in the statistical evaluation of metals at the site (Appendix E). Based on the statistical evaluation, the following metal results were identified as site related and are considered to be COPCs in subsurface soil at Parcel 66(7):

- Beryllium for sample SWR-66-SB-20 (3-3.5 feet).
- Cadmium for sample SWR-66-SB02 (6.5-7.5 feet).
- Copper for sample SWR-66-SB-18 (3-3.5 feet).

Calcium concentrations in subsurface soil also failed the three-tiered statistical evaluation

(Appendix E). However, calcium is considered a macronutrient with minimal human or ecological toxicity. Macronutrients were considered COCs only if they were present in site samples at concentrations greater than ten times the background screening criterion. The calcium concentrations in subsurface soil were below ten times the background screening criterion, with one exception. For subsurface soil sample SWR-66-SB-24 (depth 15-15.5 feet), calcium (13700 mg/kg) had a concentration greater than the ten times background screening criterion. However, the soil sample collected from the same location at a shallower depth (SWR-66-SB-24 [depth 3-3.5 feet]) had a calcium (1980 mg/kg) concentration considerably lower and well below the ten times background screening criterion. Because exposure to receptors is highly unlikely, calcium is not considered a COC for the site.

The metal COPCs in subsurface soil were compared to residential SSSLs, construction worker SSSLs, groundskeeper SSSLs, and ESVs as presented in Table 5-14. Metal COPCs exceeding either SSSLs or ESVs were considered to be COCs for the site. No metals exceeded the residential, construction worker, or groundskeeper SSSLs. Beryllium and copper exceeded the ESVs in subsurface soil. Figure 5-9 shows the sample locations and metal COCs concentrations exceeding ESVs in subsurface soil.

5.5.3 Groundwater

This section describes the evaluation of VOC and metal COCs in groundwater at Parcel 66(7).

5.5.3.1 VOCs in Groundwater

Seventeen VOCs were detected in the groundwater samples and are considered to be COPCs for groundwater at Parcel 66(7). The VOC COPCs were compared to residential, construction worker, and groundskeeper SSSLs as presented in Table 5-15. VOC COPCs exceeding SSSLs were considered to be COCs for the site. 1,1-Dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, acetone, trichloroethene and vinyl chloride exceeded either the residential, construction worker, or groundskeeper SSSLs. Figure 5-10 shows the sample locations and VOC COCs concentrations exceeding SSSLs in groundwater collected from residuum wells. Figure 5-11 shows the sample locations and VOC COCs concentrations exceeding SSSLs in groundwater collected from transition wells. Figure 5-12 shows the sample locations and VOC COCs concentrations exceeding SSSLs in groundwater collected from bedrock wells.

5.5.3.2 Metals in Groundwater

Eleven dissolved metals and fifteen total metals were detected in one or more of the groundwater samples. Only the total metals results were included in the statistical evaluation for groundwater (Appendix E). Based on the statistical evaluation, the following metal results were identified as site related and are considered to be COPCs in groundwater at Parcel 66(7):

- Chromium for samples PPMP-66-MW15 (residuum), PPMP-66-MW16 (residuum), and PPMP-66-MW24 (transition well).
- Cobalt for samples PPMP-66-MW15 (residuum), PPMP-66-MW16 (residuum),

PPMP-66-MW21 (residuum well) and PPMP-66-MW24 (transition well).

- Nickel for samples PPMP-66-MW02 (residuum), PPMP-66-MW16 (residuum), PPMP-66-MW21 (residuum), and PPMP-66-MW24 (transition well).

Potassium and sodium concentrations in groundwater also failed the three-tiered statistical evaluation (Appendix E). However, potassium and sodium are considered macronutrients with minimal human or ecological toxicity. Macronutrients were considered COCs only if they were present in site samples at concentrations greater than ten times the background screening criterion. Because the potassium and sodium concentrations in groundwater were below the ten times background screening criterion, these constituents are not considered COCs for the site.

The metal COPCs in groundwater were compared to residential, construction worker, and groundskeeper SSSLs as presented in Table 5-16. Metal COPCs exceeding SSSLs were considered to be COCs for the site. Cobalt and nickel exceeded the residential SSSLs in groundwater collected from residuum well PPMP-66-MW21. No metals exceeded the construction worker or groundskeeper SSSLs in groundwater collected from residuum wells. No metals exceeded the residential, construction worker, or groundskeeper SSSLs in groundwater collected from transition and bedrock wells. Figure 5-13 shows the sample location and metal COCs concentrations exceeding the residential SSSLs in residuum groundwater wells.

5.5.4 Total VOC and Metal Concentrations in Groundwater

To aid in visualizing the extent of chlorinated solvents and metals in groundwater, the total concentrations of VOCs in the residuum, transition, and bedrock groundwater bearing zones, and the total metals concentrations in the residuum and transition groundwater bearing zones were separately summed and plotted.

Figures 5-14, 5-15, and 5-16 show the horizontal extent of total VOCs in the residuum, transition, and bedrock groundwater zones, respectively. To further aid in visualizing extent, Figures 5-14 and 5-16 include the total VOC concentrations for the residuum and bedrock wells, respectively, from the 2002 RI that were not sampled during the 2004 RFI (PPMP-66-MW01, PPMP-66-MW03, PPMP-66-MW04, PPMP-66-MW07, PPMP-66-MW09, and PPMP-66-MW14). It appears that in the residuum and transition groundwater zones, the highest concentration of VOCs are near the southern and western walls of Building 335, near the sanitary sewer system where it was suspected that TCE was disposed during routine operations. In the bedrock groundwater zone, the highest VOC concentration was at sample well PPMP-66-MW10, north of Parcel 66(7). The VOC concentrations in the bedrock wells in the vicinity of Building 335 in Parcel 66(7) were either low (5 µg/L or less) or non-detect.

A detection of acetone (370 µg/L) was noted at sample location PPMP-66-MW10 north of Parcel 66(7) and hydraulically downgradient of Parcel 66(7). The source of acetone in groundwater is unknown but may be from operations performed at Building 335. Elevated concentrations of acetone were detected in the soil boring (SWR-66-SB-22) collected at sample location PPMP-66-MW22, which is hydraulically upgradient of PPMP-66-MW10. However, no other groundwater sample contained a detectable concentration of acetone, including samples from locations in residuum closer to Building 335. If acetone in bedrock groundwater were originating from a source near Building 335 some evidence in shallow groundwater near the building would be expected. In addition well PPMP-66-MW10 also is downgradient of a sewer line running along the Hunjan St., between this well and Building 335, which could have transported acetone from some other source in this area of McClellan. Finally, acetone is miscible in water, and therefore, less retarded in soil than the chlorinated constituents such as TCE, which means potential source areas could be more distant and therefore more difficult to identify.

Figures 5-17 and 5-18 show the horizontal extent of total metals in the residuum and transition groundwater zones, respectively. These figures indicate that the metals concentrations in groundwater are highest in the western portion of Parcel 66(7).

5.5.5 Nature and Extent Conclusions

The goal of improving the definition of contaminant nature and extent for the Small Weapons Repair Shop, Parcel 66(7) has been accomplished. The additional sampling completed as part of this RFI effort has enabled a more complete understanding of the distribution of contaminants in various environmental media and confirmed the nature of those contaminants. Important conclusions regarding nature and extent are as follows:

- Groundwater gradients are relatively low at most locations and moderate gradients are localized and limited to the area immediately surrounding Building 335. Observed gradients are also consistent with results from previous investigations.
- Shallow soil VOC contamination exceeding both SSSL and ESV values is comprised of chlorinated solvents and is limited to one sample location.
- Shallow soil metals contamination includes barium in excess of SSSL and barium and selenium in excess of ESV.
- No subsurface soil VOC contamination exceeded SSSL values.
- Subsurface soil VOC contamination exceeding ESV is limited to three chlorinated solvent compounds.
- Subsurface soil metals contamination is limited to two metals exceeding ESVs at one location each.
- No subsurface soil metals exceeded SSSL values.
- Bedrock groundwater VOC contamination exceeding SSSLs is limited to vinyl chloride in a single well in the immediate vicinity of Building 335.
- Transition zone groundwater VOC contamination exceeding SSSLs is limited to 2 wells in the immediate vicinity of Building 335.
- Residuum groundwater VOC contamination exceeding SSSLs is limited to 3 locations in the immediate vicinity of Building 335.
- Groundwater contamination downgradient of Parcel 66(7) is limited to acetone in bedrock groundwater. The concentration detected exceeds the SSSL but is not clearly associated with Parcel 66(7).
- Groundwater metals contamination exceeding SSSLs are limited to cobalt and nickel at a single location in the residuum.
- No groundwater metals contamination exceeded SSSL values in either transition zone or

bedrock groundwater.

The contaminants observed in groundwater and soils at Parcel 66(7) have not migrated a great distance from the suspected location of release. In the case of metals this is consistent with the natural behavior of metals in a natural environment. With respect to groundwater this conclusion is consistent with the evaluation of groundwater contaminant travel velocities developed by the Army (IT, 2002). The calculated VOC contaminant velocities for residuum groundwater reported by the Army ranged from 0.25 to 0.56 feet per year with the maximum value attributed to vinyl chloride (IT, 2002). These low values are the result of relatively low gradients and low hydraulic conductivity values obtained by the Army (IT, 2002) combined with the natural tendency for the movement of organic compounds to be retarded by the soil matrix.

Given the consistent and corroborative nature of the data collected during this RFI and previous investigations, and the limited number and defined extent of COCs, this RFI has been successful in defining both the nature and extent of environmental contamination at Parcel 66(7).

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) 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 Soi1

Contaminant fate and transport for metals and VOCs in soil are discussed in the following sections.

6.1.1 Possible Methods of Transport of Contaminants in Soil

Possible methods of transport of contaminants in soil at Parcel 66(7) include volatilization, dust emissions, erosion and surface runoff, and infiltration from surface soil to subsurface soil to groundwater. These methods of transport are described as follows:

- **Volatilization:** VOC constituents in surface soil (0 to 2 feet) have a high potential to volatilize to the atmosphere and be transported from the source area via air movement. Metals in the surface soil are not expected to volatilize to any great extent, with the exception of mercury. However, because the soil in Parcel 66(7) is covered by asphalt, migration of contaminants through volatilization is unlikely.

- **Dust Emissions:** Most of the metals in the surface soil are generally closely associated with particulate matter and the generation of fugitive dust and subsequent transport by the wind may potentially be a transport mechanism. However, because the soil in Parcel 66(7) is covered by asphalt and not subject to dust generation, migration of contaminants through dust emissions is unlikely.

- **Erosion and Surface Runoff:** Surface runoff via rainwater has the potential to transport contaminants either in a dissolved state or adsorbed to soil particulates or organic matter. However, because the soil in Parcel 66(7) is covered by asphalt and not subject to erosion, migration of contaminants through surface runoff is unlikely.

- **Infiltration from Surface Soil to Subsurface Soil to Groundwater:** 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 and frequency of rainfall. Infiltration from surface soil to subsurface soil to groundwater is the most probable route of contaminant migration at Parcel 66(7).

6.1.2 Contaminant Fate and Transport in Soil

The highest concentrations of metals in surface soil samples were at SWR-66-SB-20 (total metals 105,000 mg/kg) on the north side of Building 335 and on the south side of Building 335, at sample locations SWR-66-SB-18 (total metals 75,000 mg/kg) and SWR-66-SB-24 (total metals 79,000 mg/kg) (Figure 4-2). Total metal concentrations in surface soil at the remaining sample locations were between 32,000 mg/kg and 63,000 mg/kg. As with the surface soil, the highest concentrations of metals in subsurface soil samples were on the north side of Building 335 (sample SWR-66-SB-20 [77,000 mg/kg]) and south side of Building 335 (samples SWR-66-SB-24 [80,000 mg/kg] and SWR-66-SB-02 [76,000 mg/kg]) (Figure 4-2). Total metal concentrations in subsurface soil at the remaining sample locations were between 42,000 mg/kg and 72,000 mg/kg. The metal concentrations for the deeper subsurface samples collected at sample locations SWR-66-SB03, SWR-66-SB-22, SWR-66-SB-24, and PPMP-66-MW23 were between 82,000 mg/kg and 88,000 mg/kg. Generally, metal concentrations in the soil samples increased slightly (or were similar) with depth, with the exception of sample locations SWR-66-SB-20 and SWR-66-SB-18 where metal concentrations decreased with depth. The metal constituents in the surface and subsurface soil samples were primarily aluminum, calcium, iron, magnesium, and potassium, which are common elements in soils (Holtzclaw et.al, 1984). Metals in soil may migrate vertically due to the acidic nature of the rainwater in the area, which would increase the solubility of metals. However, because the site is covered by asphalt the potential for vertical migration of the metal contaminants by infiltration of surface precipitation is significantly reduced.

The highest concentrations of VOCs detected in the surface soil and subsurface soil were at sample location SWR-66-SB02 (10,600 µg/kg and 14,700 µg/kg, respectively), on the southwest corner of Building 335. Lower VOC concentrations (between 18 µg/kg and 39 µg/kg) were detected in the surface soil at sample location SWR-66-SB01 on the south wall of Building 335, and SWR-66-SB03 and SWR-66-SB-22 located west of Building 335. Higher VOC concentrations (between 95 µg/kg and 250 µg/kg) were detected in the subsurface soil at these sample locations. Review of the VOC analytical data in surface soil (Table 5-2), subsurface soil (Table 5-4), and groundwater data (Table 5-6) would indicate that infiltration from surface soil to subsurface soil to groundwater is a potential route of contaminant migration for VOCs in soils at Parcel 66(7).

6.2 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. Groundwater flow directions in residuum/transition and bedrock zones are radial with flow primarily to the north, west, and south. Tables 5-2 and 5-3 show the horizontal and vertical hydraulic gradients, respectively, for groundwater. Horizontal gradients are relatively low beneath Building 335 and vertical gradients are similar in magnitude indicating a moderate potential for downward movement of groundwater.

The highest metal concentrations in groundwater were located west of Building 335 at residuum wells PPMP-66-MW16 and PPMP-66-MW21 (Figure 5-17) and transition well PPMP-66-MW22 (Figure 5-18). The primary constituents of metals in the residuum and transition groundwater wells were calcium, magnesium, and sodium. Calcium, magnesium, and sodium are considered macronutrients with minimal human or ecological toxicity. 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 do not move quickly with groundwater flow.

The highest concentration of VOCs in groundwater were located at residuum well PPMP-66-MW06 (total VOCs 15,000 µg/L) and transition well PPMP-66-MW24 (total VOCs 5,400 µg/L) located on the south side of Building 335 (Figures 5-14 and 5-15). VOCs were also concentrated to a lesser degree at residuum well PPMP-66-MW02 (280 µg/L) and transition well PPMP-66-MW23 (21 µg/L) located on the west side of Building 335 (Figures 5-14 and 5-15). As described above, transport of contaminants by groundwater flow is limited. This is evident based on the containment of groundwater contaminated with chlorinated solvents within the confines of Parcel 66(7).

The greater the solubility of an organic constituent, the greater the potential for migration via groundwater (IT, 2002a). The VOCs that exceeded human health SSSLs in groundwater at Parcel 66(7) were chlorinated hydrocarbons. Because chlorinated hydrocarbons are moderately soluble in water, the most likely fate and transport process for organic constituents detected at Parcel 66(7) is aqueous solubility. VOCs are also attracted to the subsurface soil matrix through a combination of physical and chemical forces and typically move more slowly than groundwater. As described in Section 5.5.5, the Army calculated likely VOC contaminant velocities based on site specific measurements of physical parameters governing groundwater movement and contaminant transport (IT,2002). The results of this evaluation indicate that the VOCs detected in groundwater at Parcel 66(7) are expected to migrate at rates ranging from 0.25 to 0.56 feet per year (IT,2002). This suggests relatively low potential for significant further spread of contaminants in groundwater.

7.0 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment at Parcel 66(7) consisted of the following steps, which are discussed in the following sections.

- Identify the COCs.
- Identify the exposure point concentrations for the COCs.
- 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.

7.1 Constituents of 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 (IT, 2002a).

COCs are chemicals that may contribute significantly to risk. They are selected by comparing the site-related chemical concentrations to their respective SSSLs. Since the SSSLs are receptor-specific, COCs are also receptor-specific (e.g., a chemical may be selected as a COC for residential exposure but not for construction worker exposure). The receptor scenarios evaluated for Parcel 66(7) are resident, construction worker, and groundskeeper. These receptors were selected based on the proposed future land use for the site. The process of identifying the COCs affecting human health at Parcel 66(7) is discussed in the following subsections.

7.1.1 Metals

Detected metal concentrations were subjected to a multi-tiered statistical evaluation, described in Section 5.0, 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 (COPCs) were then compared to the SSSLs. The metal COPCs that exceeded either residential, construction worker, or groundskeeper SSSLs were considered COCs at Parcel 66(7). See Sections 5.1.1, 5.2.1, and 5.3.1 for details concerning the assessment of metal COCs for surface soil, subsurface soil, and groundwater, respectively. Table 7-1 presents a summary of the metal COCs that exceeded the human health SSSLs for surface soil or groundwater at Parcel 66(7). No metal COCs exceeded the human health SSSLs in subsurface soil at Parcel 66(7).

7.1.2 VOCs

Detected VOCs, considered to be COPCs for the site, were compared to their respective SSSLs (see Section 5.0). The VOC COPCs that exceeded either residential, construction worker, or groundskeeper SSSLs were considered COCs at Parcel 66(7). See Sections 5.1.2, 5.2.2, and 5.3.2 for details concerning the assessment of VOC COCs for surface soil, subsurface soil, and groundwater, respectively. Table 7-1 presents a summary of the VOC COCs that exceeded the human health SSSLs for surface soil and groundwater at Parcel 66(7). No VOC COCs exceeded the human health SSSLs in subsurface soil at Parcel 66(7).

7.2 Exposure Point Concentrations

Exposure point concentrations (EPCs) represent the chemical concentrations in environmental media that may come in contact with a receptor. EPCs were selected based on the lesser of the 95 percent upper confidence limit (95 percent UCL) (an estimate of the concentration of a COC averaged over the entire site) or the MDC. The 95 percent UCL was calculated for data sets having five or more values. The MDC was used as the EPC for data sets having fewer than five values. EPCs were selected for each COC identified in Section 7.1. The 95 percent UCLs for the COCs were calculated using ProUCL®. ProUCL® was developed on behalf of the EPA to calculate 95 percent UCLs following EPA Guidance, and to accommodate parametric and nonparametric data sets (EPA, 2004). The EPC for each COC was compared to the cancer and non-cancer SSSLs for each receptor. Table 7-2 presents the selected EPCs and the comparison of the EPCs to cancer and non-cancer SSSLs for the COCs in surface soil. Table 7-3 presents the selected EPCs and the comparison of the EPCs to cancer and non-cancer SSSLs for the COCs in groundwater. Estimation of EPCs for subsurface soil was not performed since no COCs exceeded the human health SSSLs in subsurface soil at Parcel 66(7).

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 each COC in each environmental medium. The ILCR and HI are ratios of concentration to risk. The ILCRs and HIs for the COCs 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 an acceptable risk range (EPA, 2001). Total ILCRs that exceed 1E-04 are considered to be unacceptable.

Table 7-4 presents the ILCRs for residents and groundskeepers exposed to surface soil. No COCs were considered cancer risks for construction workers exposed to surface soil. Table 7-5 presents the ILCRs for residents, construction workers, and groundskeepers exposed to groundwater. Because no COCs exceeded the human health SSSLs in subsurface soil, no metal or VOC constituents were considered risks for residents, construction workers, or groundskeepers exposed to subsurface soil.

The total ILCR (6.22E-06) for the resident exposed to surface soil was within the acceptable risk range. The total ILCR (3.44E-03) for the resident exposed to groundwater exceeded 1E-04 and is considered to be unacceptable. Cancer-based COCs for the resident were identified as vinyl chloride in surface soil; and 1,2-dichloroethane, TCE, and vinyl chloride in groundwater.

The surface soil at Parcel 66(7) presented a negligible cancer risk to the construction worker. The total ILCR (2.11E-05) for the construction worker exposed to groundwater is within the acceptable risk range. In groundwater, cancer-based COCs for the construction worker were identified as TCE and vinyl chloride.

The total ILCR (1.21E-06) for the groundskeeper exposed to surface soil was within the acceptable risk range. Cancer-based COCs for the groundskeeper were identified as vinyl chloride in surface soil. The total ILCR (5.29E-04) for the groundskeeper exposed to groundwater exceeded 1E-04 and is considered to be unacceptable. Cancer-based COCs for the groundskeeper were identified as TCE and vinyl chloride in groundwater.

7.3.2 Non-cancer Hazard Index

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

As presented in Table 7-4, no COCs were considered non-cancer hazards for the resident, construction worker, or groundskeeper exposed to surface soil. Because no COCs exceeded the human health SSSLs in subsurface soil, no metal or VOC constituents were considered non-cancer hazards for residents, construction workers, or groundskeepers exposed to subsurface soil.

Table 7-5 presents the HIs for residents, construction workers, and groundskeepers exposed to groundwater. The total HIs for the resident (103), construction worker (16.14), and groundskeeper (16.4) exposed to groundwater exceeded the limit of 1. Table 7-6 presents the total non-cancer hazard effects by target organ. The total HIs for liver, kidney, and erythrocyte for the resident exceeded 1. The total HIs for liver and kidney for the construction worker and groundskeeper exceeded 1.

Non-cancer-based COCs for the resident were identified as nickel, 1,1-dichloroethene, acetone, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride in groundwater. Non-cancer-based COCs for the construction worker and groundskeeper were identified as 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, and vinyl chloride in groundwater.

7.4 Uncertainty Analysis

Uncertainty is a part of any risk assessment. The primary source of uncertainty in this risk assessment is the small number of samples collected as a result of the focused nature of the investigation. Seven surface soil and eleven subsurface soil samples were collected based on the previous identification of specific suspect source areas. While designed to address previously identified concerns and make use of prior knowledge of the site the limited number of samples increase the uncertainty associated with risk related conclusions. Fortunately however this increased uncertainty is mitigated by the site specific understanding of contaminant distribution does not impair the applicability of the risk evaluation.

7.5 Human Health Risk Assessment Conclusions

Based on the cancer risk, the groundwater at Parcel 66(7) presents an unacceptable risk to the resident and groundskeeper, and an acceptable risk to the construction worker. The surface soil at Parcel 66(7) presents a negligible cancer risk to the construction worker, and an acceptable risk to the resident and groundskeeper.

The groundwater at Parcel 66(7) presents an unacceptable non-cancer hazard to the resident, construction worker, and groundskeeper. The surface soil and subsurface soil at Parcel 66(7) is not a non-cancer hazard to the resident, construction worker, or groundskeeper.

The data indicated that chlorinated VOCs in groundwater are the risk drivers and are responsible for cancer risks and non-cancer hazards exceeding acceptable levels.

8.0 ECOLOGICAL RISK ASSESSMENT

In order to evaluate the potential for ecological risks posed by site-related constituents at Parcel 66(7), an ecological risk assessment was conducted. The ecological risk assessment for Parcel 66(7) consisted of the following steps, which are discussed in the following sections.

- Identify the COCs.
- Identify the exposure point concentrations for the COCs.
- Calculate the screening-level hazard quotients and identify the constituents of ecological concern (COECs).
- Assess the COECs in relation to the environmental setting and habitat(s) in and around Parcel 66(7).

8.1 Constituents of 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).

COCs are chemicals that may contribute significantly to ecological risk. They are selected by comparing the site-related chemicals to their respective ESVs. The process of identifying COCs that may pose a risk to ecological receptors at Parcel 66(7) is discussed in the following subsections.

8.1.1 Metals

Detected metal concentrations were subjected to a multi-tiered statistical evaluation, described in Section 5.0, to identify 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 (COPCs) were then compared to the ESVs. The metal COPCs that exceeded ESVs were considered COCs at Parcel 66(7). See Sections 5.1.1 and 5.2.1 for details concerning the assessment of metal COCs for surface soil and subsurface soil, respectively. Table 8-1 presents a summary of the metal COCs that exceeded the ESVs for surface soil and subsurface soil at Parcel 66(7).

8.1.2 VOCs

Detected VOCs, considered to be COPCs for the site, were compared to their respective ESVs. The VOC COPCs that exceeded the ESVs were considered COCs at Parcel 66(7). See Sections 5.1.2 and 5.2.2 for details concerning the assessment of VOC COCs for surface soil and subsurface soil, respectively. Table 8-1 shows a summary of the VOC COCs that exceeded the ESVs for surface soil and subsurface soil at Parcel 66(7).

8.2 Exposure Point Concentrations

EPCs represent the chemical concentrations in environmental media that may come in contact with a receptor. EPCs were selected based on the lesser of the 95 percent UCL (an estimate of the concentration of a COC averaged over the entire site) or the MDC. EPCs were selected for each COC identified in Section 8.1. The 95 percent UCLs for the COCs were calculated using ProUCL® (EPA, 2004). The EPC for each COC was compared to the ESV. Table 8-2 presents the selected EPCs and the comparison of the EPCs to ESVs for the COCs in surface soil and subsurface soil at Parcel 66(7).

8.3 Screening-Level Hazard Quotients

To assess whether the COCs detected at Parcel 66(7) have the potential to pose adverse ecological risks, the COCs 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 COC is not likely to pose adverse ecological risks. COCs with an HQ value greater than one were identified as COECs and may pose adverse ecological risks to one or more receptors. Table 8-2 presents the calculated screening-level HQs and the COECs identified for surface and subsurface soil at Parcel 66(7).

Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride were identified as COECs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride were identified as COECs in subsurface soil at Parcel 66(7).

8.4 Environmental Setting and Terrestrial Habitat

Parcel 66(7) is approximately 1.15 acres. The site is bounded by Waverly Road on the north, asphalt parking area on the east and south, and Freemont Road on the west. The buildings that housed the Small Weapons Repair Shop (Building 335) and the small boiler plant (Building 336) remain on site. The site is located on a topographical divide, the northern portion of the parcel slopes slightly to the north, and the southern portion of the parcel slopes slightly to the south. The entire site and the area immediately surrounding the site are covered with asphalt or concrete paving. A 6-foot high chain-link fence surrounds the entire study area and adjacent parking area. There are no water bodies associated with this site, other than the man-made drainage ditches that border the site along Waverly Road to the north and Freemont Road to the west (IT, 2002a).

The following species, listed as threatened or endangered by the USFWS, have been recorded on McClellan (IT, 2002a):

- 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 Parcel 66(7). Parcel 66(7) is not located within a

SINA or wetland area. Because the site and the area surrounding the site is entirely paved with asphalt, ecological habitat at Parcel 66(7) is very limited.

Because Parcel 66(7) is completely covered by asphalt there are no surface soil exposure pathways for ecological receptors. The only potential exposure pathway for ecological receptors to groundwater would be via surface water exposure. Because there are no water bodies at or near Parcel 66(7), there are no groundwater exposure pathways for ecological receptors.

8.5 Uncertainty Analysis

Uncertainties are inherent in any risk assessment. The primary source of uncertainty in this risk assessment is the small number of samples collected as a result of the focused nature of the investigation. Seven surface soil and eleven subsurface soil samples were collected based on the previous identification of specific suspect source areas. While designed to address previously identified concerns and make use of prior knowledge of the site the limited number of samples increase the uncertainty associated with risk related conclusions. Fortunately however this increased uncertainty is mitigated by the site specific understanding of contaminant distribution does not impair the applicability of the risk evaluation.

8.6 Conclusions

The ecological risk assessment for Parcel 66(7) consisted of the identification of the COCs for each medium at the site, identification of the EPC for each COC, calculating HQs used to identify COCs, and assessing the COCs in relation to the environmental setting and habitat.

Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride were identified as COCs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride were identified as COCs in subsurface soil at Parcel 66(7).

The site and the area immediately surrounding the site is entirely paved with asphalt, therefore, ecological habitat at Parcel 66(7) is very limited. Because Parcel 66(7) is completely covered by asphalt there are no surface soil exposure pathways for ecological receptors. Because there are no water bodies at or near Parcel 66(7), there are no groundwater exposure pathways for ecological receptors. Because there are no complete exposure pathways for ecological receptors, it is concluded that the COCs in the soil at Parcel 66(7) did not pose a risk to the ecosystem. Therefore, neither further ecological assessment nor evaluation of potential remedial alternatives is warranted for Parcel 66(7).

9.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section summarizes the results of the 2004 RFI for the Small Weapons Repair Shop, Parcel 66(7) and presents the major conclusions and recommendations.

9.1 2004 RFI Activities

Eight monitoring wells were installed within Parcel 66(7) to further define vertical and horizontal extent of groundwater contamination. Groundwater levels were measured in the residuum (five existing and two installed during the 2004 RFI), transition (four installed during the 2004 RFI), and bedrock (five existing and two installed during the 2004 RFI) monitoring wells at Parcel 66(7).

Surface soil samples were collected from seven locations, and eleven subsurface soil samples were collected from eight locations. Groundwater samples were collected from seven residuum monitoring wells, four transition monitoring wells, and seven bedrock monitoring wells.

The surface and subsurface soil samples were analyzed for VOCs and metals. Groundwater samples from the residuum and transition monitoring wells were analyzed for VOCs and metals. Groundwater samples from the bedrock monitoring wells were analyzed for VOCs.

A data quality review was performed to assess compliance with the QA objectives, and to assess hard copy and electronic deliverable consistency and integrity. A statistical evaluation was performed to identify metals that may be present at elevated concentrations as a result of site related activities.

9.2 Results of 2004 RFI and Nature and Extent

Groundwater is encountered at this site at unusually shallow depths (less than 10 feet below ground surface). Groundwater in the residuum zone appears to flow radially away from a groundwater elevation high located beneath Building 335. This apparent groundwater mound creates a flow divide with an east-west trending axis centered under Parcel 66(7). Groundwater flow in the bedrock zone is also affected by the groundwater mound and on the northern end of Parcel 66(7) flows to the north and on the southern portion of Parcel 66(7) flows to the west. The explanation for the relatively shallow occurrence of groundwater and the localized groundwater mound appears to be the lack of a roof on the Small Weapons Repair Shop building and a concrete floor that is not as impermeable as the surrounding paved areas. This groundwater mound also increases the magnitude of both horizontal and vertical gradients in the immediate area. Horizontal gradients range from a high of 0.019 ft/ft to a low of 0.008 ft/ft. The higher horizontal gradients occur close to the center of the mounded area and generally decrease as the distance from the groundwater mound increases. Vertical gradients are generally downward in this area. In nearly all cases the horizontal gradient is slightly greater or nearly the same as the vertical gradient indicating that groundwater movement is approximately either slightly more strongly horizontal or nearly equal in the vertical and horizontal directions. The exception to this condition is at PPMP-66-MW05 where the downward vertical gradient is stronger than the horizontal gradient by a factor of nearly two. At this location the groundwater will move downward 2 feet for every foot of horizontal movement.

Several metals and VOCs were detected in one or more of the surface and subsurface soil samples, and one or more of the groundwater samples. Detected VOCs were considered to be COPCs at the site. A statistical evaluation was performed to identify metal COPCs. To evaluate COCs for the site, the VOC and metal COPCs were compared to SSSLs and ESVs. Barium and vinyl chloride exceeded the human health SSSLs in surface soil. Cobalt, nickel, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride exceeded the human health SSSLs in groundwater collected from residuum wells. 1,1-Dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, TCE, and vinyl chloride exceeded the human health SSSLs in groundwater collected from transition wells. Acetone and vinyl chloride exceeded the human health SSSLs in groundwater collected from bedrock wells. Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride exceeded the ESVs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, TCE, and vinyl chloride exceeded the ESVs in subsurface soil.

The highest concentration of total VOCs in the residuum and transition groundwater zones are near the southern and western walls of Building 335, near the sanitary sewer system where it was suspected that TCE was disposed during routine operations. In the bedrock groundwater zone, the highest total VOC concentration was at sample well PPMP-66-MW10, located off-site and north of Parcel 66(7). The highest total VOC concentration was attributed to the anomalous acetone detection and is not considered site-related. The total VOC concentrations in the bedrock wells on-site, in the vicinity of Building 335 were either low (5 µg/L or less) or non-detect. Total metals concentrations in the residuum and transition groundwater bearing zones groundwater are highest in the western portion of Parcel 66(7).

The contaminants observed in groundwater and soils at Parcel 66 have not migrated a great distance from the suspected location of release. In the case of metals this is consistent with the natural behavior of metals in a natural environment. With respect to groundwater this conclusion is consistent with the evaluation of groundwater contaminant travel velocities developed by the Army (IT, 2002). Given the consistent and corroborative nature of the data collected during this RFI and previous investigations, and the limited number and defined extent of COCs, this RFI has been successful in defining the nature and extent of environmental contamination at Parcel 66(7).

9.3 Fate and Transport

Based on the evaluation of the soil and groundwater data, the most likely fate and transport pathway is the leaching of contaminants within subsurface soils and movement to the residuum aquifer system.

Generally, metal concentrations in the soil samples increased slightly (or were similar) with depth, with the exception of sample locations SWR-66-SB-20 and SWR-66-SB-18 where metal concentrations decreased with depth.

The highest concentrations of VOCs detected in the surface soil and subsurface soil were at sample location SWR-66-SB02 on the southwest corner of Building 335. The highest concentration of VOCs in groundwater were located at residuum well PPMP-66-MW06 and transition well PPMP-66-MW24 located on the south side of Building 335. The VOCs that exceeded human health SSSLs in groundwater at Parcel 66(7) were chlorinated hydrocarbons. Because chlorinated hydrocarbons tend to be moderately soluble in water, the most likely fate and transport process for organic constituents detected at Parcel 66(7) is aqueous solubility.

Because the site is covered by asphalt the potential for vertical migration of the contaminants by infiltration of surface precipitation is significantly reduced. Groundwater flow direction in residuum/transition and bedrock zones are radial with flow primarily to the north, west, and south. Because little difference in groundwater elevation exists directly under Building 335, it appears that transport of contaminants by groundwater flow is limited based on the containment of groundwater contaminated with chlorinated solvents within the confines of Parcel 66(7).

9.4 Human Health Risk Assessment

A human health risk assessment was conducted to evaluate the potential for human health risks posed by site-related constituents at Parcel 66(7). COCs that exceeded their respective SSSLs were barium and vinyl chloride in surface soil and cobalt, nickel, 1,1-dichloroethene, 1,2-dichloroethane, acetone, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride in groundwater.

A human health risk assessment was performed to evaluate the potential threat to human health from exposure to environmental media at Parcel 66(7). Three receptor scenarios were evaluated based on future land use: resident, construction worker, and groundskeeper. EPCs (representing the chemical concentrations in environmental media that may come in contact with a receptor) were selected based on the 95 percent UCL or the MDC. The EPC for each COC was compared to the cancer and non-cancer SSSLs for each receptor. The EPCs were used to calculate the cancer ILCR and non-cancer HI for each COC in each environmental medium. The ILCRs and HIs for the COCs were summed to yield a total ILCR and total HI for a given receptor exposed to a given medium. Total cancer ILCRs that exceeded 1E-04 were considered to be unacceptable. Total HI estimates above 1 raised concern for potential non-cancer effects.

Cancer-based COCs for the resident were identified as vinyl chloride in surface soil; and 1,2-dichloroethane, TCE, and vinyl chloride in groundwater. In groundwater, cancer-based COCs for the construction worker were identified as TCE and vinyl chloride. Based on the cancer risk, the groundwater at Parcel 66(7) presents an unacceptable increased risk to the resident and groundskeeper, and an acceptable increased risk to the construction worker. The surface soil at Parcel 66(7) presents a negligible cancer risk to the construction worker and an acceptable risk to the resident and groundskeeper.

Non-cancer-based COCs for the resident were identified as nickel, 1,1-dichloroethene, acetone, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride in groundwater. Non-cancer-based COCs for the construction worker and groundskeeper were identified as 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, and vinyl chloride in groundwater. The groundwater at Parcel 66(7) presents an unacceptable increased non-cancer hazard to the resident, construction worker, and groundskeeper. The surface soil and subsurface soil at Parcel 66(7) is not a non-cancer hazard to the resident, construction worker, or groundskeeper.

The data indicated that chlorinated VOCs in groundwater are the risk drivers and are responsible for cancer risks and non-cancer hazards exceeding acceptable levels.

9.5 Ecological Risk Assessment

An ecological risk assessment was conducted to evaluate the potential for ecological risks posed by site-related constituents at Parcel 66(7). COCs that exceeded their respective ESVs were barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride in surface soil; and beryllium, copper, cis-1,2-dichloroethene, TCE, and vinyl chloride in subsurface soil.

To assess whether the COCs detected at Parcel 66(7) have the potential to pose adverse ecological risks, the COCs were evaluated against the ESVs by calculating screening-level HQs for each environmental medium. COCs with an HQ value greater than one were identified as COCs and may pose adverse ecological risks to one or more receptors. Barium, selenium, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and vinyl chloride were identified as COCs in surface soil. Beryllium, copper, cis-1,2-dichloroethene, TCE, and vinyl chloride were identified as COCs in subsurface soil at Parcel 66(7).

The site and the area immediately surrounding the site is entirely paved with asphalt, therefore, ecological habitat at Parcel 66(7) is very limited. Because Parcel 66(7) is completely covered by asphalt there are no surface soil or groundwater exposure pathways for ecological receptors. Because there are no complete exposure pathways for ecological receptors, it is concluded that the COCs in the soil at Parcel 66(7) did not pose a risk to the ecosystem.

9.6 Recommendations

Based on the summary and conclusions presented above no further actions with respect to environmental data collection are required to define the nature and extent of contamination at Parcel 66(7).

Groundwater and surface soil 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 oxidation, enhanced in-situ bioremediation and groundwater extraction and treatment.

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TABLES

Table 4-1: Sample Designations and Analytical Parameters, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Sample Identification	Depth (feet)	Well Location	Well Type	Analytical Parameters
Groundwater Samples				
PPMP-66-MW02	--	PPMP-66-MW02	residuum	VOCs, Metals
PPMP-66-MW05	--	PPMP-66-MW05	residuum	VOCs, Metals
PPMP-66-MW06	--	PPMP-66-MW06	residuum	VOCs, Metals
PPMP-66-MW08	--	PPMP-66-MW08	bedrock	VOCs
PPMP-66-MW10	--	PPMP-66-MW10	bedrock	VOCs
PPMP-66-MW11	--	PPMP-66-MW11	bedrock	VOCs
PPMP-66-MW12	--	PPMP-66-MW12	bedrock	VOCs
PPMP-66-MW13	--	PPMP-66-MW13	bedrock	VOCs
PPMP-66-MW15	--	PPMP-66-MW15	residuum	VOCs, Metals
PPMP-66-MW16	--	PPMP-66-MW16	residuum	VOCs, Metals
PPMP-66-MW17	--	PPMP-66-MW17	transition zone	VOCs, Metals
PPMP-66-MW18	--	PPMP-66-MW18	residuum	VOCs, Metals
PPMP-66-MW19	--	PPMP-66-MW19	bedrock	VOCs
PPMP-66-MW20	--	PPMP-66-MW20	bedrock	VOCs
PPMP-66-MW21	--	PPMP-66-MW21	residuum	VOCs, Metals
PPMP-66-MW22	--	PPMP-66-MW22	transition zone	VOCs, Metals
PPMP-66-MW23	--	PPMP-66-MW23	transition zone	VOCs, Metals
PPMP-66-MW24	--	PPMP-66-MW24	transition zone	VOCs, Metals
Surface Soil Samples				
SWR-66-SB01	0 - 1	SWR-66-SB01	direct push boring	VOCs, Metals
SWR-66-SB02	0 - 1	SWR-66-SB02	direct push boring	VOCs, Metals
SWR-66-SB03	0 - 1	SWR-66-SB03	direct push boring	VOCs, Metals
SWR-66-SB-18	0 - 1	PPMP-66-MW18	residuum	VOCs, Metals
SWR-66-SB-20	0 - 1	PPMP-66-MW20	bedrock	VOCs, Metals
SWR-66-SB-22	0 - 1	PPMP-66-MW22	transition zone	VOCs, Metals
SWR-66-SB-24	0 - 1	PPMP-66-MW24	transition zone	VOCs, Metals
Subsurface Soil Samples				
SWR-66-SB01	6.5 - 7.5	SWR-66-SB01	direct push boring	VOCs, Metals
SWR-66-SB02	6.5 - 7.5	SWR-66-SB02	direct push boring	VOCs, Metals
SWR-66-SB03	5 - 6	SWR-66-SB03	direct push boring	VOCs, Metals
SWR-66-SB03	8 - 9	SWR-66-SB03	direct push boring	VOCs, Metals
SWR-66-SB-18	3 - 3.5	PPMP-66-MW18	residuum	VOCs, Metals
SWR-66-SB-20	3 - 3.5	PPMP-66-MW20	bedrock	VOCs, Metals
SWR-66-SB-22	3 - 3.5	PPMP-66-MW22	transition zone	VOCs, Metals
SWR-66-SB-22	15 - 15.5	PPMP-66-MW22	transition zone	VOCs, Metals
PPMP-66-MW23	13.5 - 14	PPMP-66-MW23	transition zone	VOCs, Metals
SWR-66-SB-24	3 - 3.5	PPMP-66-MW24	transition zone	VOCs, Metals
SWR-66-SB-24	15 - 15.5	PPMP-66-MW24	transition zone	VOCs, Metals

Notes:
-- = not applicable
VOCs = volatile organic compounds by SW8260B
Metals = ICP metals by SW6010B and mercury by SW7470/7471

Table 4-2: 2004 RFI Well Installation and Soil Boring Summary
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Well Location	Well Type	Northing	Easting	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Well Depth (feet bgs)	Screen Length (feet)	Screen Interval (feet bgs)
PPMP-66-MW17	transition	1171560.70	671563.77	781.23	781.44	20.0	9.54	10.0 - 19.54
PPMP-66-MW18	residuum	1171559.60	671550.89	781.31	781.08	15.0	9.54	5.0 - 14.54
PPMP-66-MW19	bedrock	1171560.22	671557.89	781.45	781.25	75.0	9.54	65.0 - 74.54
PPMP-66-MW20	bedrock	1171666.92	671515.95	781.06	780.89	80.5	9.54	70.52 - 80.06
PPMP-66-MW21	residuum	1171623.09	671434.10	781.70	780.49	15.0	9.54	5.0 - 14.54
PPMP-66-MW22	transition	1171630.86	671430.19	781.79	780.58	25.0	9.54	14.95 - 24.49
PPMP-66-MW23	transition	1171596.48	671453.05	781.78	780.55	29.9	9.54	19.87 - 29.41
PPMP-66-MW24	transition	1171555.64	671515.35	781.88	780.70	35.0	9.54	24.95 - 34.49
SWR-66-SB01	direct push boring	1171566.97	671527.13	781.23	--	10.0 *	--	--
SWR-66-SB02	direct push boring	1171568.56	671492.50	781.23	--	10.0 *	--	--
SWR-66-SB03	direct push boring	1171605.15	671467.90	781.23	--	10.0 *	--	--

Notes:
bgs = below ground surface
* = depth of soil boring
-- = not applicable

Table 5-1: Groundwater Elevations 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Well Location	Date	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Depth to Water (feet BTOC)	Groundwater Elevation (feet)
Residuum Wells					
PPMP-66-MW01	10/18/2004	780.10	782.12	5.75	776.37
PPMP-66-MW02	10/18/2004	780.64	780.19	2.5	777.69
PPMP-66-MW03	10/18/2004	781.12	780.75	3.9	776.85
PPMP-66-MW04	10/18/2004	779.98	781.90	6.49	775.41
PPMP-66-MW05	10/18/2004	780.92	780.37	3.2	777.17
PPMP-66-MW06	10/18/2004	780.81	780.56	3.3	777.26
PPMP-66-MW07	10/18/2004	782.38	782.13	4.96	777.17
PPMP-66-MW14	10/18/2004	781.93	781.74	4.5	777.24
PPMP-66-MW15	10/18/2004	780.19	779.89	2.95	776.94
PPMP-66-MW16	10/18/2004	780.74	780.58	3.7	776.88
PPMP-66-MW18	10/18/2004	781.31	781.08	3.4	777.68
PPMP-66-MW21	10/18/2004	781.70	780.49	3.45	777.04
Transition Wells					
PPMP-66-MW17	10/18/2004	781.23	781.44	4.3	777.14
PPMP-66-MW22	10/18/2004	781.79	780.58	3.6	776.98
PPMP-66-MW23	10/18/2004	781.78	780.55	2.4	778.15
PPMP-66-MW24	10/18/2004	781.88	780.70	3.5	777.20
Bedrock Wells					
PPMP-66-MW08	10/18/2004	780.88	780.69	3.75	776.94
PPMP-66-MW09	10/18/2004	781.18	780.89	4.0	776.89
PPMP-66-MW10	10/18/2004	779.74	781.96	8.2	773.76
PPMP-66-MW11	10/18/2004	781.15	780.92	4.65	776.27
PPMP-66-MW12	10/18/2004	780.74	780.46	3.45	777.01
PPMP-66-MW13	10/18/2004	781.85	781.56	4.59	776.97
PPMP-66-MW19	10/18/2004	781.45	781.25	3.9	777.35
PPMP-66-MW20	10/18/2004	781.06	780.89	3.5	777.39

Notes:

BTOC = Below top of casing

Table 5-2: Horizontal Hydraulic Gradients, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Upgradient Monitoring Well	Groundwater Elevation 10/18/2004	Downgradient Monitoring Well	Groundwater Elevation 10/18/2004	Horizontal Distance	Elevation Difference	Horizontal Gradient (feet per foot)	Direction of flow
Residuum Wells							
PPMP-66-MW05	777.17	PPMP-66-MW04	775.41	188.4	1.76	0.009	Northerly
PPMP-66-MW06	777.26	PPMP-66-MW15	776.88	50	0.38	0.008	Southwest
PPMP-66-MW02	777.69	PPMP-66-MW01	776.37	95	1.32	0.014	Southwest
PPMP-66-MW18	777.68	PPMP-66-MW14	777.24	44	0.44	0.010	Southeast
Bedrock Wells							
PPMP-66-MW20	777.39	PPMP-66-MW10	773.76	192	3.63	0.019	North

Notes:

Elevations in feet above mean sea level.

Table 5-3: Vertical Hydraulic Gradients, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Well Cluster IDs	Well Completion Zone	Midpoint of Screen	Groundwater Elevation 10/18/2004	dH	dL	Vertical Hydraulic Gradient (feet per foot)
PPMP-66-MW18	R	9.77	777.68	0.54	5	0.108
PPMP-66-MW17	T	14.77	777.14			
PPMP-66-MW06	R	18.5	777.26	0.06	11.22	0.005
PPMP-66-MW24	T	29.72	777.2			
PPMP-66-MW21	R	9.77	777.04	0.06	9.95	0.006
PPMP-66-MW22	T	19.72	776.98			
PPMP-66-MW16	R	8	776.88	-0.1	11.72	-0.008
PPMP-66-MW22	T	19.72	776.98			
PPMP-66-MW24	T	29.72	777.2	0.19	39.48	0.005
PPMP-66-MW12	B	69.2	777.01			
PPMP-66-MW02	R	16.5	777.69	0.75	49.6	0.015
PPMP-66-MW08	B	66.1	776.94			
PPMP-66-MW03	R	19	776.85	-0.04	43	-0.001
PPMP-66-MW09	B	62	776.89			
PPMP-66-MW07	R	19.5	777.17	0.2	47.1	0.004
PPMP-66-MW13	B	66.6	776.97			
PPMP-66-MW06	R	18.5	777.26	0.25	50.7	0.005
PPMP-66-MW12	B	69.2	777.01			
PPMP-66-MW05	R	19.3	777.17	0.9	53.7	0.017
PPMP-66-MW11	B	73	776.27			
PPMP-66-MW04	R	14.5	775.41	1.65	47.5	0.035
PPMP-66-MW10	B	62	773.76			
PPMP-66-MW18	R	9.77	777.68	0.33	60	0.006
PPMP-66-MW19	B	69.77	777.35			
PPMP-66-MW05	R	19.3	777.17	-0.22	55.99	-0.004
PPMP-66-MW20	B	75.29	777.39			

Notes:
Elevations in feet above mean sea level.
- signifies upward hydraulic gradient
ID = identification
R = Residuum
T= Transition
B = Bedrock
dH = change in height (feet)
dL = change in length (feet)

Table 5-4: Groundwater Chemical and Physical Parameters, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Well Location	Sample Date	Temperature (°C)	pH	Conductivity (mScm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Oxidation Reduction Potential (mV)
Residuum Wells							
PPMP-66-MW02	5/13/2004	25.60	6.43	1.565	4.56	19.1	18.5
PPMP-66-MW05	5/19/2004	20.23	7.33	0.657	5.10	34.6	-101.0
PPMP-66-MW06	5/17/2004	22.85	7.26	0.651	4.71	18.0	-54.4
PPMP-66-MW15	5/13/2004	25.25	6.59	0.917	5.36	15.6	-32.5
PPMP-66-MW16	5/13/2004	25.70	6.29	1.730	9.54	82.0	27.9
PPMP-66-MW18	5/12/2004	23.60	6.88	1.170	9.57	37.0	NM
PPMP-66-MW21	5/12/2004	21.54	6.35	3.434	4.57	-75*	168.4
Transition Wells							
PPMP-66-MW17	5/20/2004	22.83	7.17	1.201	3.69	19.4	-86.6
PPMP-66-MW22	5/11/2004	22.34	6.70	2.301	5.59	-1.8	-45.3
PPMP-66-MW23	5/13/2004	20.95	6.62	1.143	3.34	19.5	-89.4
PPMP-66-MW24	5/17/2004	24.96	7.11	1.201	6.20	37.3	-111.8
Bedrock Wells							
PPMP-66-MW08	5/12/2004	22.78	6.91	2.103	2.92	0.3	-41.0
PPMP-66-MW10	5/19/2004	18.24	7.41	1.947	2.10	21.7	-362.8
PPMP-66-MW11	5/20/2004	20.79	7.42	1.768	8.31	1.4	-21.9
PPMP-66-MW12	5/17/2004	22.19	7.21	2.178	6.36	31.2	-120.1
PPMP-66-MW13	5/20/2004	21.28	7.45	2.380	5.48	7.5	-4.3
PPMP-66-MW19	5/20/2004	21.51	7.08	2.364	3.92	19.8	-79.8
PPMP-66-MW20	5/12/2004	23.30	7.10	0.631	10.38	3.0	NM

Notes:
* = Turbidity probe was not working properly, valid measurement could not be acquired.
°C = Degrees celsius
mg/L = milligrams per liter
mScm = millisiemens per centimeter
mV = millivolts
NM = Not measured; well bailed to dryness, no oxidation reduction potential sample was collected.
NTU = nephelometric turbidity units

Table 5-5: Summary of Surface Soil Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/kg)	SWR-66-SB01 (0 - 1')	SWR-66-SB02 (0 - 1')	SWR-66-SB03 (0 - 1')	SWR-66-SB-18 (0 - 1')	SWR-66-SB-20 (0 - 1')	SWR-66-SB-22 (0 - 1')	SWR-66-SB-24 (0 - 1')
1,1-Dichloroethane	< 5.6	36	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
1,1-Dichloroethene	< 5.6	19	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
1,2,4-Trimethylbenzene	< 5.6	6.2	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7 (UJA)	< 9.1
1,3,5-Trimethylbenzene	< 5.6	3.4 J	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7 (UJA)	< 9.1
Acetone	21 J	17 J	15 J	16 J (JH)	41	39	18 J
Carbon Disulfide	< 5.6	6.3	3.1 J	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
Cis-1,2-Dichloroethene	< 5.6	6800 (JC)	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
Toluene	< 5.6	6.7	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
Trans-1,2-Dichloroethene	< 5.6	1400	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
Trichloroethene	< 5.6	4.7 J	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1
Vinyl Chloride	< 5.6	2300	< 4.7	< 5.2 (UJH)	< 6.1	< 6.7	< 9.1

Notes:

' = feet
< = The result was not detected at the concentration shown.
µg/kg = micrograms per kilogram
VOCs = Volatile Organic Compounds

Flags:

J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JH) = Validation Flag: Detection qualified as estimated because holding time exceeded method criteria.
(UJA) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because internal standard area was outside method-specific control limits.
(UJH) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because holding time exceeded method criteria.

Table 5-6: Summary of Surface Soil Detections for Metals
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Metals (mg/kg)	1999 SI PPMP-75-GP01 (0 - 1')	1999 SI PPMP-75-GP02 (0 - 1')	1999 SI PPMP-75-GP03 (0 - 1')	2004 RFI SWR-66-SB01 (0 - 1')	2004 RFI SWR-66-SB02 (0 - 1')	2004 RFI SWR-66-SB03 (0 - 1')
Aluminum	6340	11700	11800	21000	9010	19900
Antimony	< 6.6	< 6.8	< 8.0	< 12.6 (UB)	< 12.1	< 11.1 (UB)
Arsenic	1.3 B	6.3	5.0	7.92	6.2	4.7
Barium	46.5	101	65.3	73.4	47.9	75.7
Beryllium	0.81	1.2	0.46 J	0.73 J	0.525 J	0.51 J
Calcium	24600 J	3190 J	371 J	2150	1990	3850
Chromium	7.6 J	17.1 J	16.7 J	22	12	21
Cobalt	1.3 J	23.9	3.8 J	8.57	4.77	3.75
Copper	6.5	45.1	20.8	31	9.52	19.5
Iron	4370	30500	27500	33600	18900	22700
Lead	10.8	26.0	11.5	24.9	23.2	22.1
Magnesium	7900 J	6030 J	1130 J	2060	924	2450
Manganese	209	363	15.4	86.6	174	47.4
Mercury	0.026 J	0.041 J	0.017 J	0.0745 J	< 0.12	< 0.11
Nickel	3.3 J	4.58	8.0	17.9	7.46	7.89
Potassium	531 J	457 J	404 J	1610	698	1390
Selenium	< 0.55	1.6	1.4	< 1.26	< 1.21	< 1.11
Silver	< 1.1	< 1.1	< 1.3	< 3.16	< 3.03	< 2.77
Sodium	140 B	83.7 B	123 B	110 J	132	221
Thallium	< 1.1	< 1.1	< 1.3	< 2.53	< 2.42	< 2.21
Vanadium	9.4	24.5	28.7	46.5	26.7	37.2
Zinc	16.1	100	21.6	101	25.7	56.6

Table 5-6: Summary of Surface Soil Detections for Metals
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Metals (mg/kg)	2004 RFI SWR-66-SB-18 (0 - 1')	2004 RFI SWR-66-SB-20 (0 - 1')	2004 RFI SWR-66-SB-22 (0 - 1')	2004 RFI SWR-66-SB-24 (0 - 1')
Aluminum	28100	50000	24900	27000
Antimony	< 12.8 (UB)	2.98 J	3.25 J	< 12.1 (UB)
Arsenic	8.37	7.8	6.29	6.86
Barium	140	165	137	788
Beryllium	1.54	0.988 J	1.08 J	1.82
Calcium	1830	388	1480	739
Chromium	23.6	42	24	24
Cobalt	21.4	9.62	11.5	16.9
Copper	60.8	40.6	40.5	47.1
Iron	36600	47700	29600	42300
Lead	23.1	18.6	33.5	24.9
Magnesium	5560	2780	3450	5730
Manganese	85.8	32.3	111	105
Mercury	< 0.120	< 0.130	< 0.120	< 0.12
Nickel	40.2	21.5	29.5	43
Potassium	2390	3800	2820	1460
Selenium	1.28	< 1.37	< 1.22	< 1.21
Silver	< 3.20	1.55 J	0.777 J	< 3.03
Sodium	114 J	242	161	117 J
Thallium	1.65 J	< 2.75	< 2.44 (UB)	< 2.42
Vanadium	51.7	81.6	50.2	43.5
Zinc	111	71.1	87.9	115

Notes:
' = feet
< = The result was not detected at the concentration shown.
mg/kg = milligrams per kilogram
1999 SI Flags:
J = Analyte positively identified; reported value is an estimated concentration.
B = Analyte detected in method blank at concentration greater than the reporting limit.
2004 RFI Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(UB) = Validation Flag: Result was qualified nondetect based on blank contamination.

Table 5-7: Summary of Subsurface Soil Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/kg)	SWR-66-SB01 (6.5 - 7.5')	SWR-66-SB02 (6.5 - 7.5')	SWR-66-SB03 (5 - 6')	SWR-66-SB03 (8 - 9')	SWR-66-SB-18 (3 - 3.5')	SWR-66-SB-20 (3 - 3.5')
1,1,1-Trichloroethane	< 4.1	3.1 J	< 5.1	< 5	< 4.6 (UJH)	< 6.6
1,1,2-Trichloroethane	< 4.1	4.1 J	< 5.1	< 5	< 4.6 (UJH)	< 6.6
1,1-Dichloroethane	< 4.1	16	14	< 5	< 4.6 (UJH)	< 6.6
1,1-Dichloroethene	< 4.1	2.6 J	< 5.1	< 5	< 4.6 (UJH)	< 6.6
1,2-Dichloroethane	< 4.1	2.9 J	< 5.1	< 5	< 4.6 (UJH)	< 6.6
2-Butanone (MEK)	< 16 (UJC)	15 J (JC)	< 21 (UJC)	< 20 (UJC)	< 19 (UJH)	< 26
Acetone	8.6 J	68	30	< 20	5.2 J (JH)	< 26
Cis-1,2-Dichloroethene	54	570 (JC)	56	77	< 4.6 (UJH)	< 6.6
Methylene Chloride	< 8.2	< 8.7	< 10	< 9	< 9.3 (UJH)	< 13
Toluene	< 4.1	14	< 5.1	< 5	< 4.6 (UJH)	< 6.6
Trans-1,2-Dichloroethene	< 4.1	20	39	27	< 4.6 (UJH)	< 6.6
Trichloroethene	32	14000	< 5.1	< 5	< 4.6 (UJH)	< 6.6
Vinyl Chloride	< 4.1	< 4.3	110	7.2	< 4.6 (UJH)	< 6.6

Table 5-7: Summary of Subsurface Soil Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/kg)	SWR-66-SB-22 (3 - 3.5')	SWR-66-SB-22 (15 - 15.5')	PPMP-66-MW23 (13.5 - 14')	SWR-66-SB-24 (3 - 3.5')	SWR-66-SB-24 (15 - 15.5')
1,1,1-Trichloroethane	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
1,1,2-Trichloroethane	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
1,1-Dichloroethane	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
1,1-Dichloroethene	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
1,2-Dichloroethane	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
2-Butanone (MEK)	< 20	< 22 (RA)	< 20 (UJA)	< 28	< 20 (UJC)
Acetone	15 J	130 (JSA)	24 (JA)	< 28	12 J
Cis-1,2-Dichloroethene	< 5	< 5.6 (RA)	< 5 (UJA)	11	< 5
Methylene Chloride	< 10	17 (JSA)	< 9 (UJA)	< 14	< 10 (UB)
Toluene	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
Trans-1,2-Dichloroethene	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
Trichloroethene	< 5	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5
Vinyl Chloride	2.6 J	< 5.6 (RA)	< 5 (UJA)	< 7.1	< 5

Notes:
' = feet
< = The result was not detected at the concentration shown.
µg/kg = micrograms per kilogram
VOCs = Volatile Organic Compounds

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JA) = Validation Flag: Detection qualified as estimated because internal standard area was outside method-specific control limits.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JH) = Validation Flag: Detection qualified as estimated because holding time exceeded method criteria.
(JSA) = Validation Flag: Detection qualified as estimated because internal standard and surrogate recoveries were outside laboratory historical control limits.
(UJA) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because internal standard area was outside method-specific control limits.
(UJC) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because continuing calibration was outside method-specific control limits.
(UJH) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because holding time exceeded method criteria.
(RA) = Validation Flag: The data are unusable. Results were rejected due to extremely low internal standard areas. The analyte may or may not be present in the sample.

Table 5-8: Summary of Subsurface Soil Detections for Metals
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Metals (mg/kg)	**1999 SI PPMP-75-GP01 (5 - 7')**	**1999 SI PPMP-75-GP02 (3 - 5')**	**1999 SI PPMP-75-GP03 (3 - 5')**	**2004 RFI SWR-66-SB01 (6.5 - 7.5')**	**2004 RFI SWR-66-SB02 (6.5 - 7.5')**	**2004 RFI SWR-66-SB03 (5 - 6')**	**2004 RFI SWR-66-SB03 (8 - 9')**
Aluminum	13100	13000	14900	18200	20900	26000	22200
Antimony	< 7.3	< 6.7	< 6.8	< 10.5 (UB)	< 10.6 (UB)	2.52 J	< 10.6
Arsenic	2.6	4.4	4.9	3.21	3.37	6.83	3.41
Barium	173	85.7	85.4	74.2	123	146	105
Beryllium	1.3	1.8	2.0	1.07	1.14	0.821 J	1.26
Cadmium	< 0.61	< 0.56	< 0.56	0.581 J	0.953 J	< 1.20	0.713 J
Calcium	1450 J	1020 J	894 J	4270	1830	852	2190
Chromium	16.7 J	18.1 J	19.4 J	19.8	23.8	22.8	26
Cobalt	11.1	31.8	37.4	14.3	14.2	4.59	17.8
Copper	17.6	37.7	39.0	41.1	40	17.2	43.6
Iron	23600	30600	34600	36500	39500	32500	45200
Lead	11.8	16.1	18.9	35.8	12.2	26.6	17.1
Magnesium	3330 J	6720 J	7500 J	10600	10700	1980	11800
Manganese	132	312	179	272	353	24.6	528
Mercury	0.019 J	0.054 J	0.032 J	0.0434 J	0.0455 J	< 0.120	< 0.100
Nickel	21.8	71.8	69.9	42	45.4	10.8	52.5
Potassium	493 J	420 J	380 J	1850	2080	1510	1860
Selenium	1.0	1.5	1.6	< 1.05	< 1.06	< 1.20	< 1.06
Silver	< 1.2	< 1.1	< 1.1	< 2.64	< 2.64	< 2.99	< 2.65
Sodium	195 B	92.3 B	125 B	116	195	196	115
Thallium	0.43 J	0.61 J	< 1.1	< 2.11	< 2.11	< 2.39	< 2.12
Vanadium	21.0	18.3	18.4	22.5	25.5	43.9	25.5
Zinc	41.1	104	111	103	120	41.2	124

Table 5-8: Summary of Subsurface Soil Detections for Metals
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Metals (mg/kg)	2004 RFI SWR-66-SB-18 (3 - 3.5')	2004 RFI SWR-66-SB-20 (3 - 3.5')	2004 RFI SWR-66-SB-22 (3 - 3.5')	2004 RFI SWR-66-SB-22 (15 - 15.5')	2004 RFI PPMP-66-MW23 (13.5 - 14')	2004 RFI SWR-66-SB-24 (3 - 3.5')	2004 RFI SWR-66-SB-24 (15 - 15.5')
Aluminum	17000	22100	32000	22400	29700	20600	20200
Antimony	< 10.8 (UB)	< 10.9	< 12.4 (UJM)	< 10.2	< 12.0	< 11.0	< 11.5
Arsenic	7.92	7.77	4.86	5.64	4.4	4.8	5.22
Barium	97.4	129	130	124	206	111	145
Beryllium	0.975 J	3.65	0.504 J	1.08	1.47	1.1	1.09 J
Cadmium	< 1.08	0.763 J	< 1.24	0.745 J	< 1.20	< 1.10	< 1.15
Calcium	1050	1250	442	11800	8560	1980	13700
Chromium	16.9	23.7	24.3	23.6	28.5	20.6	23.7
Cobalt	5.45	30.1	2.13 J	13.4	10.1	15.3	12.7
Copper	58.4	44	16.9	41.7	29.1	43	38
Iron	30300	39400	27200	36100	29200	44000	34800
Lead	19.7	18.4	16.6	15.3	24.2	19.6	15.4
Magnesium	8090	10600	1970	12900	8380	11500	12100
Manganese	39.1	241	13.6	219	271	478	280
Mercury	< 0.100	0.0382 J	< 0.120	< 0.100	0.0439 J	< 0.110	< 0.110
Nickel	49.3	87.5	8.17	40.4	27.5	47	39.1
Potassium	2330	2280	1680	3710	5010	1230	3130
Selenium	0.675 J	< 1.09	< 1.24	< 1.02	< 1.20	< 1.10	< 1.15
Silver	< 2.70	0.999 J	1.34 J	1.14 J	< 2.99	< 2.74	< 2.86
Sodium	105 J	156	152	137	277	79.1 J	136
Thallium	< 2.16	< 2.18	< 2.48 (UB)	< 2.49 (UB)	< 2.40	1.63 J	< 2.29
Vanadium	39.8	32.3	59.5	29.7	44	23.7	28
Zinc	136	138	28.4	121	83.5	113	118

Notes:

' = feet

< = The result was not detected at the concentration shown.

mg/kg = milligrams per kilogram

1999 SI Flags:

J = Analyte positively identified; reported value is an estimated concentration.

B = Analyte detected in method blank at concentration greater than the reporting limit.

2004 RFI Flags:

J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.

(UB) = Validation Flag: Result was qualified nondetect based on blank contamination.

(UJM) = Validation Flag: Analyte was not detected; the reported quantitation limit is estimated because the matrix spike and matrix spike duplicate recoveries were outside laboratory historical control limits.

Table 5-9: Summary of Groundwater Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/L)	PPMP-66-MW02 5/13/04 (residuum)	PPMP-66-MW05 5/19/04 (residuum)	PPMP-66-MW06 5/17/04 (residuum)	PPMP-66-MW15 5/13/04 (residuum)	PPMP-66-MW16 5/13/04 (residuum)	PPMP-66-MW18 5/12/04 (residuum)
1,1,1-Trichloroethane	0.66 J (JC)	< 1.0	58	< 1.0 (UJC)	< 1.0 (UJC)	< 1.0
1,1-Dichloroethane	10	< 1.0	91	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	28	< 1.0	300	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0
2-Butanone (MEK)	< 10	< 10	< 100	< 10	< 10	< 10
4-Methyl-2-Pentanone (MIBK)	< 10 (UJC)	< 10	< 100	< 10 (UJC)	< 10 (UJC)	< 10
Acetone	7.4 J	5.6 J	< 100	< 10	< 10	< 10
Carbon Disulfide	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0
Chloroethane	4	< 2.0	< 20	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	36	< 1.0	1600	< 1.0	< 1.0	< 1.0
Methylene Chloride	< 2	< 2	< 20	< 2	< 2	< 2
Naphthalene	< 2.0	< 2.0	< 20	< 2.0	< 2.0	< 2.0
O-Xylene	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0
Toluene	< 1.0	< 1.0	2.6 J	0.25 J	< 1.0	< 1.0
Trans-1,2-Dichloroethene	10	< 1.0	130	< 1.0	< 1.0	< 1.0
Trichloroethene	74	< 1.0	13000	< 1.0	< 1.0	< 1.0
Vinyl Chloride	110	< 1.0	10	< 1.0	0.26 J	< 1.0

Table 5-9: Summary of Groundwater Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/L)	PPMP-66-MW21 5/12/04 (residuum)	PPMP-66-MW17 5/20/04 (transition)	PPMP-66-MW22 5/11/04 (transition)	PPMP-66-MW23 5/13/04 (transition)	PPMP-66-MW24 5/17/04 (transition)	PPMP-66-MW08 5/12/04 (bedrock)
1,1,1-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0 (UJC)	11	< 1.0
1,1-Dichloroethane	0.29 J	< 1.0	< 1.0	0.75 J	41 E	< 1.0
1,1-Dichloroethene	< 1.0	< 1.0	< 1.0	2.2	180	< 1.0
1,2-Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	0.69 J	< 1.0
2-Butanone (MEK)	< 10	< 10	< 10	< 10	< 10	< 10
4-Methyl-2-Pentanone (MIBK)	< 10	< 10	< 10	< 10 (UJC)	< 10	< 10
Acetone	< 10	< 10	< 10	5.4 J	< 10	< 10
Carbon Disulfide	< 1.0	0.68 J	< 1.0	< 1.0	0.33 J	< 1.0
Chloroethane	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Cis-1,2-Dichloroethene	4.4	< 1.0	< 1.0	1.6	130	< 1.0
Methylene Chloride	< 2	< 2	< 2	< 2	< 2	< 2
Naphthalene	< 2.0	0.46 J	< 2.0	< 2.0	< 2.0	< 2.0
O-Xylene	< 1.0	< 1.0	< 1.0	< 1.0	0.3 J	< 1.0
Toluene	< 1.0	< 1.0	< 1.0	< 1.0	3.7	< 1.0
Trans-1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0	8.2	< 1.0
Trichloroethene	< 1.0	< 1.0	< 1.0	1.4	5000	< 1.0
Vinyl Chloride	0.48 J	< 1.0	< 1.0	9.2	1.2	< 1.0

Table 5-9: Summary of Groundwater Detections for VOCs, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

VOCs (µg/L)	PPMP-66-MW10 5/19/04 (bedrock)	PPMP-66-MW11 5/20/04 (bedrock)	PPMP-66-MW12 5/17/04 (bedrock)	PPMP-66-MW13 5/20/04 (bedrock)	PPMP-66-MW19 5/20/04 (bedrock)	PPMP-66-MW20 5/12/04 (bedrock)
1,1,1-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	< 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
2-Butanone (MEK)	33	< 10	< 10	< 10	< 10	< 10
4-Methyl-2-Pentanone (MIBK)	5.6 J	< 10	< 10	< 10	< 10	< 10
Acetone	370	< 10	< 10	< 10	< 10	< 10
Carbon Disulfide	3.2 (JM)	< 1.0	< 1.0	< 1.0	1.3	< 1.0
Chloroethane	< 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
Methylene Chloride	1.2 J	< 2	< 2	< 2	< 2	< 2
Naphthalene	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
O-Xylene	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	< 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	< 1.0	5.1	< 1.0	< 1.0	< 1.0
Vinyl Chloride	< 1.0	< 1.0	0.21 J	< 1.0	< 1.0	< 1.0

Notes:
< = The result was not detected at the concentration shown.
µg/L = micrograms per liter
VOCs = Volatile Organic Compounds

Flags:
E = Lab Flag: Result is above the maximum calibration range.
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JM) = Validation Flag: Detection qualified as estimated because the matrix spike and matrix spike duplicate recoveries were outside laboratory historical control limits.
(UJC) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because continuing calibration was outside method-specific control limits.

Table 5-10: Summary of Groundwater Detections for Metals, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Parameter Name	PPMP-66-MW02 5/13/04 (residuum)	PPMP-66-MW05 5/19/04 (residuum)	PPMP-66-MW06 5/17/04 (residuum)	PPMP-66-MW15 5/13/04 (residuum)	PPMP-66-MW16 5/13/04 (residuum)	PPMP-66-MW21 5/12/04 (residuum)
Metals (Dissolved) (mg/L)						
Barium	0.0253	0.0554	0.0356	0.0337	0.0879	0.0273
Cadmium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.00224 J
Calcium	190	55.9	62.3	106 (JM)	296	413
Cobalt	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.106
Iron	0.863 J	1.09	0.166 J	1.66	0.0615 J	< 1
Magnesium	108	55.8	51.6	68.6	174	387
Manganese	0.683	0.0411	0.061	2.2 (JM)	2.14	4.94
Nickel	0.0108 J	< 0.02	< 0.02	0.0103 J	0.0115 J	0.0678
Potassium	2.98 J	1.36 J	1.1 J (J-)	2.53 J	3.48 J	5 U^ (UB)
Sodium	146	18.5	50.2	67.9	172	208
Zinc	< 0.1	0.1 U^ (UB)	< 0.1	0.0191 J	0.0192 J	0.139
Metals (Total) (mg/L)						
Aluminum	0.843	0.516	1.14	1.15	7.14	1.35
Barium	0.0341	0.0697	0.0456	0.04	0.186	0.0369
Calcium	170	64.5	64.6	92.6	332	378
Chromium	< 0.02	< 0.02	< 0.02	0.00798 J	0.00788 J	< 0.02
Cobalt	< 0.02	< 0.02	< 0.02	0.00933 J	0.0111 J	0.109
Copper	< 0.02	< 0.02	< 0.02	0.00552 J	0.0106 J	< 0.02
Iron	1.99	2.66	1.47	2.9	12.3	1.62
Lead	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.00798 J
Magnesium	97.2	64.3	53.5	60.4	197	349
Manganese	0.63	0.0514	0.0696	1.95	2.45	4.77
Nickel	0.0139 J	< 0.02	< 0.02	< 0.02	0.0206	0.0646
Potassium	3.21 J	1.42 J	1.51 J	2.42 J	5.94	2.95 J
Sodium	131	21.2	51.8	59.2	190	191
Vanadium	< 0.01	< 0.01	< 0.01	< 0.01	0.00973 J	< 0.01
Zinc	0.0161 J	0.1 U^ (UB)	0.00896 J	0.0267 J	0.0605 J	0.119

Table 5-10: Summary of Groundwater Detections for Metals, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Parameter Name	PPMP-66-MW17 5/20/04 (transition)	PPMP-66-MW22 5/11/04 (transition)	PPMP-66-MW23 5/13/04 (transition)	PPMP-66-MW24 5/17/04 (transition)	PPMP-66-MW18 5/12/04 (bedrock)
Metals (Dissolved) (mg/L)					
Barium	0.0258	0.0308	0.0744	0.0512	0.0502
Cadmium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Calcium	43.5	321	148	124	79.1
Cobalt	< 0.02	0.02 U^ (UB)	< 0.02	0.0499	< 0.02
Iron	< 1	3.1	2.36	2.47	< 1
Magnesium	28.3	167	73.7	69.4	63
Manganese	0.121	0.605	0.839	0.337	0.334
Nickel	< 0.02	< 0.02	< 0.02	0.014 J	< 0.02
Potassium	2.15 J (J-)	3.77 J	8.88	3.6 J (J-)	5 U^ (UB)
Sodium	94.3	158	94.8	98.5	116
Zinc	0.116	< 0.1	0.00728 J	0.0131 J	0.0261 J
Metals (Total) (mg/L)					
Aluminum	< 0.2 (UJQ)	< 0.2	1.54	2.75	0.156 J
Barium	0.0262 (JQ)	0.0299	0.0966	0.0708	0.0536
Calcium	44.3 (JQ)	295	171	136	81.4
Chromium	< 0.02 (UJQ)	< 0.02	< 0.02	0.0233	< 0.02
Cobalt	< 0.02 (UJQ)	< 0.02	< 0.02	0.0824	< 0.02
Copper	< 0.02 (UJQ)	< 0.02	< 0.02	0.00648 J	< 0.02
Iron	0.0461 J (JQ)	2.99	5.16	7.26	0.119 J
Lead	< 0.01 (UJQ)	< 0.01	< 0.01	< 0.01	< 0.01
Magnesium	28.9 (JQ)	153	86.7	75.7	66
Manganese	0.125 (JQ)	0.575	0.967	0.396	0.346
Nickel	< 0.02 (UJQ)	< 0.02	< 0.02	0.0221	< 0.02
Potassium	2.44 J (J-Q)	3.04 J	7.8	5.72 (J-)	1.76 J
Sodium	94.9 (JQ)	145	109	105	122
Vanadium	< 0.01 (UJQ)	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.0188 J (JQ)	< 0.1	0.00978 J	0.0338 J	0.0158 J

Table 5-10: Summary of Groundwater Detections for Metals, 2004 RFI
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Notes:
< = The result was not detected at the concentration shown.
mg/L = milligrams per liter

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(J-) = Validation Flag: Detection qualified as estimated because analyte was reported as a negative concentration in the method and/or continuing calibration blank; sample detect may be biased low.
(J-Q) = Validation Flag: Detection qualified as estimated because the sample pH did not meet method criteria and because the analyte was reported as a negative concentration in the method and/or continuing calibration blank; sample detect may be biased low.
(JM) = Validation Flag: Detection qualified as estimated because the matrix spike and matrix spike duplicate recoveries were outside laboratory historical control limits.
(JQ) = Validation Flag: Detection qualified as estimated because the sample pH did not meet method criteria.
(UB) = Validation Flag: Result was qualified nondetect based on blank contamination.
(UJQ) = Validation Flag: Analyte was analyzed for, but was not detected. The reported quantitation limit is estimated because the sample pH did not meet method criteria.

Table 5-11: Surface Soil VOC Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	ESV	SWR-66-SB01 (0 - 1')	SWR-66-SB02 (0 - 1')	SWR-66-SB03 (0 - 1')	SWR-66-SB-18 (0 - 1')
VOCs (μg/kg)								
1,1-Dichloroethane	777000	4910000	10000000	100		36		
1,1-Dichloroethene	1050	57800	4720	100		19		
1,2,4-Trimethylbenzene	388000	1580000	3200000	100		6.2		
1,3,5-Trimethylbenzene	388000	1580000	3200000	100		3.4 J		
Acetone	776000	4950000	10200000	2500	21 J	17 J	15 J	16 J (JH)
Carbon Disulfide	777000	4920000	10100000	94		6.3	3.1 J	
Cis-1,2-Dichloroethene	77700	498000	1020000	100		**6800 (JC)**		
Toluene	1550000	9620000	19600000	50		6.7		
Trans-1,2-Dichloroethene	155000	996000	2030000	100		**1400**		
Trichloroethene	46600	298000	256000	1		**4.7 J**		
Vinyl Chloride	370	23232	1897	10		**2300**		

Table 5-11: Surface Soil VOC Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	ESV	SWR-66-SB-20 (0 - 1')	SWR-66-SB-22 (0 - 1')	SWR-66-SB-24 (0 - 1')
VOCs (µg/kg)							
1,1-Dichloroethane	777000	4910000	10000000	100			
1,1-Dichloroethene	1050	57800	4720	100			
1,2,4-Trimethylbenzene	388000	1580000	3200000	100			
1,3,5-Trimethylbenzene	388000	1580000	3200000	100			
Acetone	776000	4950000	10200000	2500	41	39	18 J
Carbon Disulfide	777000	4920000	10100000	94			
Cis-1,2-Dichloroethene	77700	498000	1020000	100			
Toluene	1550000	9620000	19600000	50			
Trans-1,2-Dichloroethene	155000	996000	2030000	100			
Trichloroethene	46600	298000	256000	1			
Vinyl Chloride	370	23232	1897	10			

Notes:
' = feet
µg/kg = micrograms per kilogram
COPC = Constituent of potential concern
ESV = Ecological screening level
SSSL = Site-specific screening level
VOCs = Volatile Organic Compounds

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JH) = Validation Flag: Detection qualified as estimated because holding time exceeded method criteria.

> residential and groundskeeper SSSL
> ESV

Table 5-12: Surface Soil Metal Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	ESV	1999 SI PPMP-75-GP02 (0 - 1')	1999 SI PPMP-75-GP03 (0 - 1')	2004 RFI SWR-66-SB-18 (0 - 1')	2004 RFI SWR-66-SB-20 (0 - 1')	2004 RFI SWR-66-SB-22 (0 - 1')	2004 RFI SWR-66-SB-24 (0 - 1')
Metals (mg/kg)										
Barium	547	325	650	165						**788**
Selenium	39.1	255	511	0.81	**1.6**	**1.4**	**1.28**			
Silver	39.1	256	511	2				1.55 J	0.777 J	

Notes:
' = feet
COPC = Constituent of potential concern
ESV = Ecological Screening Value
mg/kg = milligrams per kilogram
SI = Site Investigation
RFI = RCRA Facility Investigation
SSSL = Site-Specific Screening Level

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.

▨ > residential, construction worker, and groundskeeper SSSLs
☐ **> ESV**

Table 5-13: Subsurface Soil VOC Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	ESV	SWR-66-SB01 (6.5 - 7.5')	SWR-66-SB02 (6.5 - 7.5')	SWR-66-SB03 (5 - 6')	SWR-66-SB03 (8 - 9')	SWR-66-SB-18 (3 - 3.5')
VOCs (µg/kg)									
1,1,1-Trichloroethane	1550000	9830000	20100000	100		3.1 J			
1,1,2-Trichloroethane	11100	199000	407000	100		4.1 J			
1,1-Dichloroethane	777000	4910000	10000000	100		16	14		
1,1-Dichloroethene	1050	57800	4720	100		2.6 J			
1,2-Dichloroethane	6930	376000	30700	400		2.9 J			
2-Butanone (MEK)	4660000	28600000	58600000	89600		15 J (JC)			
Acetone	776000	4950000	10200000	2500	8.6 J	68	30		5.2 J (JH)
Cis-1,2-Dichloroethene	77700	498000	1020000	100	54	**570 (JC)**	56	77	
Methylene Chloride	84100	2980000	378000	2000					
Toluene	1550000	9620000	19600000	50		14			
Trans-1,2-Dichloroethene	155000	996000	2030000	100		20	39	27	
Trichloroethene	46600	298000	256000	1	**32**	**14000**			
Vinyl Chloride	370	23232	1897	10			**110**	7.2	

Table 5-13: Subsurface Soil VOC Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	ESV	SWR-66-SB-22 (3 - 3.5')	SWR-66-SB-22 (15 - 15.5')	PPMP-66-MW23 (13.5 - 14')	SWR-66-SB-24 (3 - 3.5')	SWR-66-SB-24 (15 - 15.5')
VOCs (µg/kg)									
1,1,1-Trichloroethane	1550000	9830000	20100000	100					
1,1,2-Trichloroethane	11100	199000	407000	100					
1,1-Dichloroethane	777000	4910000	10000000	100					
1,1-Dichloroethene	1050	57800	4720	100					
1,2-Dichloroethane	6930	376000	30700	400					
2-Butanone (MEK)	4660000	28600000	58600000	89600					
Acetone	776000	4950000	10200000	2500	15 J	130 (JSA)	24 (JA)		12 J
Cis-1,2-Dichloroethene	77700	498000	1020000	100				11	
Methylene Chloride	84100	2980000	378000	2000		17 (JSA)			
Toluene	1550000	9620000	19600000	50					
Trans-1,2-Dichloroethene	155000	996000	2030000	100					
Trichloroethene	46600	298000	256000	1					
Vinyl Chloride	370	23232	1897	10	2.6 J				

Notes:

' = feet
µg/kg = micrograms per kilogram
COPC = Constituent of potential concern
ESV = Ecological screening level
SSSL = Site-specific screening level
VOCs = Volatile Organic Compounds

Flags:

J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JA) = Validation Flag: Detection qualified as estimated because internal standard area was outside method-specific control limits.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JH) = Validation Flag: Detection qualified as estimated because holding time exceeded method criteria.
(JSA) = Validation Flag: Detection qualified as estimated because internal standard and surrogate recoveries were outside laboratory historical control limits.

> ESV

Table 5-14: Subsurface Soil Metal Constituents of Potential Concern Compared to SSSLs and ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	**Residential SSSL**	**Construction Worker SSSL**	**Groundskeeper SSSL**	**ESV**	**2004 RFI SWR-66-SB02 (6.5 - 7.5')**	**2004 RFI SWR-66-SB-18 (3 - 3.5')**	**2004 RFI SWR-66-SB-20 (3 - 3.5')**
Metals (mg/kg)							
Beryllium	9.6	9.6	17.0	1.1			**3.65**
Cadmium	6.25	21.3	22.7	1.6	0.953 J		
Copper	313	2040	4080	40		**58.4**	

Notes:

' = feet

COPC = Constituent of potential concern

ESV = Ecological Screening Value

mg/kg = milligrams per kilogram

RFI = RCRA Facility Investigation

SSSL = Site-Specific Screening Level

Flags:

J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.

> ESV

Table 5-15: Groundwater VOC Constituents of Potential Concern Compared to SSSLs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	PPMP-66-MW02 (5/13/04)	PPMP-66-MW05 (5/19/04)	PPMP-66-MW06 (5/17/04)	PPMP-66-MW10 (5/19/04)
VOCs (µg/L)							
1,1,1-Trichloroethane	305	1910	1910	0.66 J (JC)		58	
1,1-Dichloroethane	154	986	986	10		91	
1,1-Dichloroethene	0.0936	11.2	0.448	28		300	
1,2-Dichloroethane	0.448	76.9	3.08				
2-Butanone (MEK)	714	6100	6100				33
4-Methyl-2-Pentanone (MIBK)	58.4	805	805				5.6 J
Acetone	156	1020	1020	7.4 J	5.6 J		370
Carbon Disulfide	151	921	921				3.2 (JM)
Chloroethane	14.1	2390	95.5	4			
Cis-1,2-Dichloroethene	15.5	99.1	99.1	36		1600	
Methylene Chloride	7.85	602	37.5				1.2 J
Naphthalene	3.01	159	159				
O-Xylene	2800	15400	15400				
Toluene	259	1730	1730			2.6 J	
Trans-1,2-Dichloroethene	30.7	195	195	10		130	
Trichloroethene	9.15	57.5	24.2	74		13000	
Vinyl Chloride	0.0441	9.65	0.386	110		10	

Table 5-15: Groundwater VOC Constituents of Potential Concern Compared to SSSLs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	PPMP-66-MW12 (5/17/04)	PPMP-66-MW15 (5/13/04)	PPMP-66-MW16 (5/13/04)	PPMP-66-MW17 (5/20/04)
VOCs (µg/L)							
1,1,1-Trichloroethane	305	1910	1910				
1,1-Dichloroethane	154	986	986				
1,1-Dichloroethene	0.0936	11.2	0.448				
1,2-Dichloroethane	0.448	76.9	3.08				
2-Butanone (MEK)	714	6100	6100				
4-Methyl-2-Pentanone (MIBK)	58.4	805	805				
Acetone	156	1020	1020				
Carbon Disulfide	151	921	921				0.68 J
Chloroethane	14.1	2390	95.5				
Cis-1,2-Dichloroethene	15.5	99.1	99.1				
Methylene Chloride	7.85	602	37.5				
Naphthalene	3.01	159	159				0.46 J
O-Xylene	2800	15400	15400				
Toluene	259	1730	1730		0.25 J		
Trans-1,2-Dichloroethene	30.7	195	195				
Trichloroethene	9.15	57.5	24.2	5.1			
Vinyl Chloride	0.0441	9.65	0.386	0.21 J		0.26 J	

Table 5-15: Groundwater VOC Constituents of Potential Concern Compared to SSSLs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	PPMP-66-MW19 (5/20/04)	PPMP-66-MW21 (5/12/04)	PPMP-66-MW23 (5/13/04)	PPMP-66-MW24 (5/17/04)
VOCs (µg/L)							
1,1,1-Trichloroethane	305	1910	1910				11
1,1-Dichloroethane	154	986	986		0.29 J	0.75 J	41 E
1,1-Dichloroethene	0.0936	11.2	0.448			2.2	180
1,2-Dichloroethane	0.448	76.9	3.08				0.69 J
2-Butanone (MEK)	714	6100	6100				
4-Methyl-2-Pentanone (MIBK)	58.4	805	805				
Acetone	156	1020	1020			5.4 J	
Carbon Disulfide	151	921	921	1.3			0.33 J
Chloroethane	14.1	2390	95.5				
Cis-1,2-Dichloroethene	15.5	99.1	99.1		4.4	1.6	130
Methylene Chloride	7.85	602	37.5				
Naphthalene	3.01	159	159				
O-Xylene	2800	15400	15400				0.3 J
Toluene	259	1730	1730				3.7
Trans-1,2-Dichloroethene	30.7	195	195				8.2
Trichloroethene	9.15	57.5	24.2			1.4	5000
Vinyl Chloride	0.0441	9.65	0.386		0.48 J	9.2	1.2

Notes:
µg/L = micrograms per liter
COPC = Constituent of potential concern
SSSL = Site-Specific Screening Level
VOCs = Volatile Organic Compounds

Flags:
E = Lab Flag: Result is above the maximum calibration range.
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.
(JM) = Validation Flag: Detection qualified as estimated because the matrix spike and matrix spike duplicate recoveries were outside laboratory historical control limits.

> residential, construction worker, or groundskeeper SSSL

Table 5-16: Groundwater Metal Constituents of Potential Concern Compared to SSSLs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COPC	Residential SSSL	Construction Worker SSSL	Groundskeeper SSSL	PPMP-66-MW02 (5/13/04)	PPMP-66-MW15 (5/13/04)	PPMP-66-MW16 (5/13/04)	PPMP-66-MW21 (5/12/04)	PPMP-66-MW24 (5/17/04)
Total Metals (mg/L)								
Chromium	2.35	0.0283	0.0283		0.00798 J	0.00788 J		0.0233
Cobalt	0.0939	0.608	0.608		0.00933 J	0.0111 J	0.109	0.0824
Nickel	0.0313	0.202	0.202	0.0139 J		0.0206	0.0646	0.0221

Notes:
COPC = Constituent of potential concern
mg/L = milligrams per liter
SSSL = Site-Specific Screening Level

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.

> residential SSSL

Table 7-1: Summary of Constituents of Concern Exceeding SSSLs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Surface Soil COCs	**SWR-66-SB02 (0 - 1')**	**SWR-66-SB-24 (0 - 1')**
Metals (mg/kg)		
Barium		788
VOCs (µg/kg)		
Vinyl Chloride	2300	

Groundwater COCs	**PPMP-66-MW02 (residuum)**	**PPMP-66-MW06 (residuum)**	**PPMP-66-MW16 (residuum)**	**PPMP-66-MW21 (residuum)**	**PPMP-66-MW23 (transition)**	**PPMP-66-MW24 (transition)**	**PPMP-66-MW10 (bedrock)**	**PPMP-66-MW12 (bedrock)**
Metals (mg/L)								
Cobalt				0.109				
Nickel				0.0646				
VOCs (µg/L)								
1,1-Dichloroethene	28	300			2.2	180		
1,2-Dichloroethane						0.69 J		
Acetone							370	
cis-1,2-Dichloroethene	36	1600				130		
trans-1,2-Dichloroethene		130						
Trichloroethene	74	13000				5000		
Vinyl Chloride	110	10	0.26 J	0.48 J	9.2	1.2		0.21 J

Notes:

' = feet

µg/kg = micrograms per kiolgram

µg/L = micrograms per liter

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

COC = Constituent of concern

SSSL = Site-Specific Screening Level

VOC = Volatile Organic Compound

Flags:

J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.

Table 7-2: Comparison of EPCs to Cancer and Non-Cancer SSSLs for Constituents of Concern in Surface Soil
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

				Residential SSSL				**Construction Worker SSSL**				**Groundskeeper SSSL**			
COC	**MDC**	**95% UCL**	**EPC**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**
Metals (mg/kg)															
Barium	788	324	324	NA	NA	547	No	NA	NA	325	No	NA	NA	650	No
VOCs (µg/kg)															
Vinyl Chloride	2300	3596	2300	370	Yes	23317	No	23232	No	149226	No	1897	Yes	304363	No

Notes:
\> = greater than
% = percent
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
COC = Constituent of concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
MDC = Maximum Detected Concentration
NA = Not applicable
SSSL = Site-Specific Screening Level
VOC = Volatile organic compound
UCL = Upper confidence limit

Table 7-3: Comparison of EPCs to Cancer and Non-Cancer SSSLs for Constituents of Concern in Groundwater
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

				Residential SSSL				Construction Worker SSSL				Groundskeeper SSSL			
COC	**MDC**	**95% UCL**	**EPC**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**	**cancer**	**EPC > SSSL**	**noncancer**	**EPC > SSSL**
Total Metals (mg/L)															
Cobalt	0.109	0.0718	0.0718	NA	NA	0.0939	No	NA	NA	0.608	No	NA	NA	0.608	No
Nickel	0.0646	0.0388	0.0388	NA	NA	0.0313	Yes	NA	NA	0.202	No	NA	NA	0.202	No
VOCs (µg/L)															
1,1-Dichloroethene	300	216	216	NA	NA	13.8	Yes	NA	NA	86.3	Yes	NA	NA	86.3	Yes
1,2-Dichloroethane	0.69	1.85	0.69	0.448	Yes	4.88	No	76.9	No	300	No	3.08	No	300	No
Acetone	370	230	230	NA	NA	156	Yes	NA	NA	1020	No	NA	NA	1020	No
cis-1,2-Dichloroethene	1600	980	980	NA	NA	15.5	Yes	NA	NA	99.1	Yes	NA	NA	99.1	Yes
trans-1,2-Dichloroethene	130	80.0	80.0	NA	NA	30.7	Yes	NA	NA	195	No	NA	NA	195	No
Trichloroethene	13000	8547	8547	4.51	Yes	9.15	Yes	606	Yes	57.2	Yes	24.2	Yes	57.2	Yes
Vinyl Chloride	110	67.9	67.9	0.0441	Yes	4.64	Yes	9.65	Yes	29.8	Yes	0.386	Yes	29.8	Yes

Notes:
> = greater than
% = percent
µg/L = micrograms per liter
mg/L = milligrams per liter
COC = Constituent of concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
MDC = Maximum Detected Concentration
NA = Not applicable
SSSL = Site-Specific Screening Level
VOC = Volatile organic compound
UCL = Upper confidence limit

Table 7-4: Cancer Risk and Non-Cancer Hazard Measurements for Residents and Groundskeepers Exposed to Surface Soil
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

		Resident		Groundskeeper	
		Cancer	Noncancer	Cancer	Noncancer
COC	**EPC**	**ILCR**	**HI**	**ILCR**	**HI**
VOCs (µg/kg)					
Vinyl Chloride	2300	6.22E-06	NA	1.21E-06	NA
Total ILCR / HI		**6.22E-06**	**NA**	**1.21E-06**	**NA**

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

Table 7-5: Cancer Risk and Non-Cancer Hazard Measurements for Residents, Construction Workers, and Groundskeepers Exposed to Groundwater
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

		Resident		Construction Worker		Groundskeeper	
COC	**EPC**	**cancer ILCR**	**noncancer HI**	**cancer ILCR**	**noncancer HI**	**cancer ILCR**	**noncancer HI**
Total Metals (mg/L)							
Nickel	0.0388	NA	0.124	NA	NA	NA	NA
VOCs (µg/L)							
1,1-Dichloroethene	216	NA	1.565	NA	0.250	NA	0.250
1,2-Dichloroethane	0.69	1.54E-06	NA	NA	NA	NA	NA
Acetone	230	NA	0.147	NA	NA	NA	NA
cis-1,2-Dichloroethene	980	NA	6.32	NA	0.990	NA	0.990
trans-1,2-Dichloroethene	80.0	NA	0.261	NA	NA	NA	NA
Trichloroethene	8547	1.90E-03	93.4	1.41E-05	14.9	3.53E-04	14.9
Vinyl Chloride	67.9	1.54E-03	1.46	7.04E-06	0.228	1.76E-04	0.228
Total ILCR / HI		**3.44E-03**	**1.03E+02**	**2.11E-05**	**1.64E+01**	**5.29E-04**	**1.64E+01**

Notes:
µg/L = micrograms per liter
mg/L = milligrams per liter
COC = Constituent of 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
NA = Not applicable
VOC = Volatile organic compound

Table 7-6: Separation of Non-Cancer Hazard by Target Organ for the Resident, Construction Worker, and Groundskeeper Exposed to Groundwater

Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

		Resident Target Organ Hazard				Construction Worker Target Organ Hazard				Groundskeeper Target Organ Hazard			
COC	**EPC**	**Lung**	**Liver**	**Kidney**	**Erythrocyte**	**Lung**	**Liver**	**Kidney**	**Erythrocyte**	**Lung**	**Liver**	**Kidney**	**Erythrocyte**
Total Metals (mg/L)													
Nickel	0.0388	0.124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOCs (µg/L)													
1,1-Dichloroethene	216	NA	1.565	NA	NA	NA	0.25	NA	NA	NA	0.25	NA	NA
Acetone	230	NA	0.147	0.147	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	980	NA	NA	NA	6.32	NA	NA	NA	0.99	NA	NA	NA	0.99
trans-1,2-Dichloroethene	80.0	NA	0.261	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	8547	NA	93.4	93.4	NA	NA	14.9	14.9	NA	NA	14.9	14.9	NA
Vinyl Chloride	67.9	NA	1.46	NA	NA	NA	0.228	NA	NA	NA	0.228	NA	NA
Total HI		**0.12**	**96.83**	**93.55**	**6.32**	**0.00**	**15.38**	**14.90**	**0.99**	**0.00**	**15.38**	**14.90**	**0.99**

Notes:

µg/L = micrograms per liter
mg/L = milligrams per liter
COC = Constituent of concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
HI = Hazard index
NA = Not applicable
VOCs = Volatile organic compounds

Table 8-1: Summary of Constituents of Concern Exceeding ESVs
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

Surface Soil COCs	**PPMP-75-GP02 (0 - 1')**	**PPMP-75-GP03 (0 - 1')**	**SWR-66-SB02 (0 - 1')**	**SWR-66-SB-18 (0 - 1')**	**SWR-66-SB-24 (0 - 1')**
Metals (mg/kg)					
Barium					788
Selenium	1.6	1.4		1.28	
VOCs (µg/kg)					
cis-1,2-Dichloroethene			6800 (JC)		
trans-1,2-Dichloroethene			1400		
Trichloroethene			4.7 J		
Vinyl Chloride			2300		

Subsurface Soil COCs	**SWR-66-SB01 (6.5 - 7.5')**	**SWR-66-SB02 (6.5 - 7.5')**	**SWR-66-SB03 (5 - 6')**	**SWR-66-SB-18 (3 - 3.5')**	**SWR-66-SB-20 (3 - 3.5')**
Metals (mg/kg)					
Beryllium					3.65
Copper				58.4	
VOCs (µg/kg)					
cis-1,2-Dichloroethene		570 (JC)			
Trichloroethene	32	14000			
Vinyl Chloride			110		

Notes:
' = feet
COC = Constituent of concern
ESV = Ecological Screening Value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
VOCs = Volatile organic compounds

Flags:
J = Lab Flag: The analyte is positively identified and the concentration is less than the reporting limit but greater than the method detection limit.
(JC) = Validation Flag: Detection qualified as estimated because continuing calibration was outside method-specific control limits.

Table 8-2: Constituents of Ecological Concern in Surface and Subsurface Soil
Small Weapons Repair Shop, Parcel 66(7), McClellan, Anniston, Alabama

COCs	MDC	95% UCL	EPC	ESV	HQ	COEC
Surface Soil						
Metals (mg/kg)						
Barium	788	324	324	165	2.0	Yes
Selenium	1.6	1.25	1.25	0.81	1.5	Yes
VOCs (µg/kg)						
cis-1,2-Dichloroethene	6800	10635	6800	100	68	Yes
trans-1,2-Dichloroethene	1400	2188	1400	100	14	Yes
Trichloroethene	4.7	4.03	4.03	1	4.0	Yes
Vinyl Chloride	2300	3596	2300	10	230	Yes
Subsurface Soil						
Metals (mg/kg)						
Beryllium	3.65	1.74	1.74	1.1	1.6	Yes
Copper	58.4	41.8	41.8	40	1.0	Yes
VOCs (µg/kg)						
cis-1,2-Dichloroethene	570	292	292	100	2.9	Yes
Trichloroethene	14000	13936	13936	1	13936	Yes
Vinyl Chloride	110	110	110	10	11	Yes

Notes:

% = percent
COC = Constituent of concern
COEC = Constituent of ecological concern
EPC = Exposure point concentration (the lesser value of the 95 percent UCL or maximum detected concentration)
ESV = Ecological Screening Value
HQ = Hazard quotient
MDC = Maximum Detected Concentration
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
UCL = Upper confidence limit
VOCs = Volatile organic compounds

FIGURES

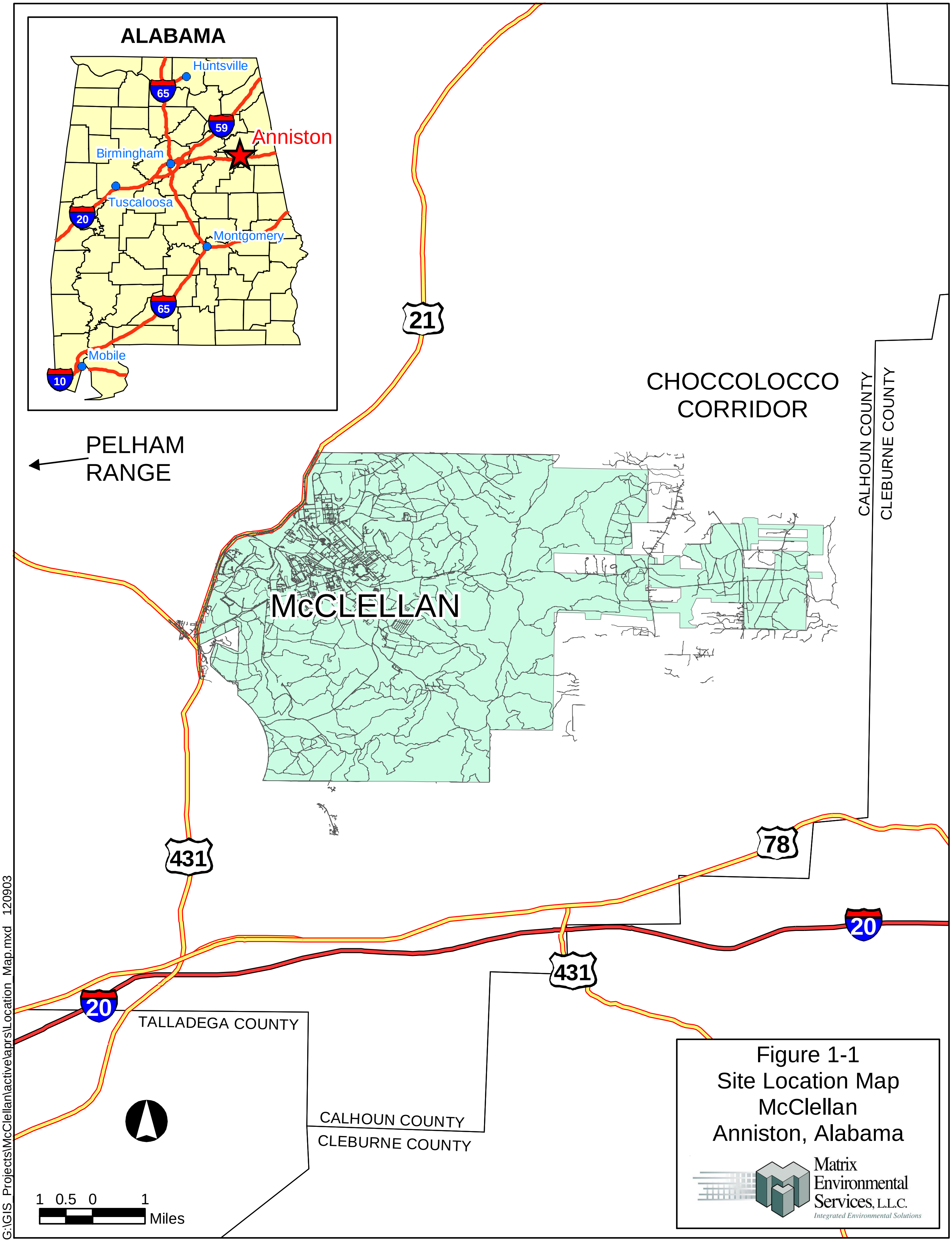


Figure 1-1
Site Location Map
McClellan
Anniston, Alabama

G:\GIS_Projects\McClellan\active\aprs\Location_Map.mxd 120903

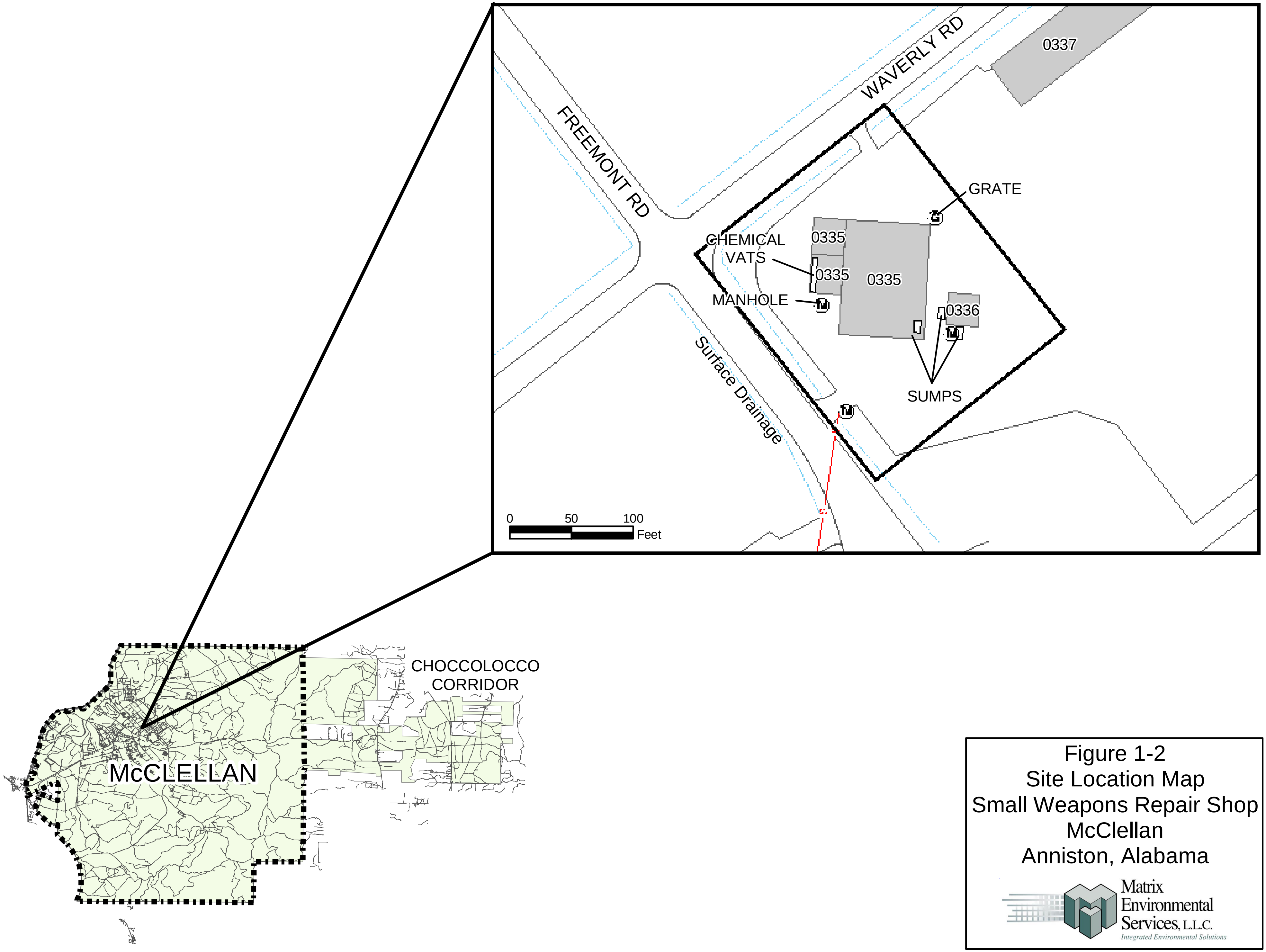
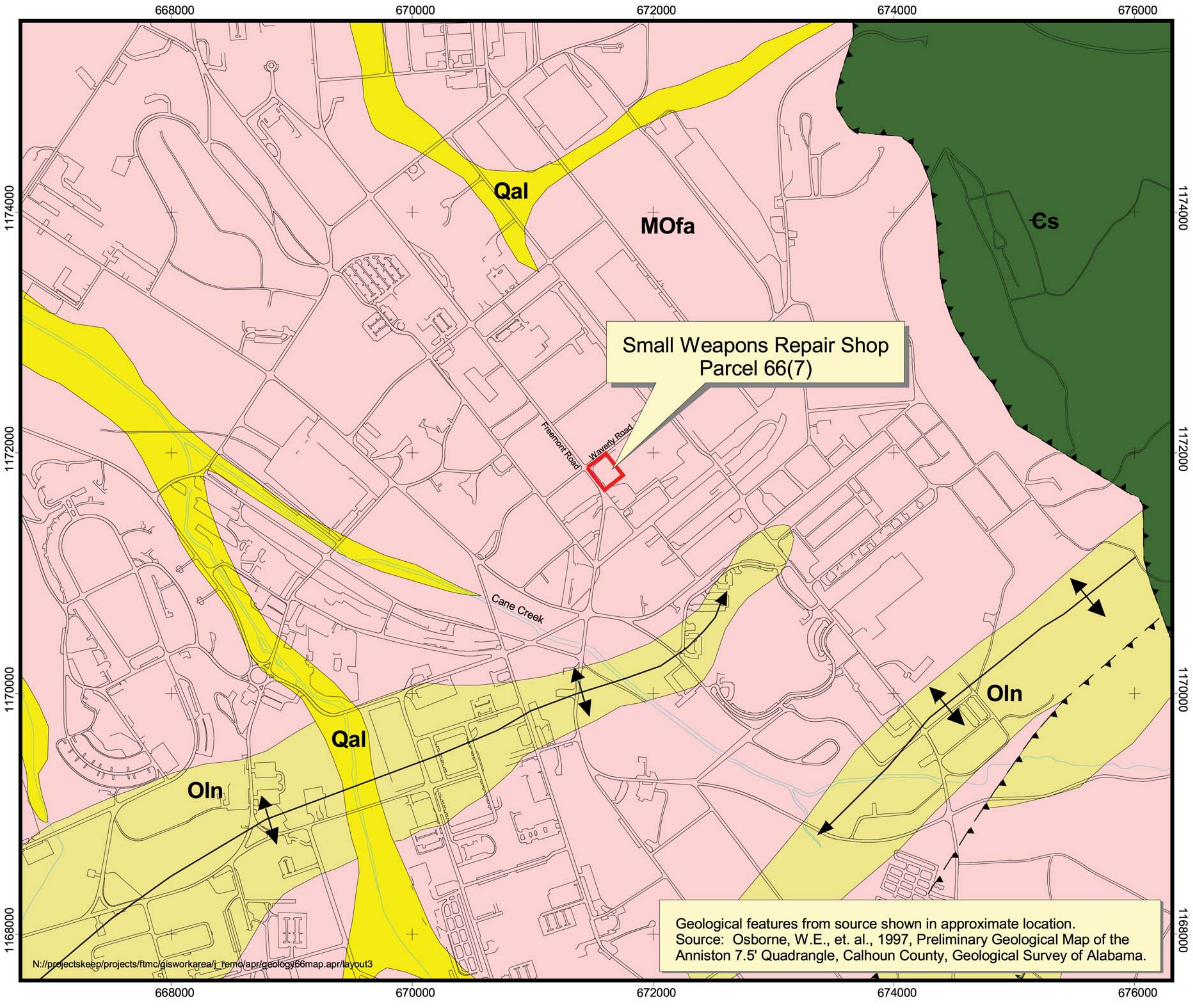


Figure 1-2
Site Location Map
Small Weapons Repair Shop
McClellan
Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\matrixden4\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_Location_Map.mxd, 12/22/2004, wilson_wheeler



Geological features from source shown in approximate location.
Source: Osborne, W.E., et. al., 1997, Preliminary Geological Map of the Anniston 7.5' Quadrangle, Calhoun County, Geological Survey of Alabama.

Figure 2-1

Site Geologic Map
Small Weapons Repair Shop, Parcel 66(7)
Fort McClellan
Calhoun County, Alabama

Legend

- 🟥 Parcel Boundary
- ═ Roads
- — Streams

Geology

Qal	Quaternary - Alluvium
MOfa	Mississippian/Ordovician Floyd and Athens Shale, Undifferentiated
Oln	Ordovician Little Oak and Newala Limestones, Undifferentiated
Єs	Cambrian Shady Dolomite

- ▲ Thrust Fault
- ▲ ▲ Inferred Thrust Fault
- ↕ Plunging Anticline

800 0 800 Feet
NAD 83 State Plane Coordinates

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

DWG. NO.: ...\796887es.431
PROJ. NO.: 796887
INITIATOR: J. REMO
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 05/07/02
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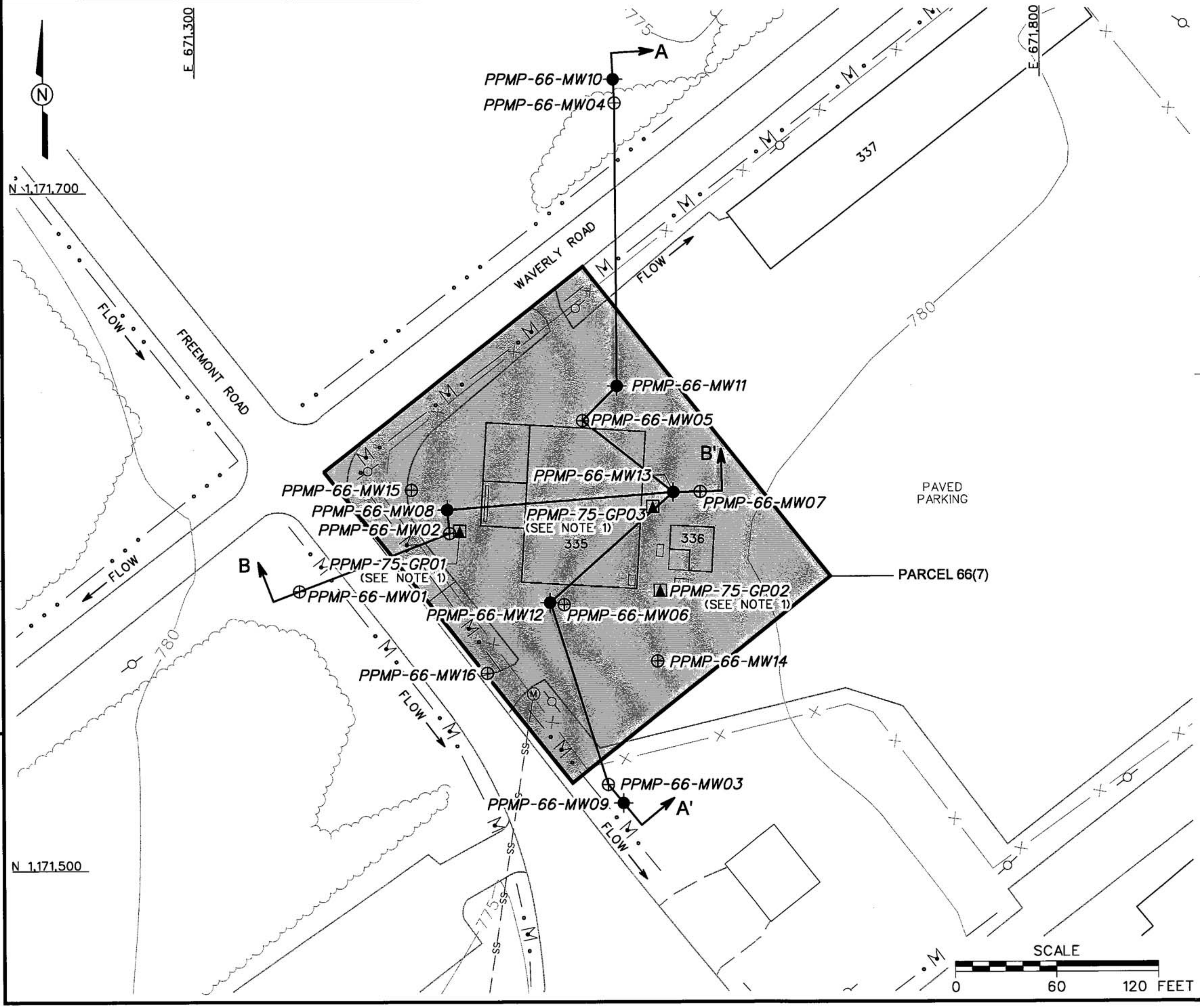

LEGEND

═ ═	UNIMPROVED ROADS AND PARKING
═	PAVED ROADS AND PARKING
▭	BUILDING
775	TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
	TREES / TREELINE
▨	PARCEL BOUNDARY
	CULVERT WITH HEADWALL
— • • • —	SURFACE DRAINAGE / CREEK
— • M • —	MANMADE SURFACE DRAINAGE FEATURE
← FLOW	SURFACE WATER FLOW DIRECTION
—x—	FENCE
	UTILITY POLE
— — SS — —	SANITARY SEWER LINE
Ⓜ	MANHOLE
●	BEDROCK MONITORING WELL AND GROUNDWATER SAMPLE LOCATION
⊕	RESIDUUM MONITORING WELL AND GROUNDWATER SAMPLE LOCATION
▲	GROUNDWATER, SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
A A'	CROSS SECTION LOCATION

NOTE:

1. RESIDUUM MONITORING WELL LOCATION.

FIGURE 2-2
CROSS SECTION LOCATION MAP
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

DWG. NO.: ...\796887es.380
PROJ. NO.: 796887
INITIATOR: J. REMO
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
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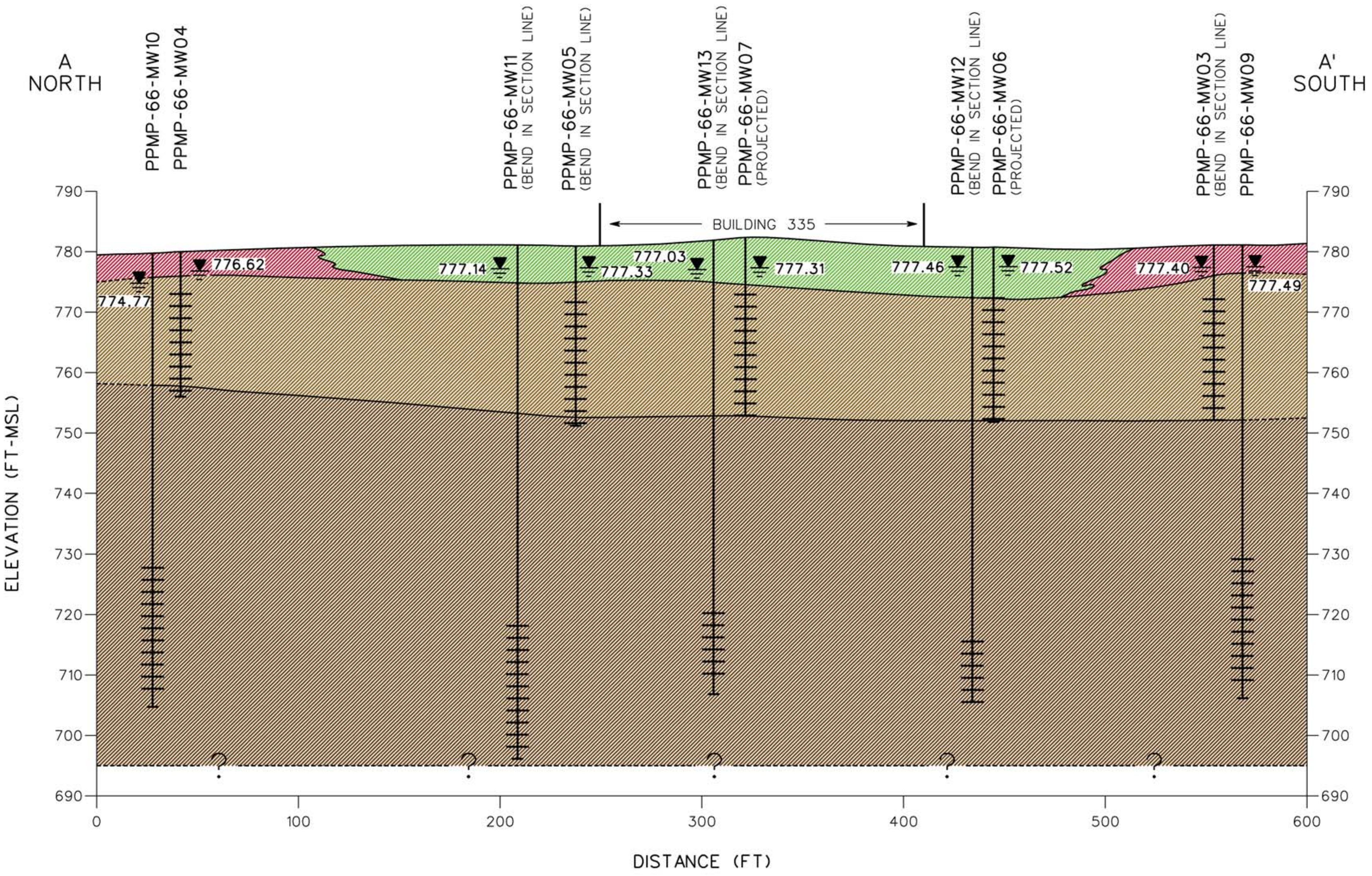


LEGEND

┼ SCREEN INTERVAL

▼ WATER TABLE (JANUARY 2002)

774.77 GROUNDWATER ELEVATION (FT MSL)

---- ? ----- CONTACT DASHED WHERE INFERRED

🟩 CLAY

🟥 SILTY CLAY

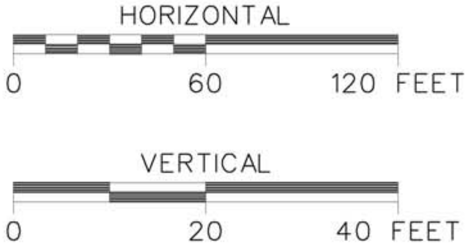
▨ WEATHERED SHALE

▨ SHALE

NOTES:

1. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
2. DASHED WHERE INFERRED.

FIGURE **2-3**
GEOLOGIC CROSS SECTION A-A'
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)



Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

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INITIATOR: J. REMO
PROJ. MGR.: J. YACOUB
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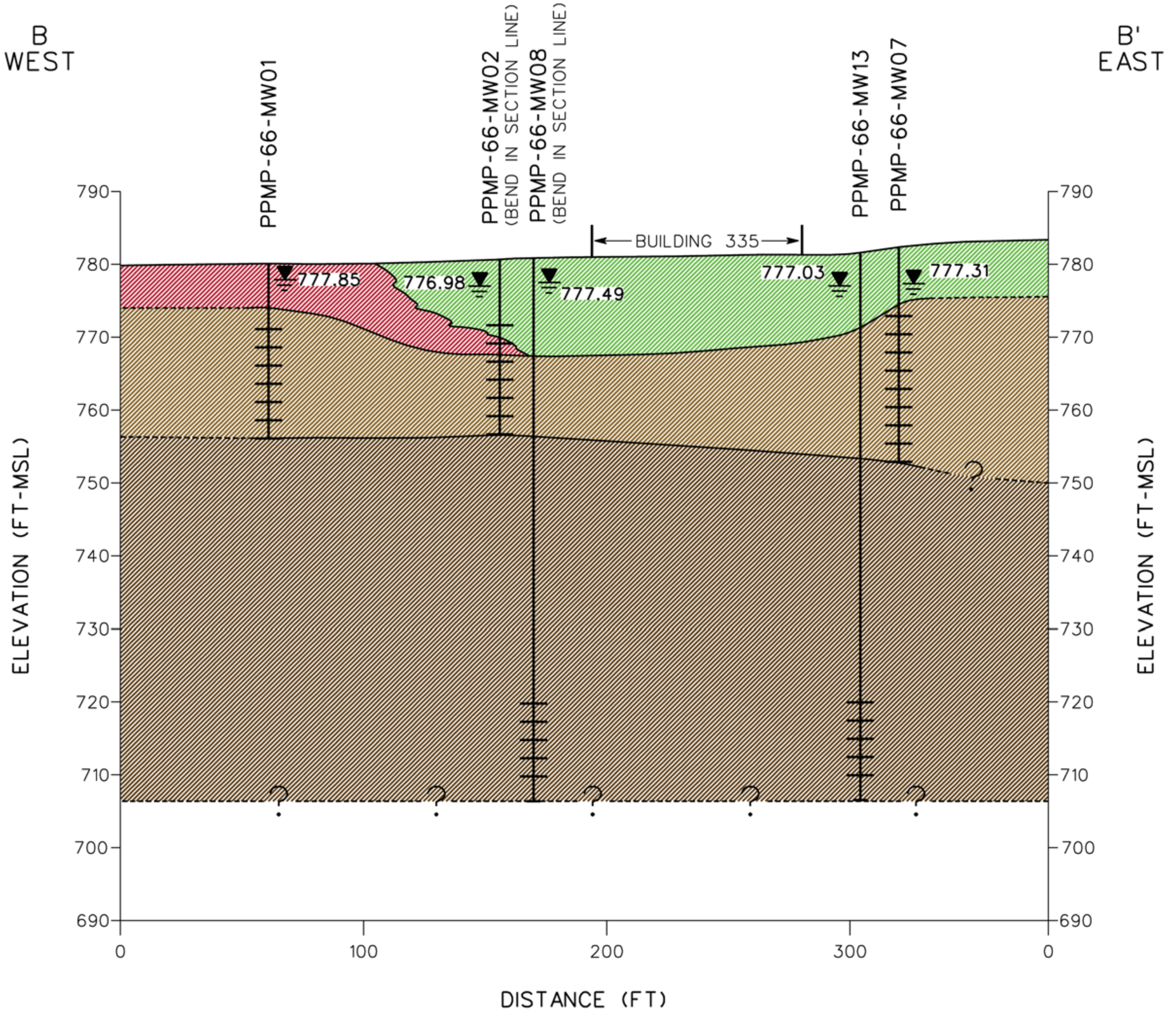

LEGEND

╪ SCREEN INTERVAL

▼ WATER TABLE (JANUARY 2002)

776.98 GROUNDWATER ELEVATION (FT MSL)

---- ? ---- CONTACT DASHED WHERE INFERRED

🟩 CLAY

🟥 SILTY CLAY

▨ WEATHERED SHALE

▨ SHALE

NOTES:

1. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
2. DASHED WHERE INFERRED.

HORIZONTAL
0 60 120 FEET

VERTICAL
0 20 40 FEET

FIGURE **2-4**
GEOLOGIC CROSS SECTION B-B'
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

DWG. NO.: ...\796887es.383
PROJ. NO.: 796887
INITIATOR: J. REMO
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
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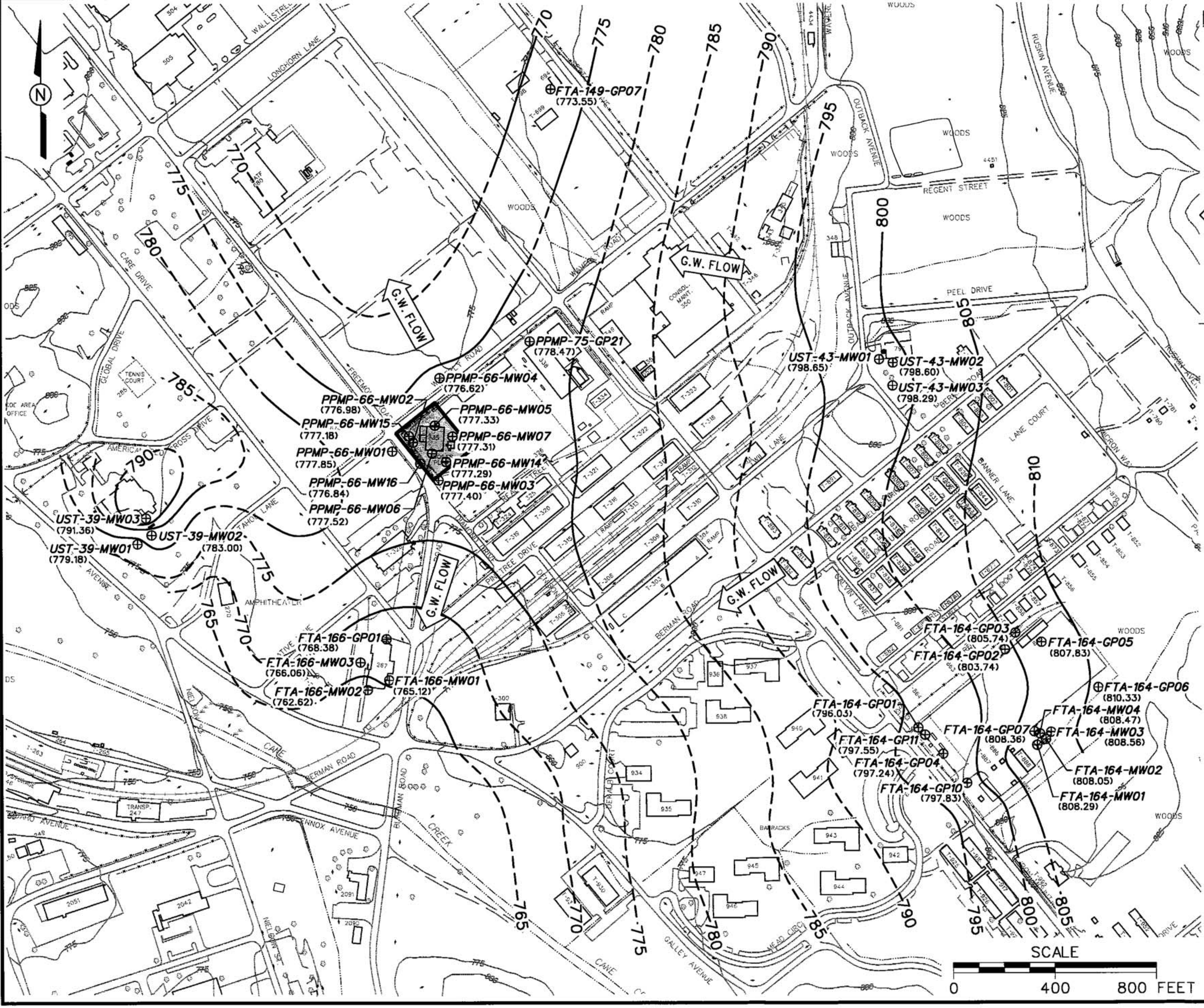

LEGEND

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- 775 TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 25 FOOT)
- 776 GROUNDWATER ELEVATION CONTOUR
- (777.33) GROUNDWATER ELEVATION (FT MSL) (JANUARY 2002)
- G.W. FLOW GROUNDWATER FLOW DIRECTION
- ▨ PARCEL BOUNDARY
- CULVERT WITH HEADWALL
- SURFACE DRAINAGE / CREEK
- M MANMADE SURFACE DRAINAGE FEATURE
- FENCE
- UTILITY POLE
- ⊕ RESIDUUM MONITORING WELL LOCATION

FIGURE 2-5
GROUNDWATER ELEVATION MAP
RESIDUUM MONITORING WELLS
JANUARY 2002
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7) AND ADJACENT AREAS

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

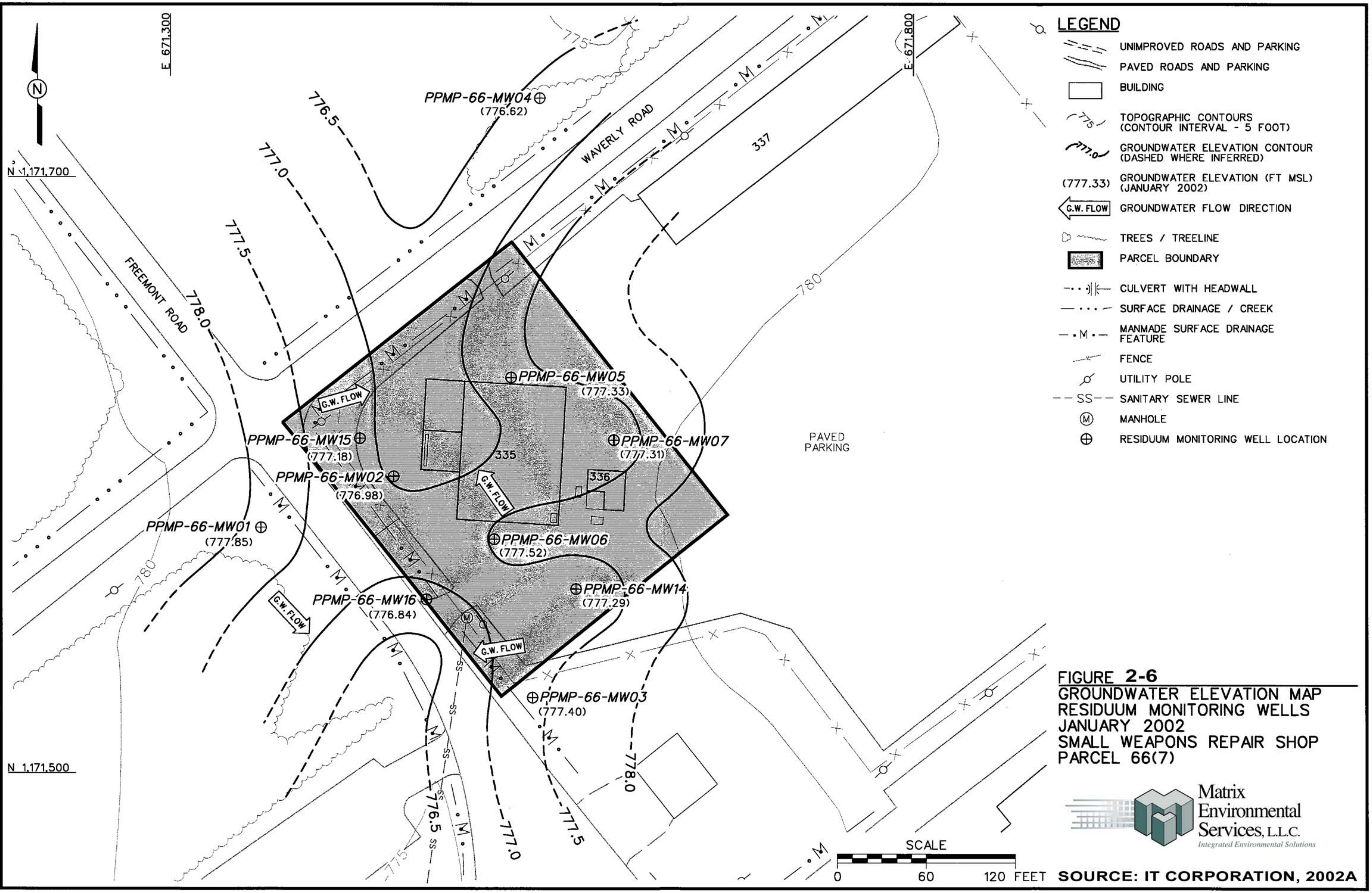

FIGURE 2-6
GROUNDWATER ELEVATION MAP
RESIDUUM MONITORING WELLS
JANUARY 2002
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)

SOURCE: IT CORPORATION, 2002A

DWG. NO.: ...\796887es.426
PROJ. NO.: 796887
INITIATOR: J. REMO
PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 03/26/02
DRAWN BY: D. BOMAR
05/16/02
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STARTING DATE: 03/26/02
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INITIATOR: J. REMO
DWG. NO.: ...\796887es.423
DRAWN BY: D. BOMAR
DRAWN BY:
ENGR. CHCK. BY: S. MORAN
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PROJ. NO.: 796887

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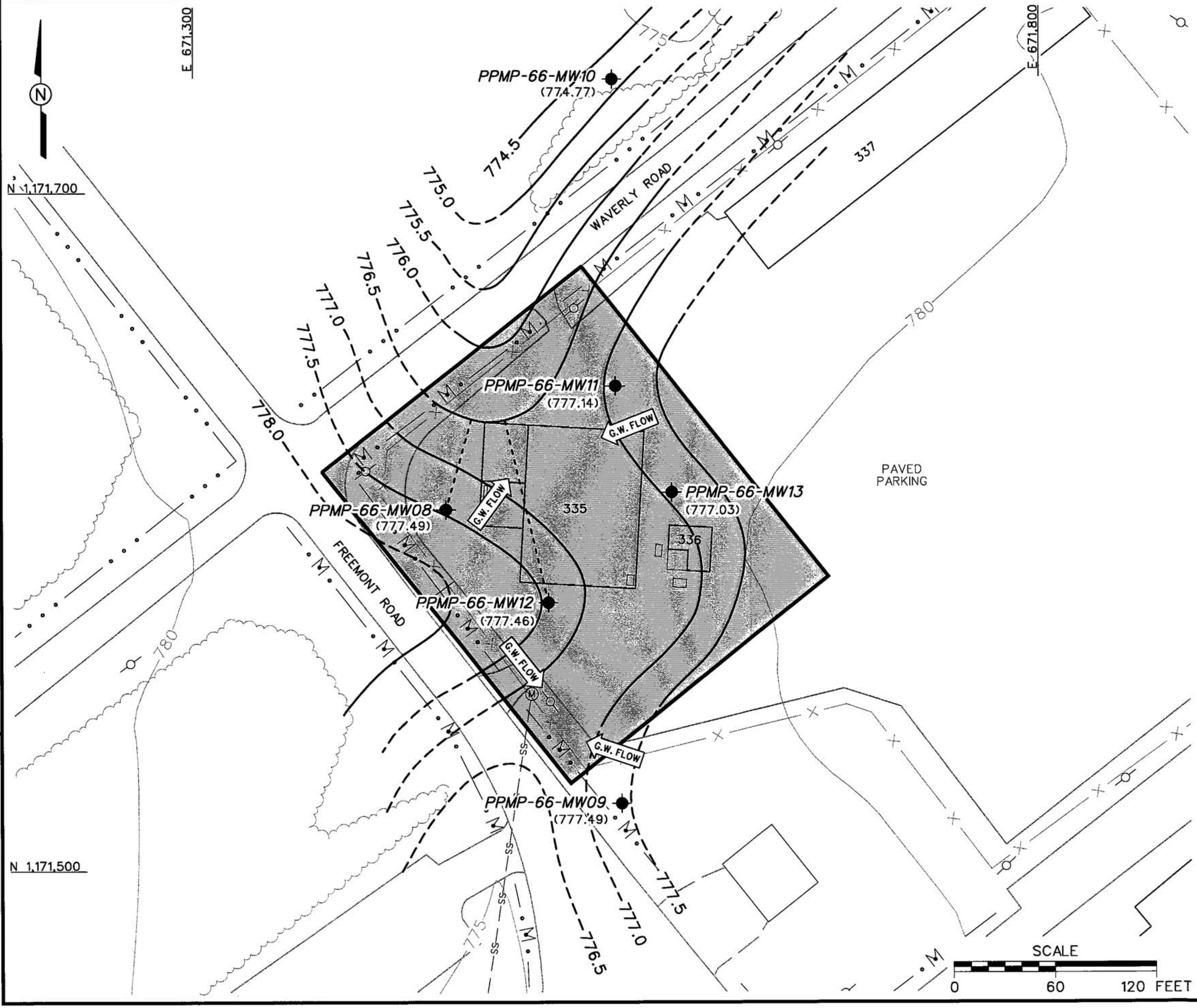


LEGEND

═ ═	UNIMPROVED ROADS AND PARKING
═	PAVED ROADS AND PARKING
☐	BUILDING
775	TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
777	GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
(777.03)	GROUNDWATER ELEVATION (FT MSL) (JANUARY 2002)
G.W. FLOW	GROUNDWATER FLOW DIRECTION
	TREES / TREELINE
▨	PARCEL BOUNDARY
	CULVERT WITH HEADWALL
— · · · —	SURFACE DRAINAGE / CREEK
— · M · —	MANMADE SURFACE DRAINAGE FEATURE
—×—	FENCE
	UTILITY POLE
— — SS — —	SANITARY SEWER LINE
Ⓜ	MANHOLE
●	BEDROCK MONITORING WELL LOCATION
- - - -	LINE OF TRANSECT FOR HORIZONTAL HYDRAULIC GRADIENTS

FIGURE 2-7
GROUNDWATER ELEVATION MAP
BEDROCK MONITORING WELLS
JANUARY 2002
SMALL WEAPONS REPAIR SHOP
PARCEL 66(7)

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

SOURCE: IT CORPORATION, 2002A

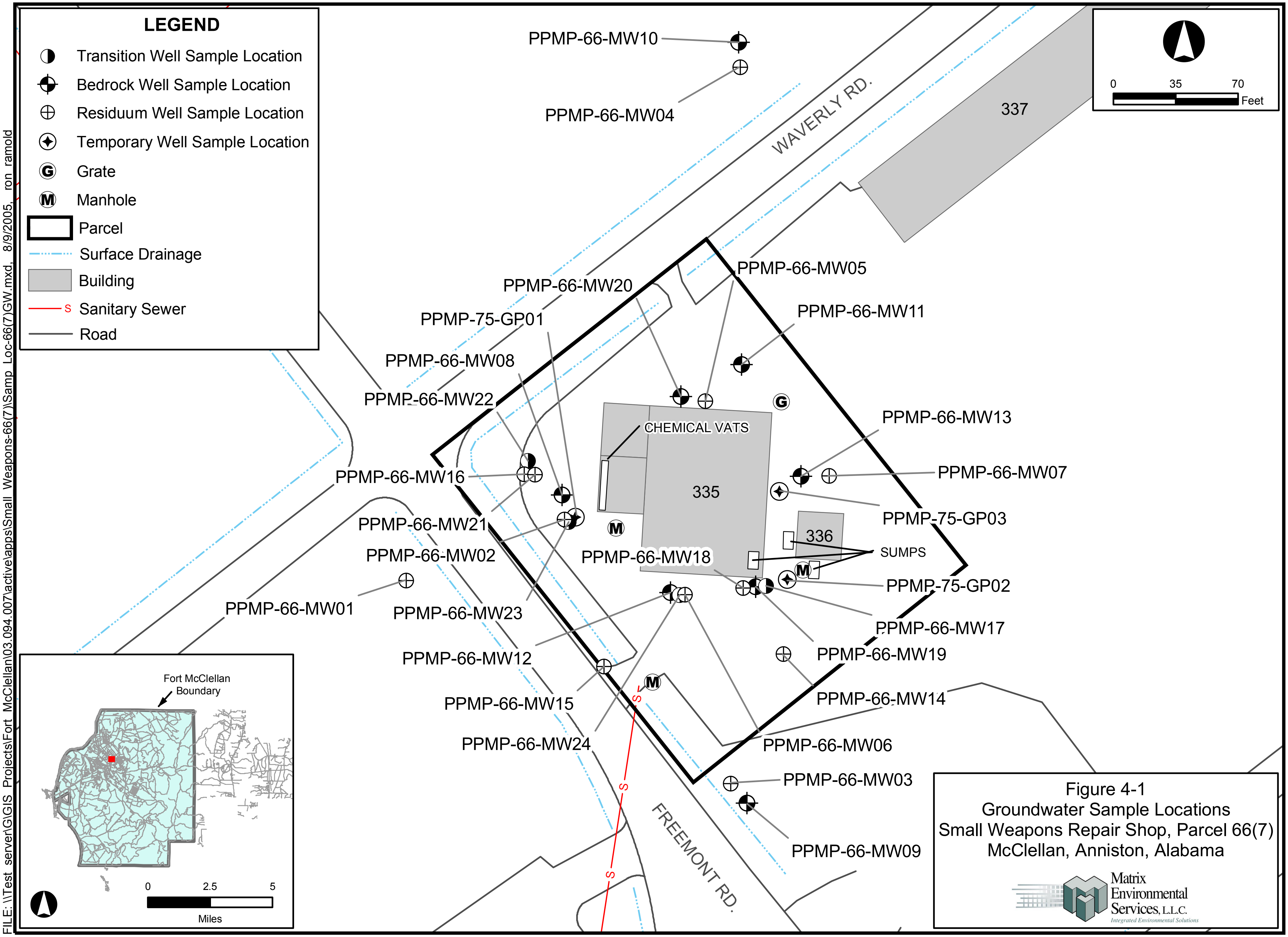


Figure 4-1
Groundwater Sample Locations
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test server\G\GIS Projects\Fort McClellan\03.094.007\active\apps\Small Weapons-66(7)\Samp Loc-66(7)GW.mxd, 8/9/2005, ron ramold

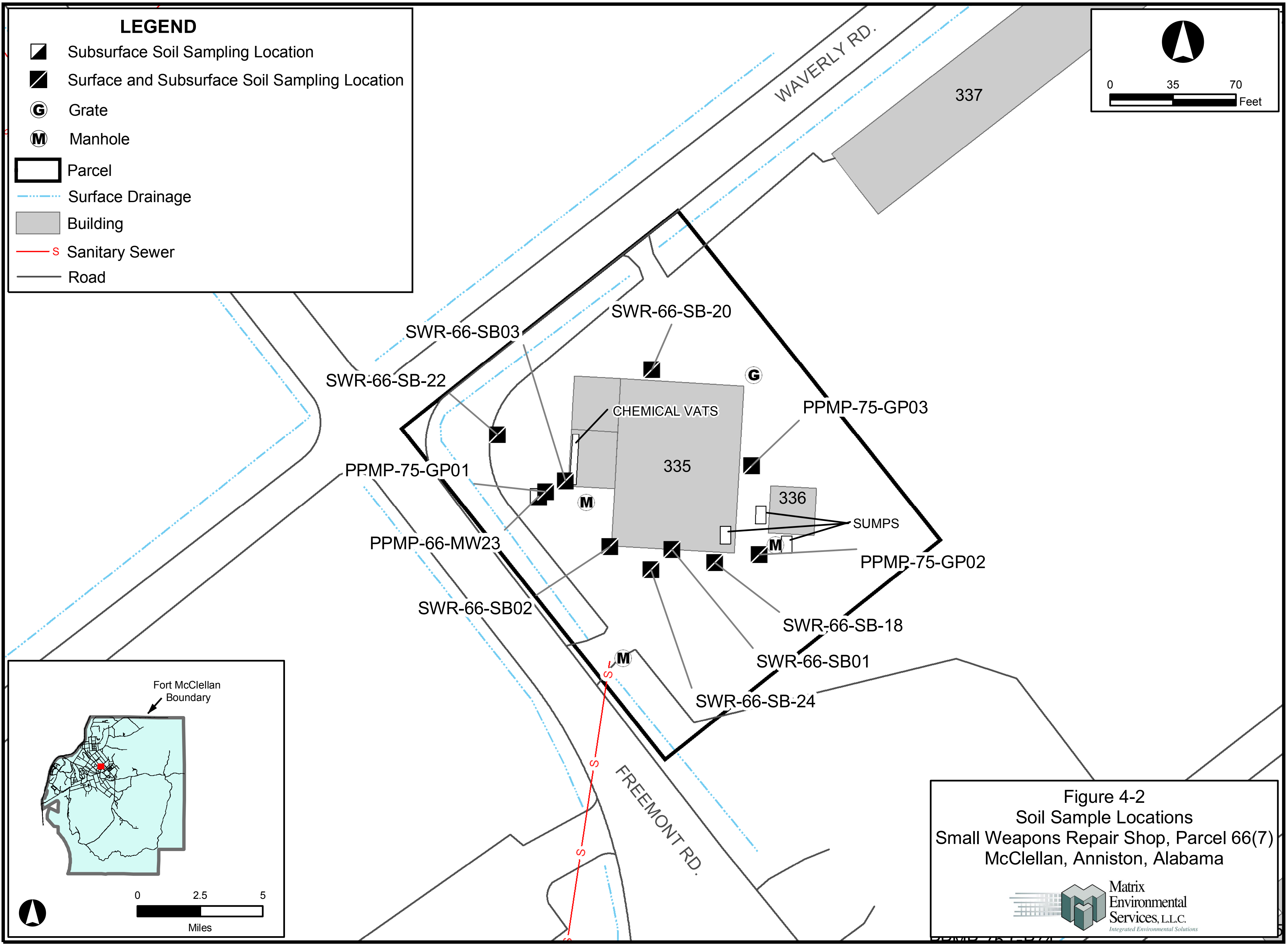


Figure 4-2
Soil Sample Locations
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\Samp_Loc-66(7)Soil.mxd, 8/30/2005, ron_ramold

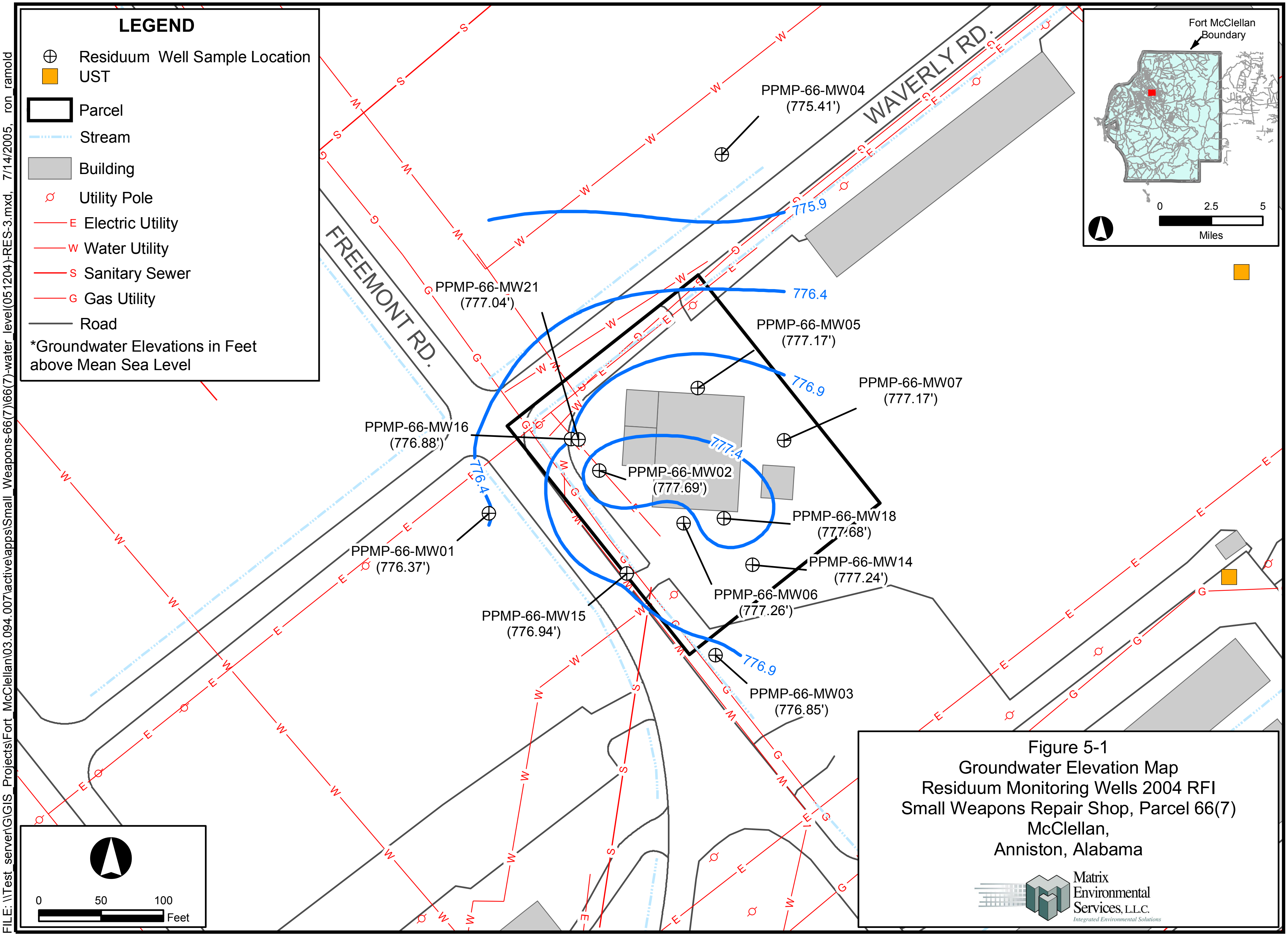


Figure 5-1
Groundwater Elevation Map
Residuum Monitoring Wells 2004 RFI
Small Weapons Repair Shop, Parcel 66(7)
McClellan,
Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)-water_level(051204)-RES-3.mxd, 7/14/2005, ron_ramold

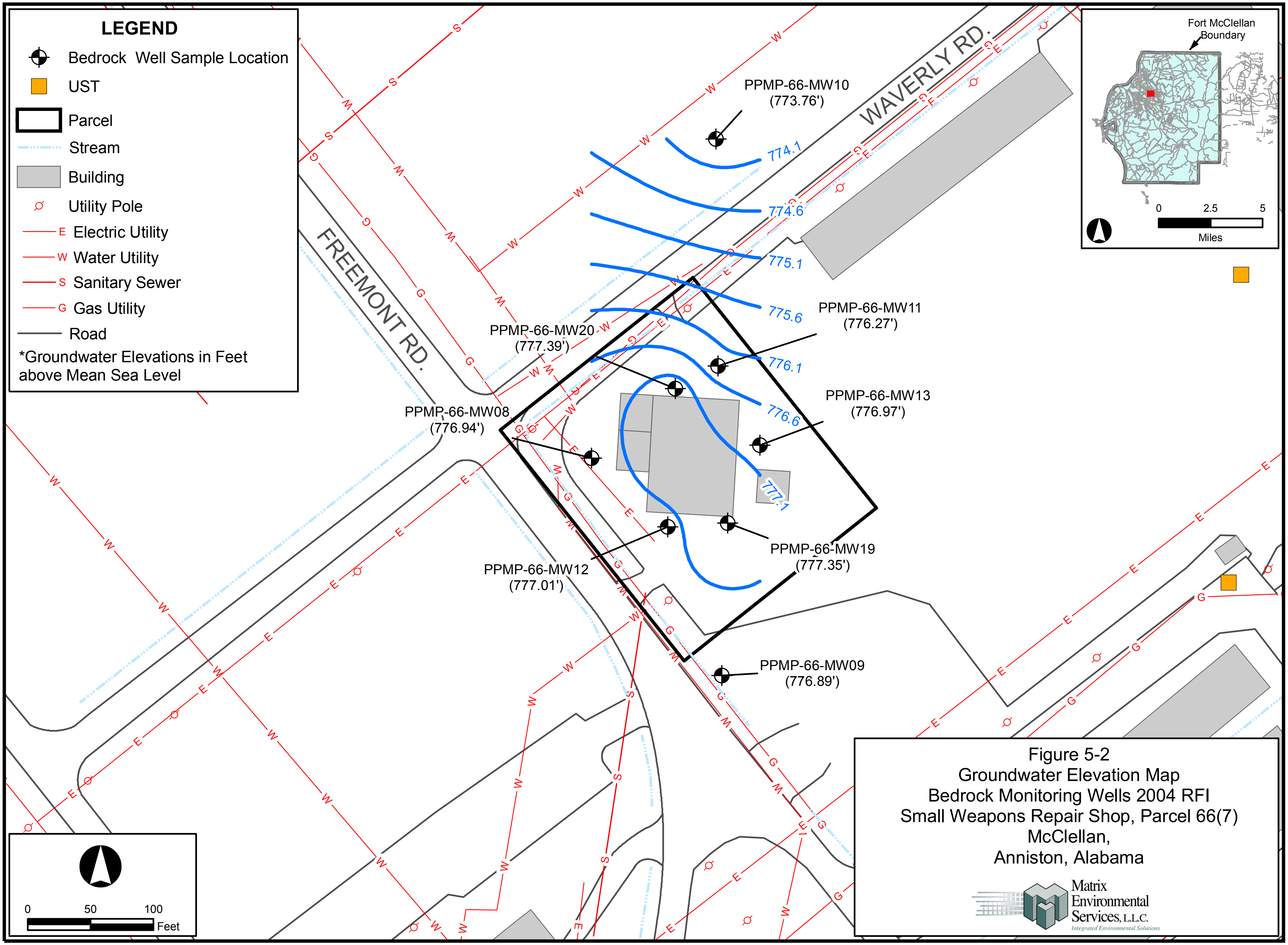


Figure 5-2
Groundwater Elevation Map
Bedrock Monitoring Wells 2004 RFI
Small Weapons Repair Shop, Parcel 66(7)
McClellan,
Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)-water_level(051204)-BR2.mxd, 7/14/2005, ron_ramold

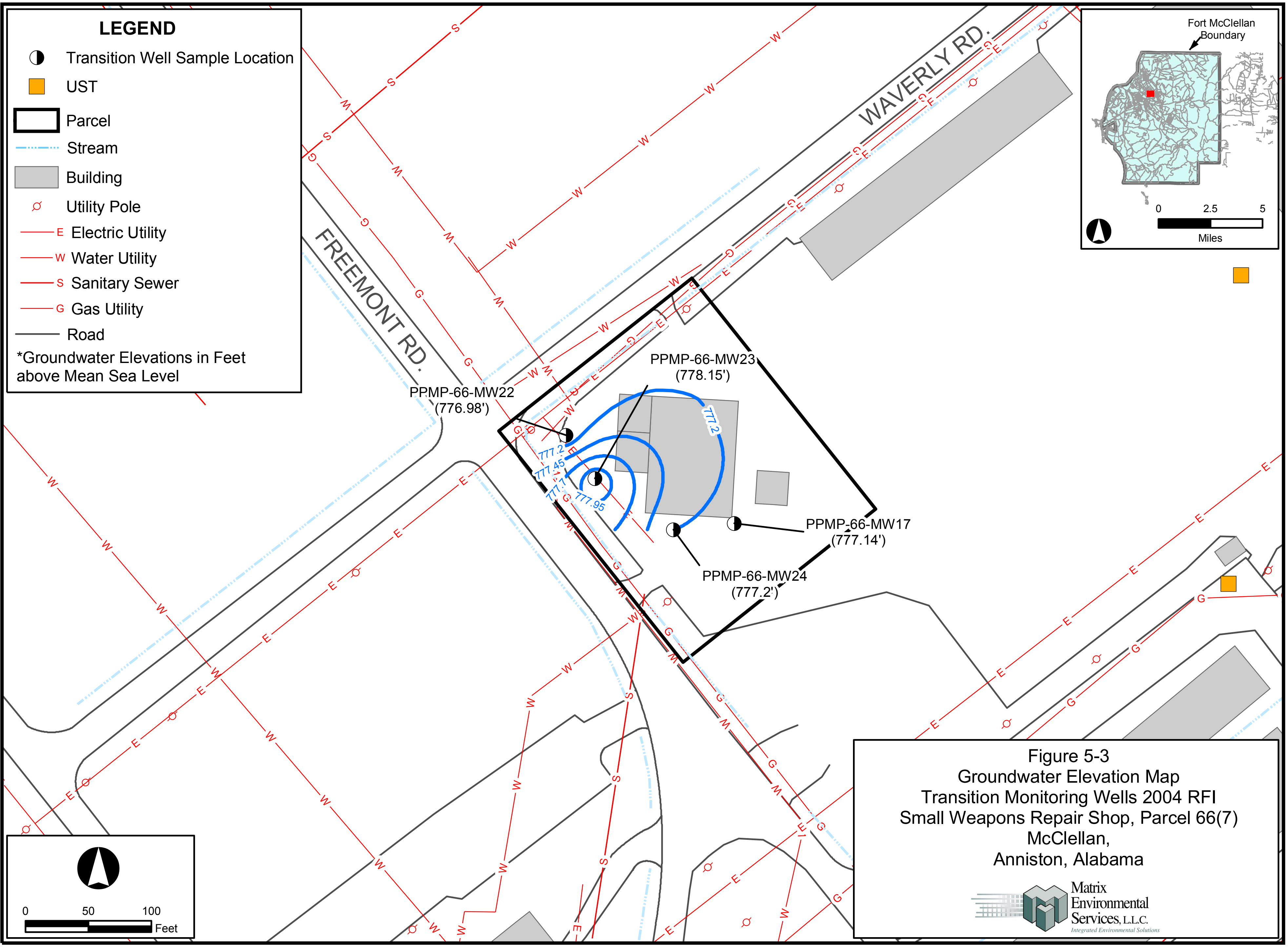
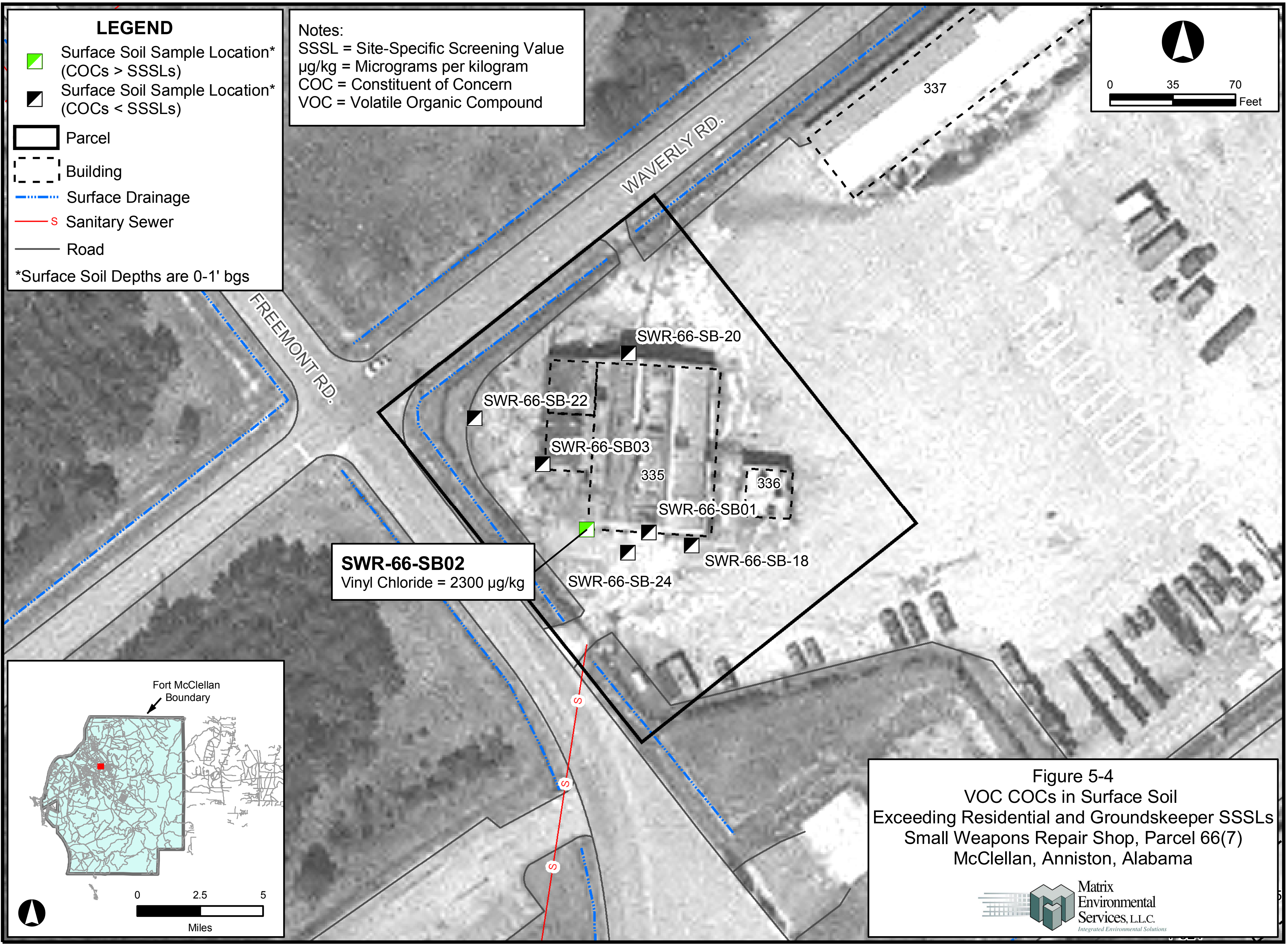


Figure 5-3
Groundwater Elevation Map
Transition Monitoring Wells 2004 RFI
Small Weapons Repair Shop, Parcel 66(7)
McClellan,
Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)-water_level(051204)-TRANS.mxd, 7/14/2005, ron_ramold



LEGEND

🟩 Surface Soil Sample Location* (COCs > SSSLs)

◩ Surface Soil Sample Location* (COCs < SSSLs)

▭ Parcel

⬚ Building

Surface Drainage

S Sanitary Sewer

Road

*Surface Soil Depths are 0-1' bgs

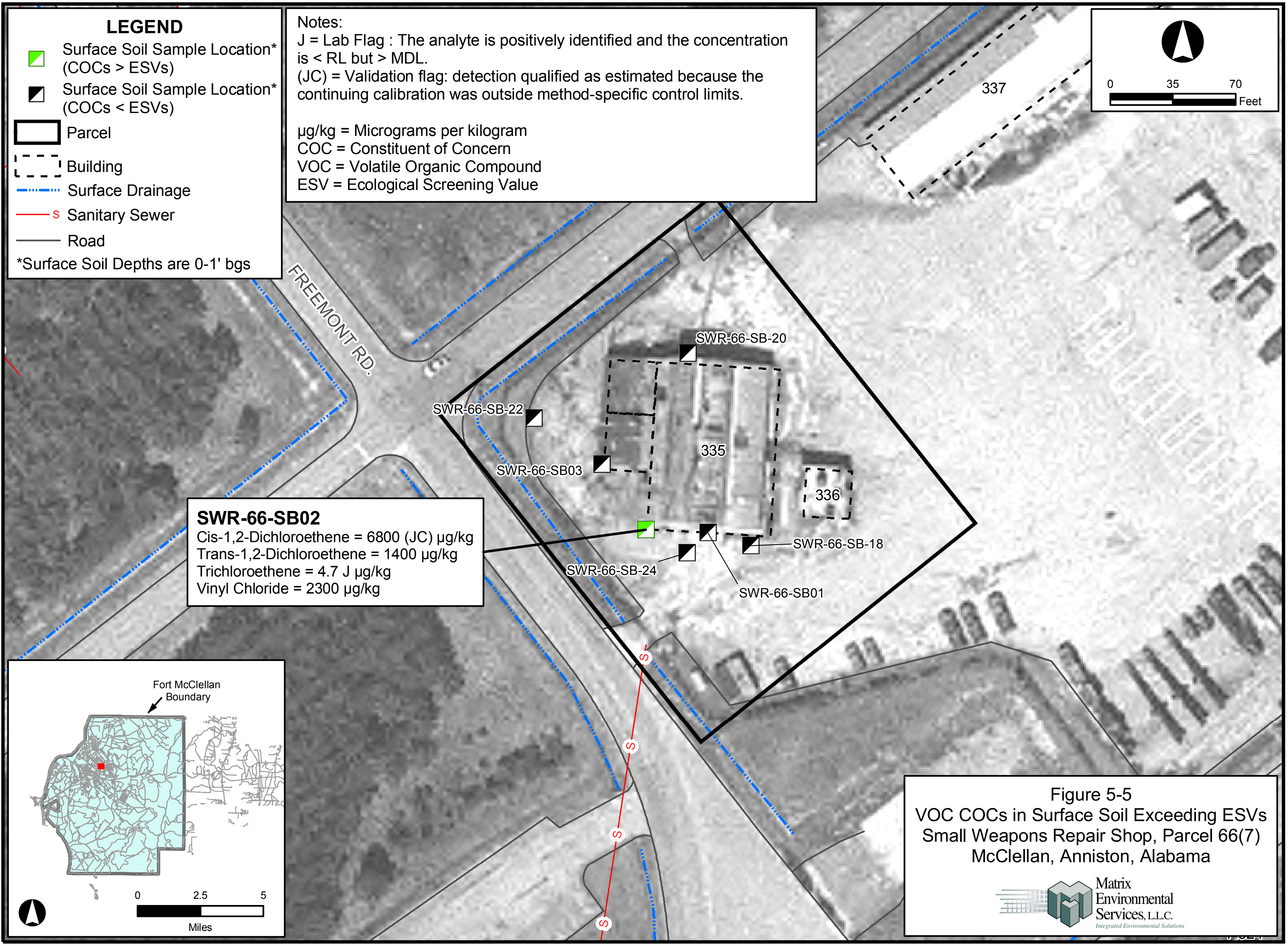
Notes:
SSSL = Site-Specific Screening Value
µg/kg = Micrograms per kilogram
COC = Constituent of Concern
VOC = Volatile Organic Compound

SWR-66-SB02
Vinyl Chloride = 2300 µg/kg

Figure 5-4
VOC COCs in Surface Soil
Exceeding Residential and Groundskeeper SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_Soil_HH.mxd, 8/9/2005, ron_ramold



LEGEND

🟩 Surface Soil Sample Location* (COCs > ESVs)
◩ Surface Soil Sample Location* (COCs < ESVs)
▭ Parcel
⬚ Building
-·-·· Surface Drainage
—S Sanitary Sewer
— Road
*Surface Soil Depths are 0-1' bgs

Notes:
J = Lab Flag : The analyte is positively identified and the concentration is < RL but > MDL.
(JC) = Validation flag: detection qualified as estimated because the continuing calibration was outside method-specific control limits.

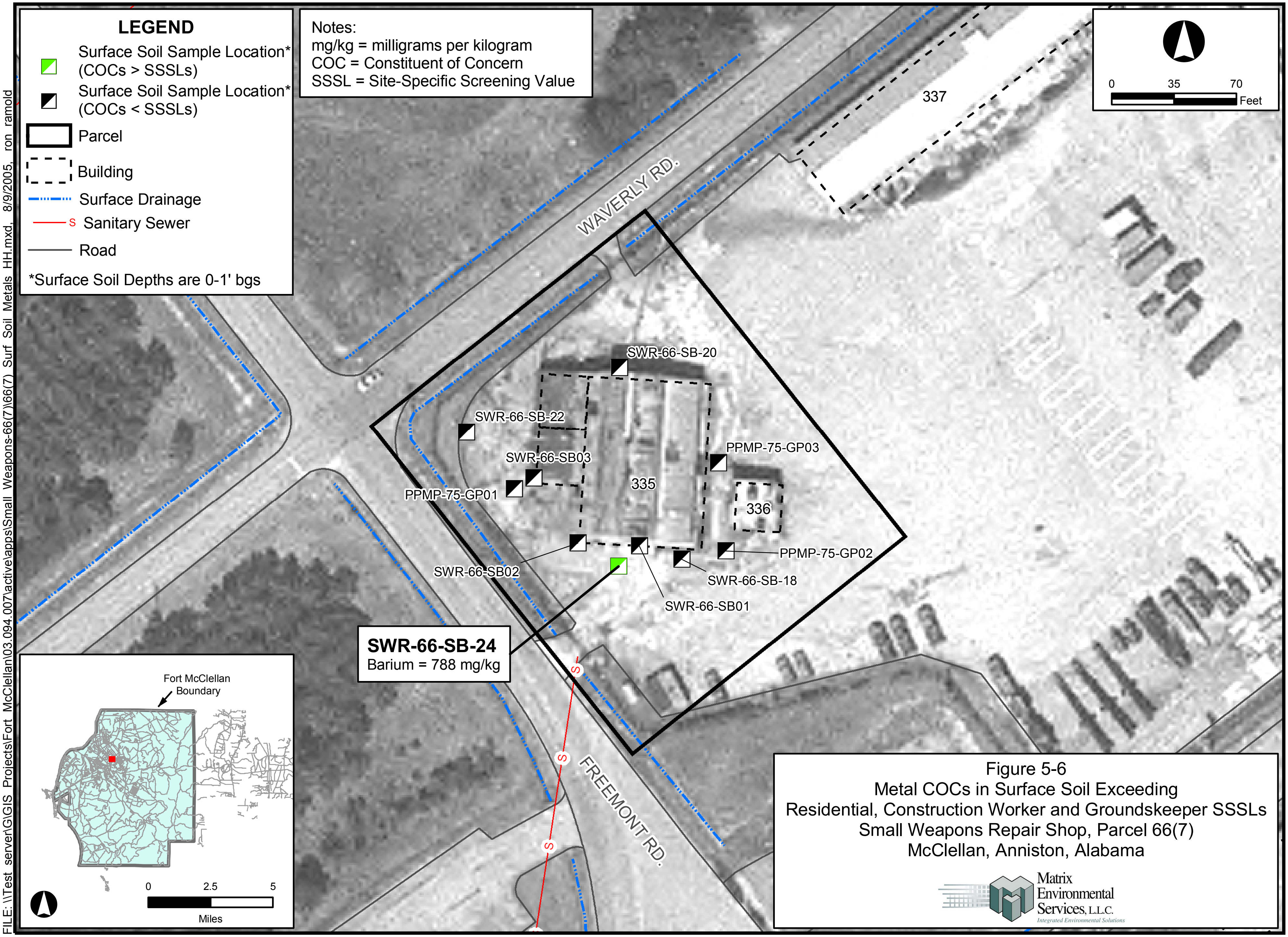
µg/kg = Micrograms per kilogram
COC = Constituent of Concern
VOC = Volatile Organic Compound
ESV = Ecological Screening Value

SWR-66-SB02
Cis-1,2-Dichloroethene = 6800 (JC) µg/kg
Trans-1,2-Dichloroethene = 1400 µg/kg
Trichloroethene = 4.7 J µg/kg
Vinyl Chloride = 2300 µg/kg

Figure 5-5
VOC COCs in Surface Soil Exceeding ESVs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\activeapps\Small_Weapons-66(7)\66(7)_Surf_Soil_ESV.mxd, 8/9/2005, ron_ramold

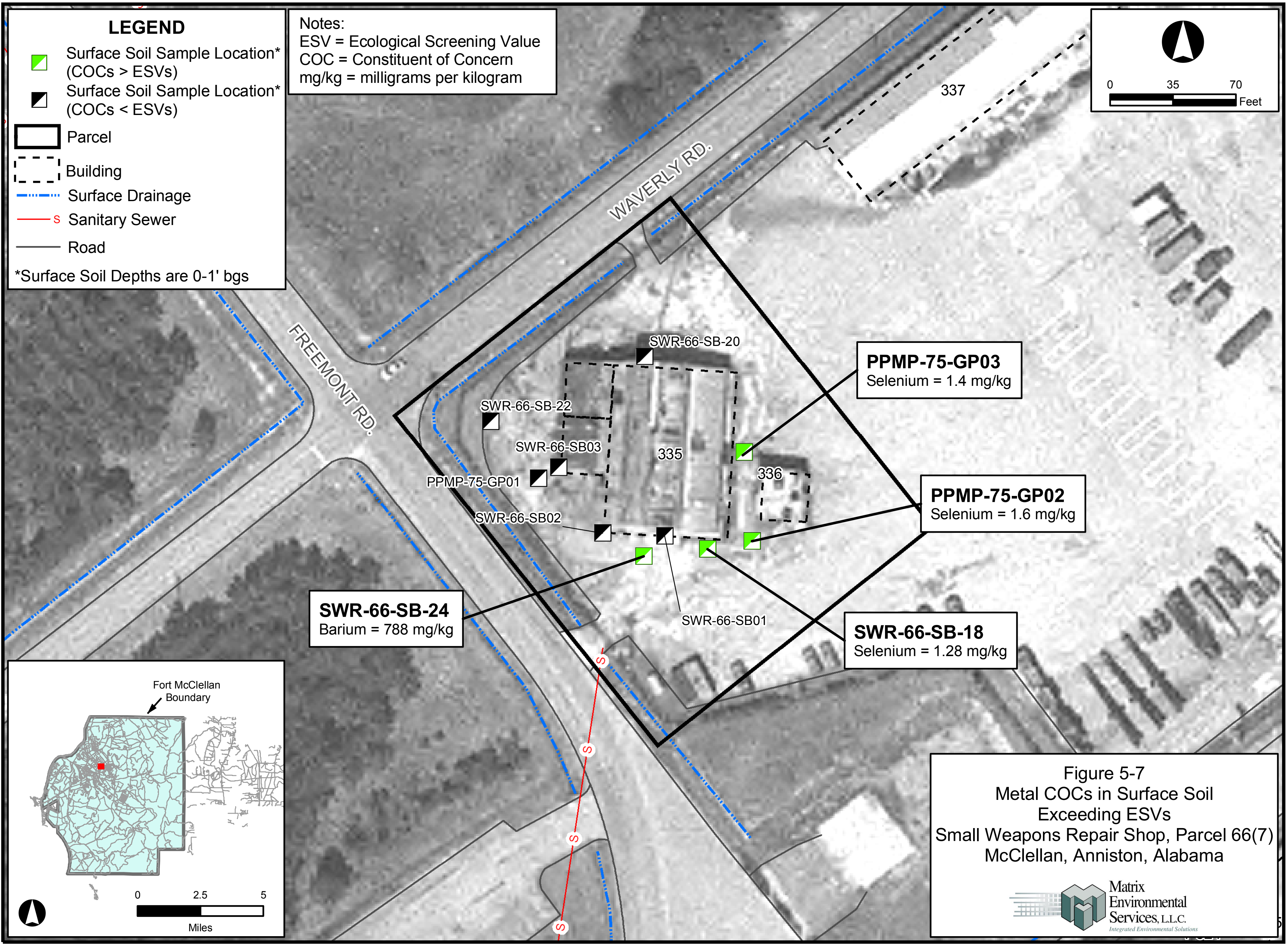


Notes:
mg/kg = milligrams per kilogram
COC = Constituent of Concern
SSSL = Site-Specific Screening Value

Figure 5-6
Metal COCs in Surface Soil Exceeding
Residential, Construction Worker and Groundskeeper SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test server\G\GIS Projects\Fort McClellan\03.094.007\active\apps\Small Weapons-66(7)\66(7) Surf Soil Metals HH.mxd, 8/9/2005, ron ramold



Notes:
ESV = Ecological Screening Value
COC = Constituent of Concern
mg/kg = milligrams per kilogram

Figure 5-7
Metal COCs in Surface Soil
Exceeding ESVs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_Surf_Soil_Metals_ECO.mxd, 8/9/2005, ron_ramold

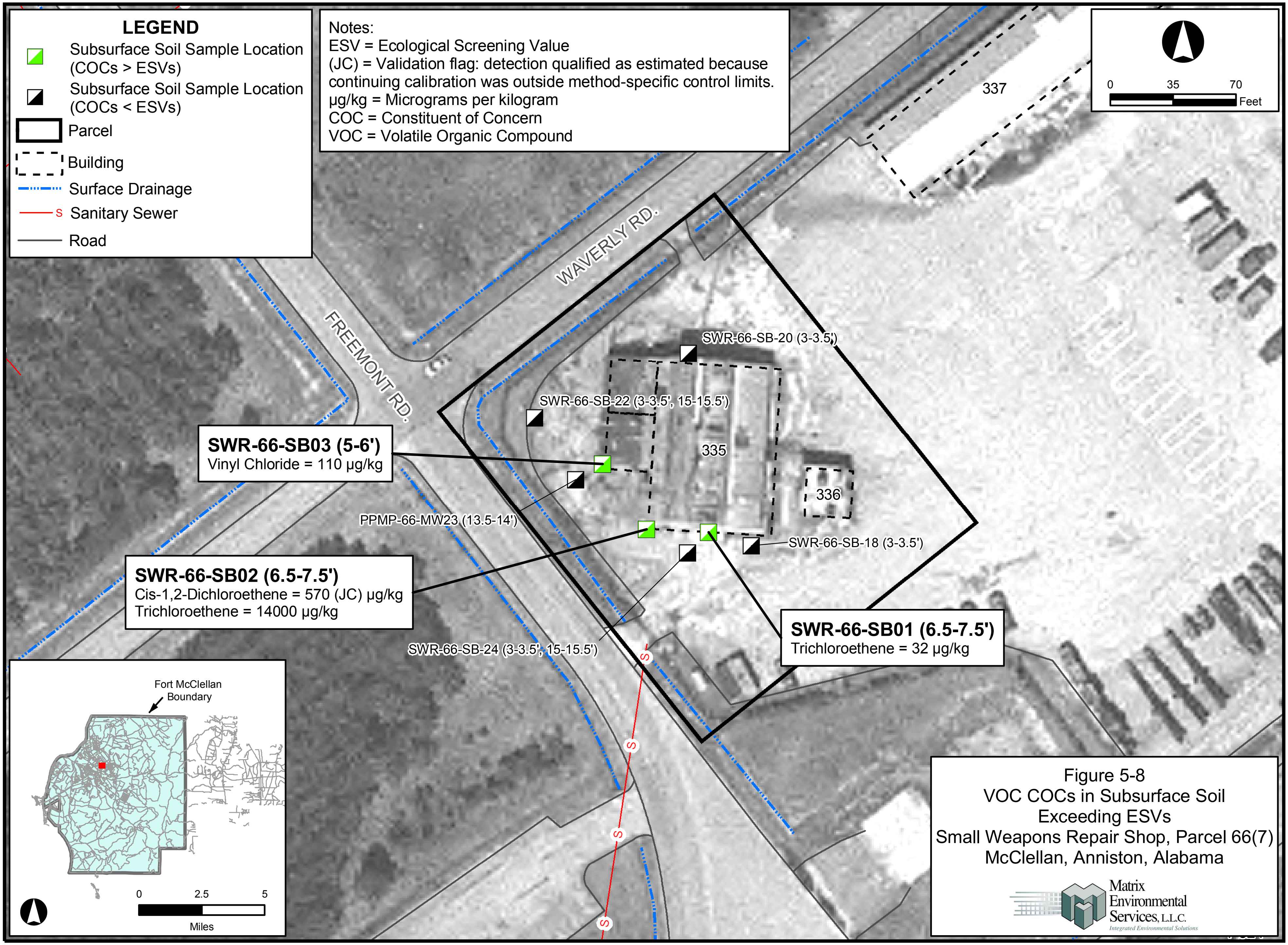


Figure 5-8
VOC COCs in Subsurface Soil Exceeding ESVs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

LEGEND

- 🟩 Subsurface Soil Sample Location (COCs > ESVs)
- ◩ Subsurface Soil Sample Location (COCs < ESVs)
- ▭ Parcel
- ⬚ Building
- Surface Drainage
- S Sanitary Sewer
- Road

Notes:
ESV = Ecological Screening Value
(JC) = Validation flag: detection qualified as estimated because continuing calibration was outside method-specific control limits.
µg/kg = Micrograms per kilogram
COC = Constituent of Concern
VOC = Volatile Organic Compound

SWR-66-SB03 (5-6')
Vinyl Chloride = 110 µg/kg

SWR-66-SB02 (6.5-7.5')
Cis-1,2-Dichloroethene = 570 (JC) µg/kg
Trichloroethene = 14000 µg/kg

SWR-66-SB01 (6.5-7.5')
Trichloroethene = 32 µg/kg

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_Soil_ESV.mxd, 8/9/2005, ron_ramold

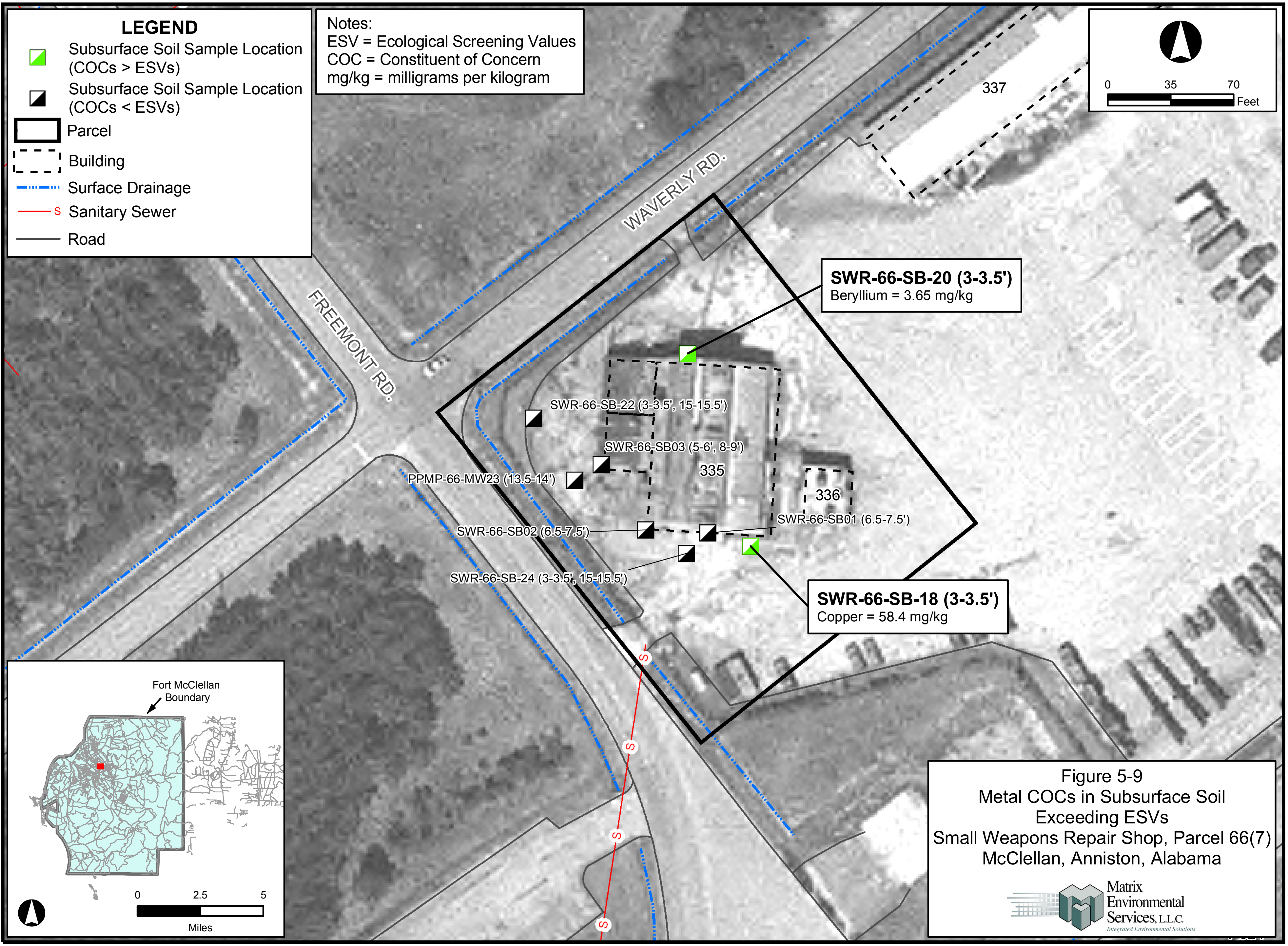
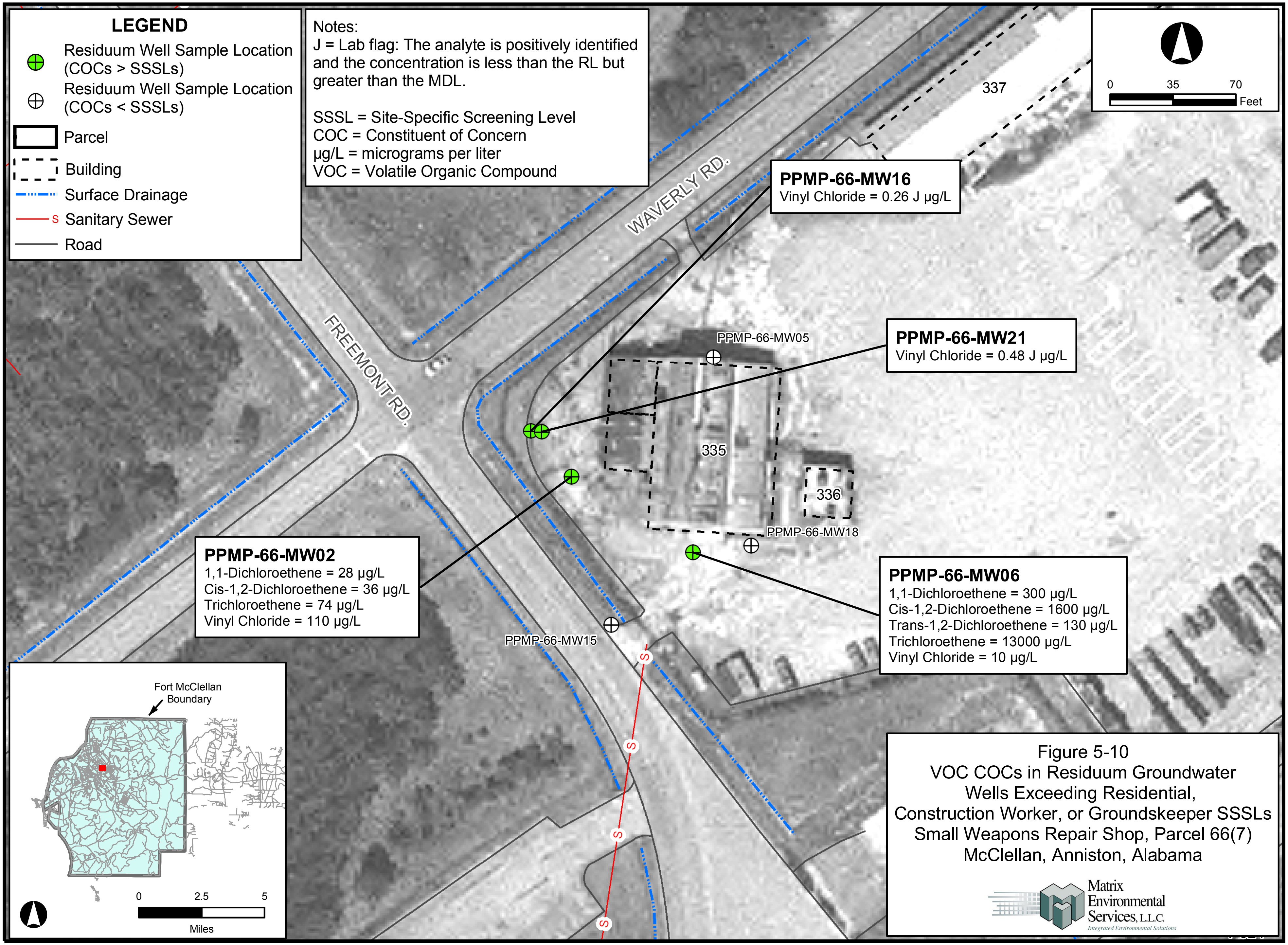


Figure 5-9
Metal COCs in Subsurface Soil Exceeding ESVs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Notes:
ESV = Ecological Screening Values
COC = Constituent of Concern
mg/kg = milligrams per kilogram

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_Subsurf_Soil_Metals_ECO.mxd, 8/9/2005, ron_ramold



LEGEND

⊕ Residuum Well Sample Location (COCs > SSSLs)

⊕ Residuum Well Sample Location (COCs < SSSLs)

▭ Parcel

⬚ Building

Surface Drainage

S Sanitary Sewer

Road

Notes:
J = Lab flag: The analyte is positively identified and the concentration is less than the RL but greater than the MDL.

SSSL = Site-Specific Screening Level
COC = Constituent of Concern
µg/L = micrograms per liter
VOC = Volatile Organic Compound

PPMP-66-MW16
Vinyl Chloride = 0.26 J µg/L

PPMP-66-MW21
Vinyl Chloride = 0.48 J µg/L

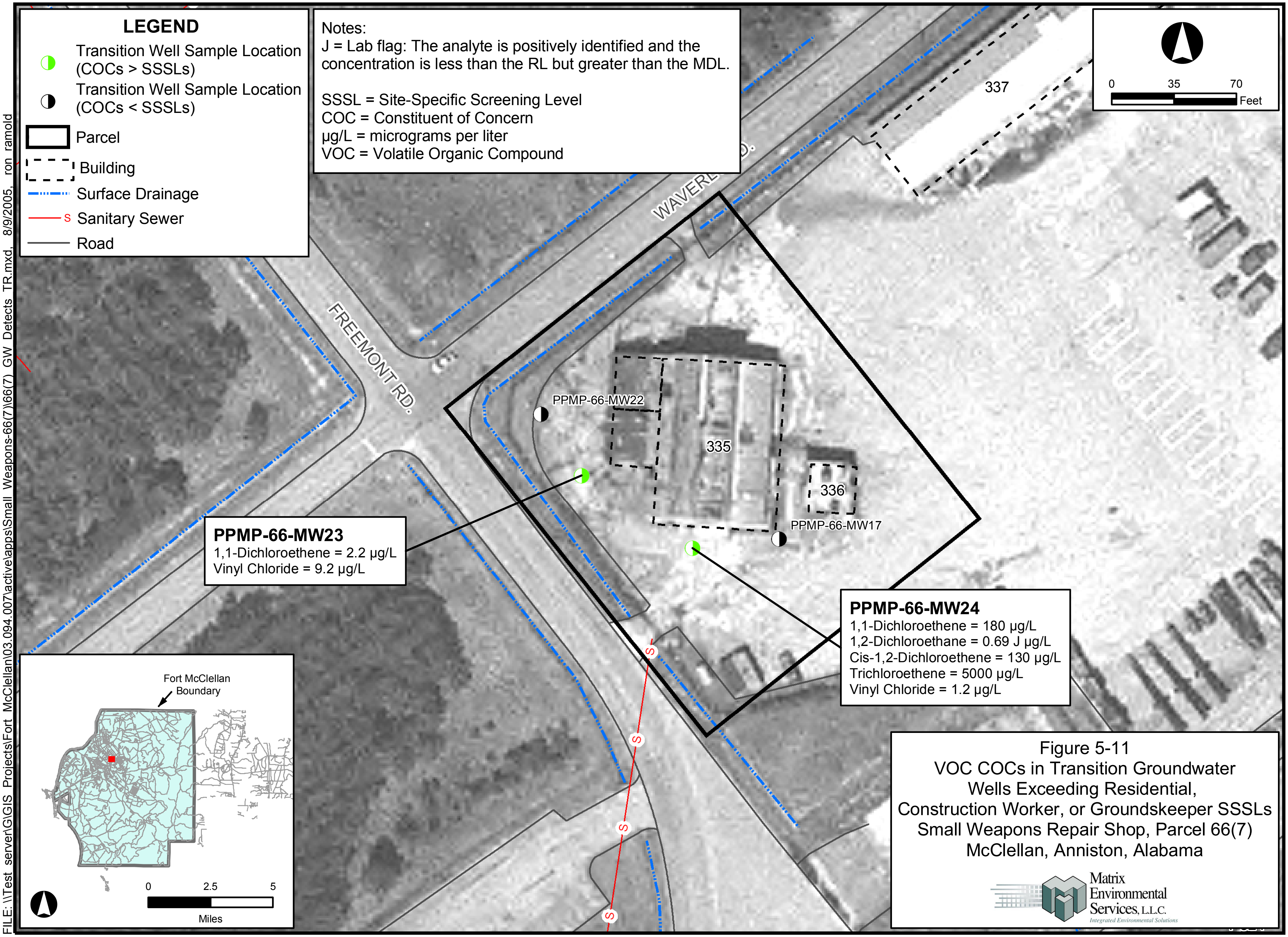
PPMP-66-MW02
1,1-Dichloroethene = 28 µg/L
Cis-1,2-Dichloroethene = 36 µg/L
Trichloroethene = 74 µg/L
Vinyl Chloride = 110 µg/L

PPMP-66-MW06
1,1-Dichloroethene = 300 µg/L
Cis-1,2-Dichloroethene = 1600 µg/L
Trans-1,2-Dichloroethene = 130 µg/L
Trichloroethene = 13000 µg/L
Vinyl Chloride = 10 µg/L

Figure 5-10
VOC COCs in Residuum Groundwater
Wells Exceeding Residential,
Construction Worker, or Groundskeeper SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_GW_Detects_RES.mxd, 8/9/2005, ron_ramold



Notes:
J = Lab flag: The analyte is positively identified and the concentration is less than the RL but greater than the MDL.

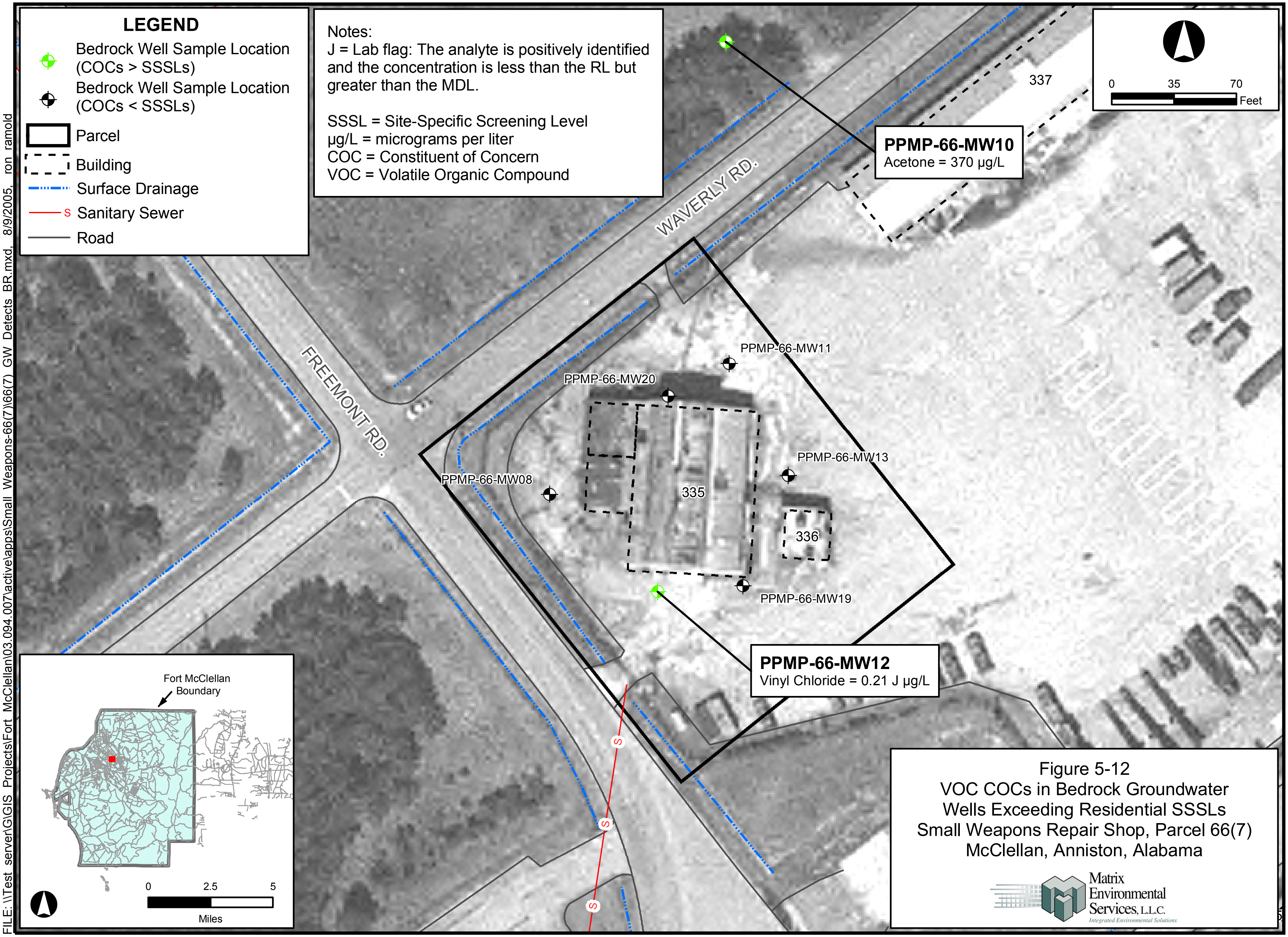
SSSL = Site-Specific Screening Level
COC = Constituent of Concern
µg/L = micrograms per liter
VOC = Volatile Organic Compound

PPMP-66-MW23
1,1-Dichloroethene = 2.2 µg/L
Vinyl Chloride = 9.2 µg/L

PPMP-66-MW24
1,1-Dichloroethene = 180 µg/L
1,2-Dichloroethane = 0.69 J µg/L
Cis-1,2-Dichloroethene = 130 µg/L
Trichloroethene = 5000 µg/L
Vinyl Chloride = 1.2 µg/L

Figure 5-11
VOC COCs in Transition Groundwater Wells Exceeding Residential, Construction Worker, or Groundskeeper SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

FILE: \\Test server\G\GIS Projects\Fort McClellan\03.094.007\active\apps\Small Weapons-66(7)\66(7) GW Detects TR.mxd, 8/9/2005, ron ramold



LEGEND

⊕	Bedrock Well Sample Location (COCs > SSSLs)
⊕	Bedrock Well Sample Location (COCs < SSSLs)
▭	Parcel
⬚	Building
-··-	Surface Drainage
—S	Sanitary Sewer
—	Road

Notes:
J = Lab flag: The analyte is positively identified and the concentration is less than the RL but greater than the MDL.

SSSL = Site-Specific Screening Level
µg/L = micrograms per liter
COC = Constituent of Concern
VOC = Volatile Organic Compound

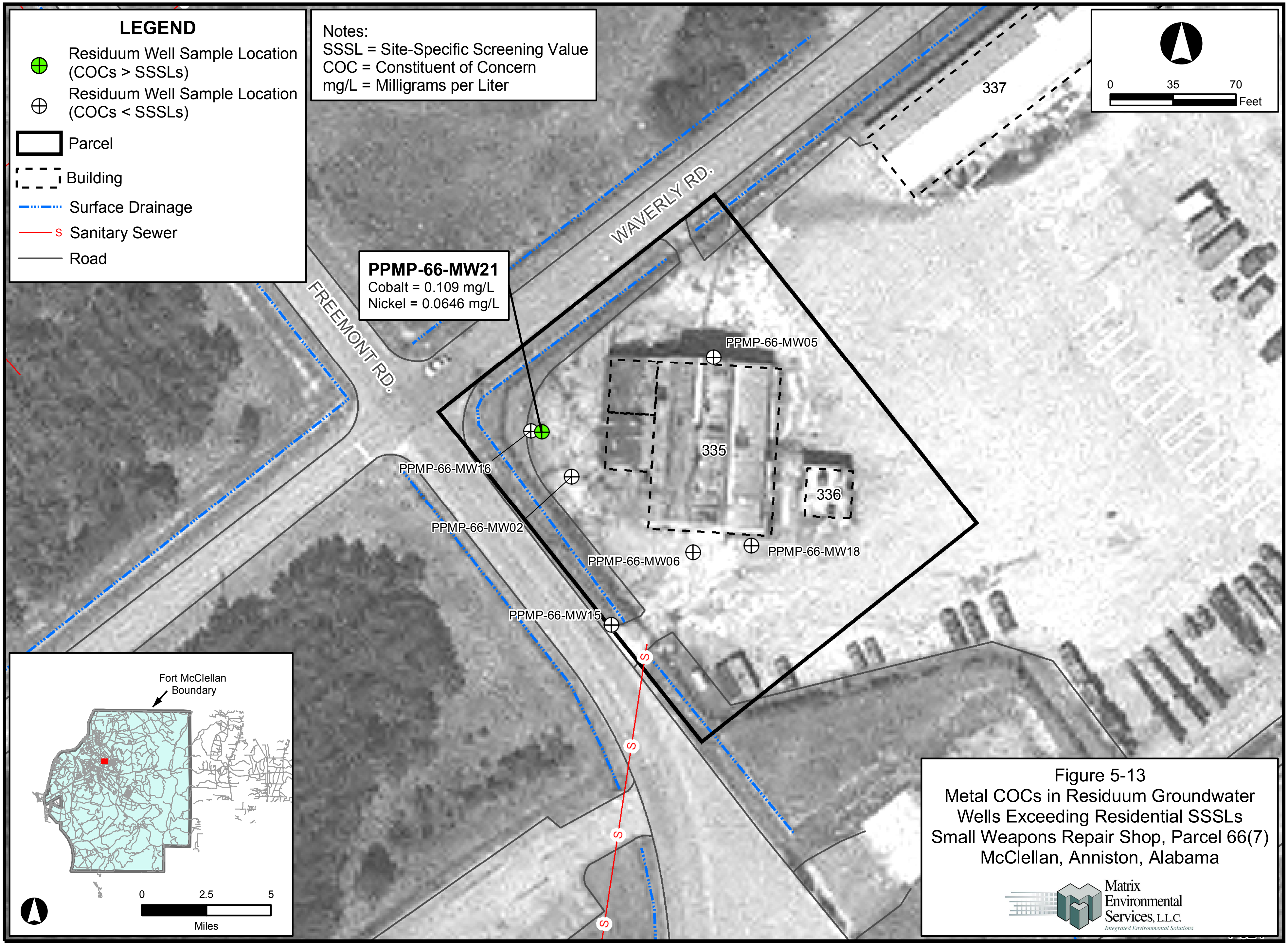
PPMP-66-MW10
Acetone = 370 µg/L

PPMP-66-MW12
Vinyl Chloride = 0.21 J µg/L

Figure 5-12
VOC COCs in Bedrock Groundwater
Wells Exceeding Residential SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test server\G\GIS Projects\Fort McClellan\03.094.007\active\apps\Small Weapons-66(7)\66(7) GW Detects BR.mxd, 8/9/2005, ron ramold



Notes:
SSSL = Site-Specific Screening Value
COC = Constituent of Concern
mg/L = Milligrams per Liter

PPMP-66-MW21
Cobalt = 0.109 mg/L
Nickel = 0.0646 mg/L

Figure 5-13
Metal COCs in Residuum Groundwater
Wells Exceeding Residential SSSLs
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\66(7)_GW_Metals_R.mxd, 8/9/2005, ron_ramold

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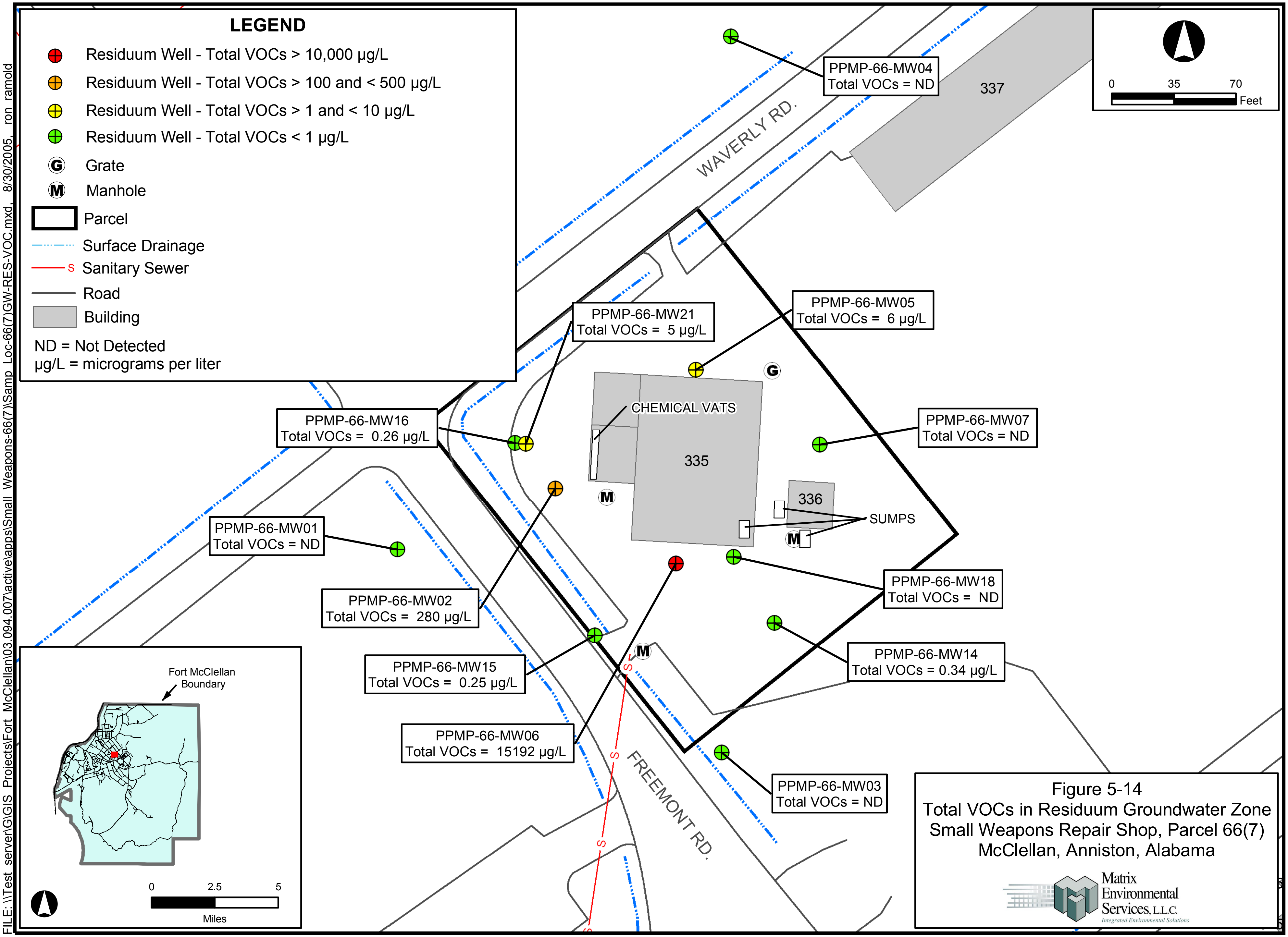

Figure 5-14
Total VOCs in Residuum Groundwater Zone
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

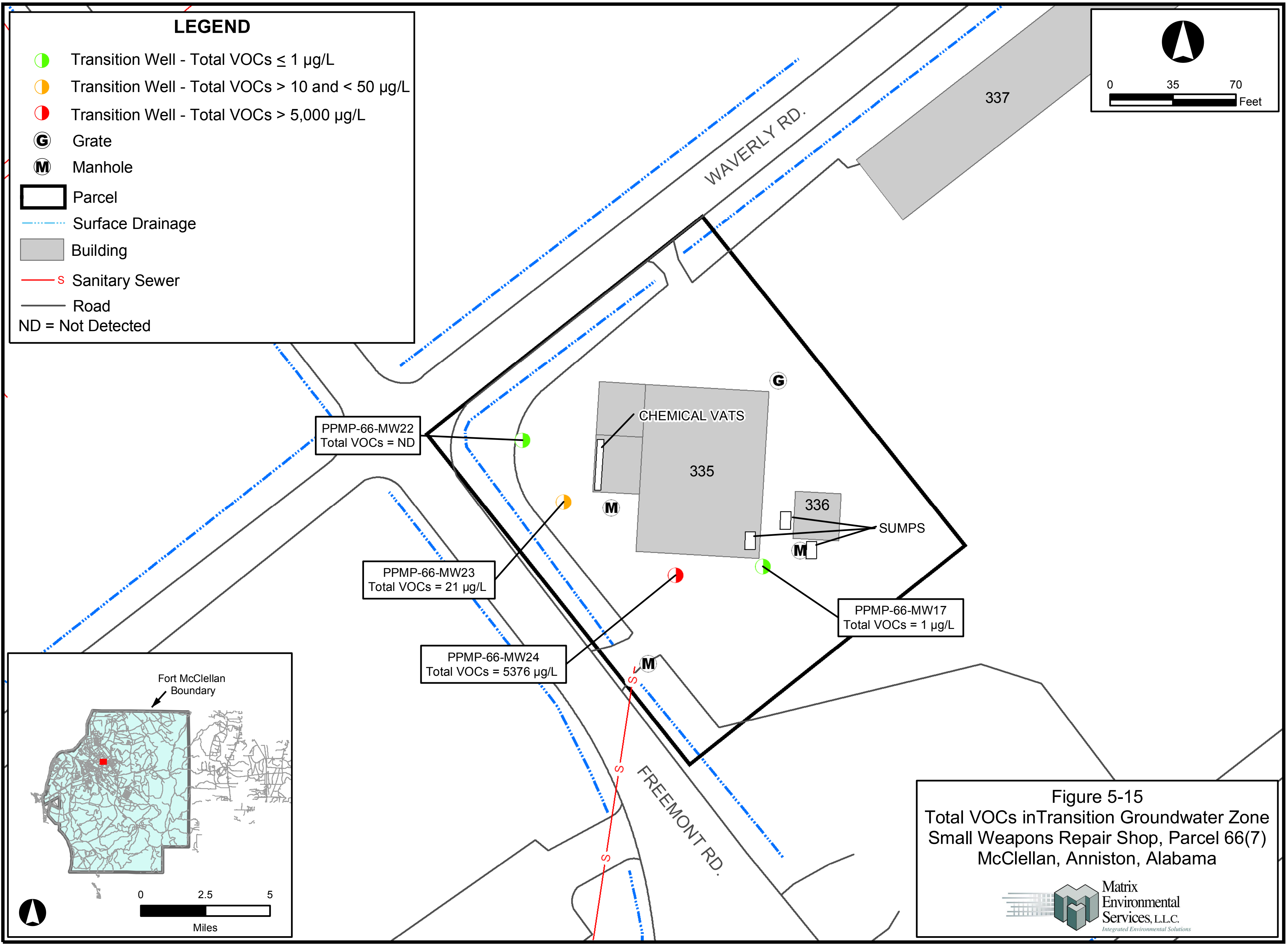

Figure 5-15
Total VOCs inTransition Groundwater Zone
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\Samp_Loc-66(7)GW-TR-VOC.mxd, 8/9/2005, ron_ramold

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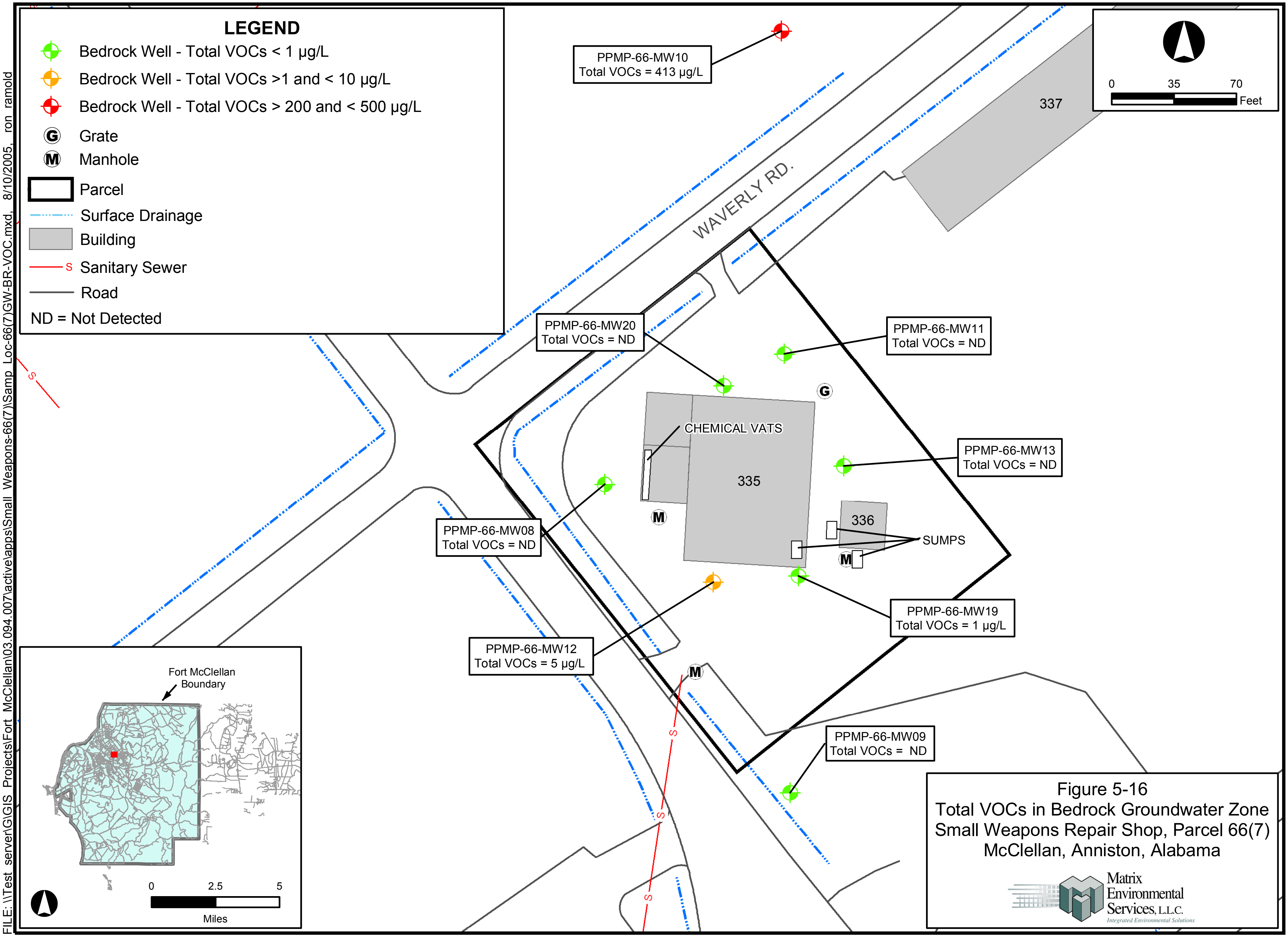

Figure 5-16
Total VOCs in Bedrock Groundwater Zone
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

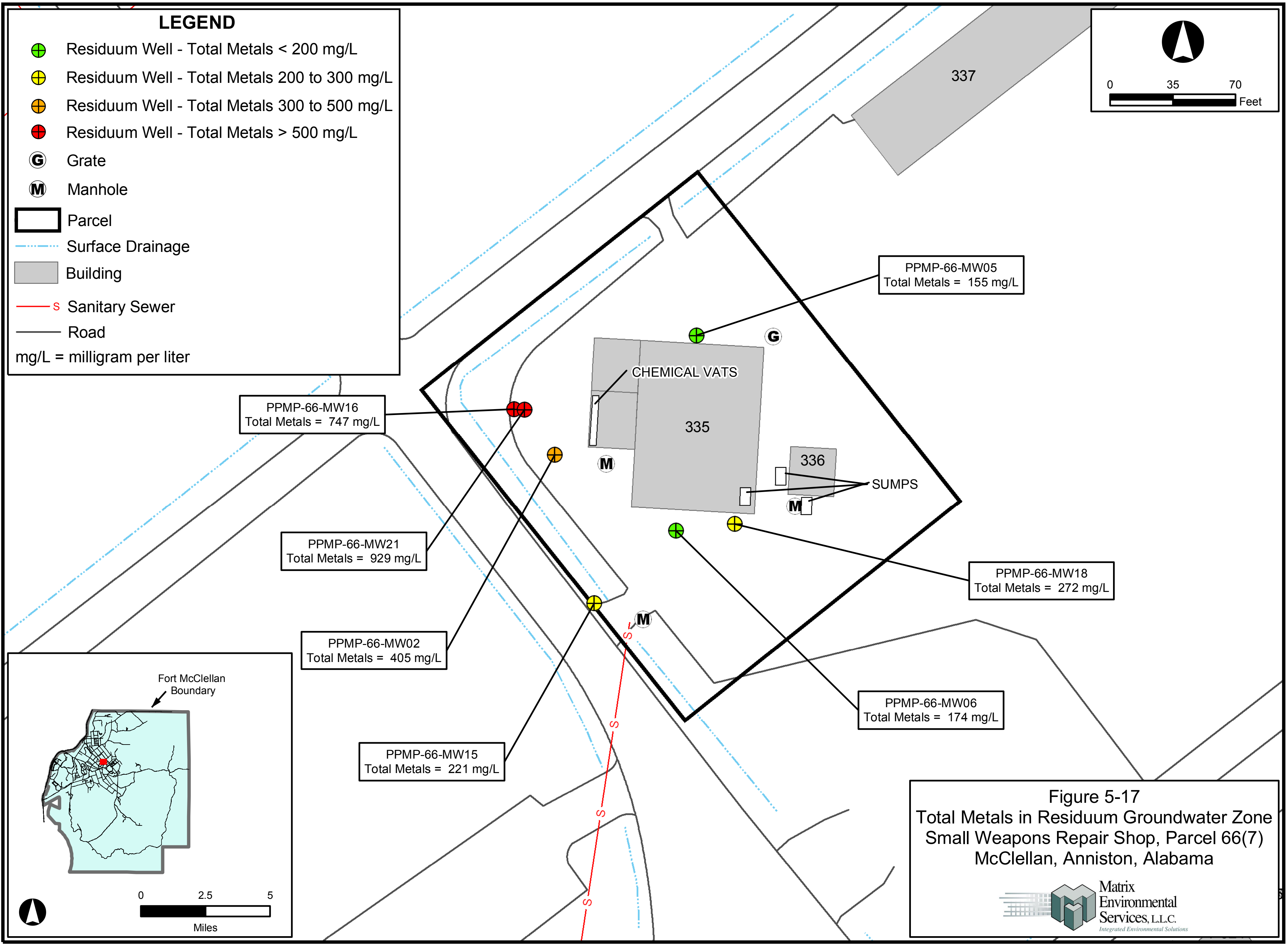

Figure 5-17
Total Metals in Residuum Groundwater Zone
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test_server\G\GIS_Projects\Fort_McClellan\03.094.007\active\apps\Small_Weapons-66(7)\Samp_Loc-66(7)GW-RES.mxd, 8/31/2005, ron_ramold

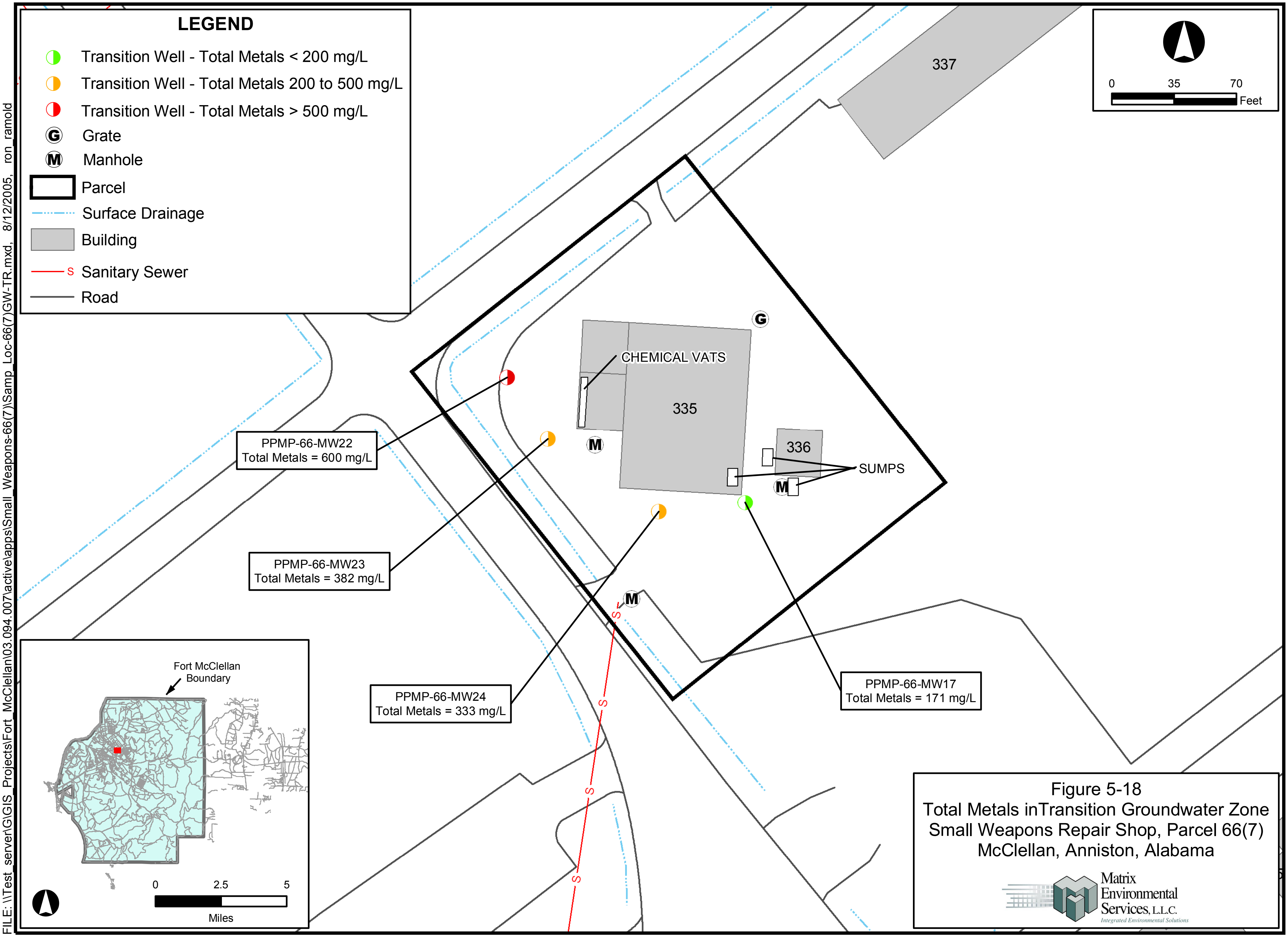

Figure 5-18
Total Metals inTransition Groundwater Zone
Small Weapons Repair Shop, Parcel 66(7)
McClellan, Anniston, Alabama

Matrix Environmental Services, L.L.C.
Integrated Environmental Solutions

FILE: \\Test server\G\GIS Projects\Fort McClellan\03.094.007\active\apps\Small Weapons-66(7)\Samp Loc-66(7)GW-TR.mxd, 8/12/2005, ron ramold