WORKING FINAL
SITE WIDE RCRA FACILITY INVESTIGATION REPORT

U.S. ARMY GARRISON
FORT BUCHANAN, PUERTO RICO

MAY 2012

Prepared for:

U.S. Army Environmental Command
San Antonio, Texas

Contract No. W91ZLK-04-D-0015

Site Wide RCRA Facility Investigation Report
U.S. Army Garrison
Fort Buchanan, Puerto Rico

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List of Acronyms

AEC	Army Environmental Command
AES	Atomic Emission Spectroscopy
AOC	Area of Concern
AST	Aboveground Storage Tank
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
BRAPF	Baseline Risk Assessment Problem Formulation
CMS	Corrective Measures Study
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CPR	Caribbean Petroleum Refining Company
CSM	Conceptual Site Model
DoD	Department of Defense
DPW	Directorate of Public Works
DQI	Data Quality Indicator
DRO	Diesel Range Organics
EA	EA Engineering, Science, and Technology, Inc.
EBS	Environmental Baseline Study
EDD	Electronic Data Deliverable
EDS	Environmental Data Services
EPC	Exposure Point Concentration
ft	Foot/Feet
FORSCOM	U.S. Army Forces Command
GCMS	Gas Chromatography Mass Spectrometry
GRO	Gasoline Range Organics
HHRA	Human Health Risk Assessment
HI	Hazard Index
IA	Installation Assessment
IAP	Installation Action Plan
ICAP	Inductively Coupled Argon Plasma

IDM	Investigative Derived Material
km	kilometer
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LUC	Land Use Control
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
MMRP	Military Munitions Response Program
MS	Mass Spectrometry
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Monitoring Well
NFA	No Further Action
NWBA	Northwest Boundary Area
PAH	Polycyclic Aromatic Hydrocarbon
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts per million
PQRL	Project Required Quantitation Limit
PRASA	Puerto Rico Aqueduct and Sewage Authority
PREQB	Puerto Rico Environmental Quality Board
PVC	Polyvinyl Chloride
PX	Post Exchange
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation

RL	Reporting Limit
ROTC	Reserve Officer Training Corps
RPD	Relative Percent Difference
RSL	Regional Screening Level
SDG	Sample Delivery Group
SIM	Selected Ion Monitoring
SLERA	Screening-Level Ecological Risk Assessment
SOP	Standard Operating Procedure
sq ft	square foot/feet
SQL	Structured Query Language
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
UCLM	Upper Confidence Level of the Mean
UPL	Upper Prediction Limit
U.S.	United States
USACE-WES	U.S. Army Corps of Engineers—Waterways Experiment Station
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USARSO	U.S. Army South
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VI	Vapor Intrusion
VOC	Volatile Organic Compound
°F	degrees Fahrenheit
ug/g	micrograms per gram
ug/kg	micrograms per kilogram
ug/L	micrograms per liter

Executive Summary

This report presents the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for 14 sites at Fort Buchanan, Puerto Rico. The objectives of the RFI are to characterize potential contaminants of concern in surface soil, subsurface soil, surface water, sediment, and groundwater at the Sites and to prepare baseline risk assessments for human and ecological receptors in order to support decisions regarding the need for further investigation or action at the sites. While 14 sites are included in this report, 15 total sites are part of the RFI. Site 14, the Small Arms Firing Range, is being investigated under the Military Munitions Response Program (MMRP), and therefore is not included in this report.

Fort Buchanan is located southwest of San Juan, Puerto Rico and consists of primarily developed areas with some relatively undeveloped areas. Ornamental plantings are common in the developed portions of the installation while semi-native forest is found along the installation's southern and northeast perimeters where less development has occurred.

Fort Buchanan has been used for military purposes since 1923, and during World War II occupied 4,500 acres. After the war, Fort Buchanan was gradually reduced in size to its current 746 acres. The Fort has been used as a maneuver training area and range, supply depot, and it has housed a command group that provided support for the United States (U.S.) Army Reserve, the National Guard, the Reserve Officer Training Corps (ROTC), and an Armed Forces Examining and Entrance Station and Intelligence Corps Detachment. Currently, Fort Buchanan is a reserve installation under the U.S. Army Reserve Command that provides support to active and reserve soldiers in Puerto Rico and the U.S. Virgin Islands, and it supports U.S. Department of Defense (DoD) operations in the Caribbean area.

Previous studies have identified a number of Solid Waste Management Units (SWMUs) and other areas of potential contamination at Fort Buchanan. These areas have been designated as Sites, and 14 Sites are being addressed in this RFI.

- Site 1, SWMU 1: Old Hazardous Waste Containers
- Site 2, SWMU 3: Pesticides and Chemicals Burial trench
- Site 3, SWMU 4: Spent Solvents Storage Area
- Site 4, SWMU 5: PCB Transformer Storage Area #1
- Site 5, SWMU 6: PCB Transformer Storage Area #2
- Site 6: Pesticide Storage Area
- Site 7: Building 541

- Site 8: Building S-563
- Site 9: Used Oil Staging Area
- Site 10: 65th Army Reserve Command Refueling Area
- Site 11: Heavy Equipment Storage Area
- Site 12: Old Landfill
- Site 13: Potential Hazardous Material Burial Site
- Site 15: Building S-159

Environmental data were generated for this RFI between October 2006 and September 2011. Chemicals of Potential Concern (COPCs) were identified for each Site by comparing detected concentrations of chemicals to screening levels identified in the project Quality Assurance Project Plan (QAPP) (EA 2010). These screening levels include U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) and Region 4 Ecological Screening Levels. In addition, background data were available for soil, and comparisons to the 95% Upper Prediction Limits (UPLs) of the background dataset were also considered. Based on the analytical data, the RFI Nature and Extent findings were:

- Site 1: Pesticides and polycyclic aromatic hydrocarbons (PAHs) are COPCs in soil. Volatile organic compounds (VOCs) are COPCs in groundwater, and the groundwater is being addressed in the Corrective Measures Study (CMS) for the NWBA.
- Site 2: Metals and Total Petroleum Hydrocarbons (TPH) are COPCs in soil. VOCs are COPCs in groundwater, and the groundwater is being addressed in the CMS for the NWBA.
- Site 3: Metals are COPCs in soil. Trichloroethene (TCE) is a COPC in groundwater, which is being addressed in the CMS for the NWBA.
- Site 4: Metals are COPCs in groundwater, which is being addressed in the CMS for the NWBA.
- Site 5: No COPCs were identified.
- Site 6: Pesticides and herbicides are COPCs in soil and sediment.
- Site 7: Pesticides and metals are COPCs in soil. Metals are COPCs in groundwater, which is being addressed in the CMS for the NWBA.
- Site 8: Metals and TPH are COPCs in soil. Metals are COPCs in groundwater, which is being addressed in the CMS for the NWBA.
- Site 9: Metals are COPCs in soil.

- Site 10: Metals are COPCs in groundwater, which is being addressed in the CMS for the NWBA.
- Site 11: Metals are COPCs in soil.
- Site 12: Metals are COPCs in sediment, surface water, and groundwater. Pesticides and PAHs are COPCs in sediment.
- Site 13: Metals, pesticides, herbicides, and TPH are COPCs in soil.
- Site 15: Metals and TPH are COPCs in soil.

A Human Health Risk Assessment (HHRA) was completed for the RFI Sites. The HHRA concluded that there were no COPCs or risk concerns at Sites 1, 4, 5, 6, 7, 8, 10, 12, and 13. There are potential concerns for future residential receptors at Sites 2, 3, and 11 from arsenic, chromium, and manganese in subsurface soil. There are potential concerns for construction workers and future residents from arsenic, chromium, iron, and manganese in subsurface soil at Site 9. There are potential concerns for future residential receptors at Site 15 from arsenic and chromium; however, maximum detected concentrations of chemicals of concern only minimally exceed the background UPLs, suggesting the concentrations of these analytes may be consistent with background and may not warrant further evaluation.

A Baseline Ecological Risk Assessment (BERA) was also completed as part of the RFI. The BERA evaluated the potential for risks to terrestrial plants, soil invertebrates, aquatic and benthic organisms, herbivorous mammals and birds, insectivorous mammals and birds, predatory mammals and birds, and piscivorous birds under current and future exposure scenarios. There may be a potential for risks to terrestrial receptors at a number of the Fort Buchanan RFI Sites. However, in light of site-specific information, the precautionary nature of the assumptions made in the BERA, and expected future land uses, further efforts to characterize or manage these potential risks are considered unwarranted. Benthic organisms are potentially at risk from concentrations of arsenic and pesticides in sediment and barium in water at Site 12. Consideration of background concentrations of arsenic in sediment is recommended in order to accurately conclude whether further characterization of the potential for risks to benthic organisms at this site is warranted

The RFI integrated the conclusions of the Nature and Extent Evaluation, the HHRA, and the BERA and reached the following conclusions.

- Sites 1, 4, 5, 10, 6, 7, 8, 13, and 15 are recommended for no further action (NFA).
- A CMS should be completed that considers land use controls (LUCs) or deed restrictions for Sites 2, 3, 9, 11, and 12.

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this Site Wide Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Fort Buchanan is to investigate the nature and extent of potential contamination resulting from former activities at 14 Sites and to prepare baseline risk assessments to assist in determining the future disposition of the sites. This document includes summaries of the Sites' histories, a summary of field efforts, a presentation and evaluation of analytical results, and supplemental documentation supporting the conclusions of the investigation.

The scope of this RFI includes the surface media of the sites and the groundwater under two of the sites (Sites 12 and 13). The majority of the sites where groundwater is a media of concern are located within the Northwest Boundary Area (NWBA) (Figure 1-1), and a separate RFI for groundwater of the NWBA was completed in March 2012 (EA 2012). The NWBA RFI included a full Human Health Risk Assessment (HHRA) with vapor intrusion (VI) evaluation. Because the NWBA RFI looked at the aquifer as a whole, it provides a complete and holistic evaluation of the aquifer, potential sources, and contaminant movement. The individual site evaluations included in the Site Wide RFI will refer to and summarize the findings of the NWBA RFI and HHRA as they apply to each site. Groundwater evaluations for Sites 12 and 13, which are not within the NWBA, are included in the Site Wide RFI.

1.2 SITE AND PROJECT BACKGROUND

1.2.1 Installation History

Camp Buchanan was established in 1923, and was originally located on a 300-acre tract of land approximately six miles south of San Juan Bay (Figure 1-2). From 1926 to 1930 Camp Buchanan was used as a maneuver training area and range by the regular Army, by National Guard troops, and as a Citizen Military Training Camp. In 1940 it was designated as Fort Buchanan and expanded to 1,514 acres, later expanding to 4,500 acres just after the end of World War II.

During World War II, Fort Buchanan housed a depot supplying the Army Antilles Department. It also processed local troops through its replacement center. The industrial complex included pier facilities, ammunition storage areas, and an extensive railroad network connecting it to the bay. After World War II, the Installation was gradually reduced in size to its present 746 acres. Until closure as an Army Installation in 1966, it remained a Command Depot with post facilities, a personnel center, and a special training center. With the deactivation of the Antilles Command in 1966, Fort Buchanan came under United States (U.S.) Army control. A detachment of Army personnel remained as a residual element designated as U.S. Army Command Group and placed under command of the U.S. Army Forces Southern Command in Panama. This element consisted of a small command group and support detachment, Rodriguez U.S. Army Hospital (inactivated in 1971), and advisory groups for the U.S. Army Reserve, the National Guard, and the Reserve Officer Training Corps (ROTC). While not related to the command, an Armed Forces Examining and Entrance Station and Intelligence Corps Detachment (inactivated in 1971) also received support from the command.

In 1971, Fort Buchanan returned to U.S. Army control under the Third Army. It continued to support the Army Reserve, including support of seven Army Reserve Centers throughout Puerto Rico, serving as host to a number of tenant activities through the Navy, Coast Guard, Air Force Reserve components, and several non-military federal agencies.

In 1973, during reorganization, the installation was re-designated as U.S. Army Garrison, Fort Buchanan, under direct control of the U.S. Army Forces Command (FORSCOM). Fort Buchanan became a U.S. Army South (USARSO) installation in June 1997, and USARSO headquarters moved to the installation in 1999. In October 2003, Fort Buchanan was transferred from an active military installation under USARSO to a reserve installation under the U.S. Army Reserve Command.

Today, Fort Buchanan continues to support both active and reserve component soldiers in Puerto Rico and the U.S. Virgin Islands. The installation also provides support to Department of Defense (DoD) operations in the Caribbean area. Fort Buchanan is located approximately 10 kilometers (km) southwest of the city of San Juan, Puerto Rico (Figure 1-2). The installation is bordered by PR-No. 165 (Roosevelt Avenue) to the east, PR-No. 2 to the south, PR-No. 28 to the immediate northwest (with Caribbean Petroleum Refinery Company [CPR] beyond), and PR-No. 28 (De Diego Expressway) to the north (Figure 1-3). The installation occupies approximately 746 acres within two municipalities, Bayamon and Guaynabo. Physiographically, Fort Buchanan is located on the northern coastal plain of Puerto Rico, which is about 8 km wide and slopes gently upward to a central mountain chain, the Cordillera Central.

1.2.2 Previous Investigations

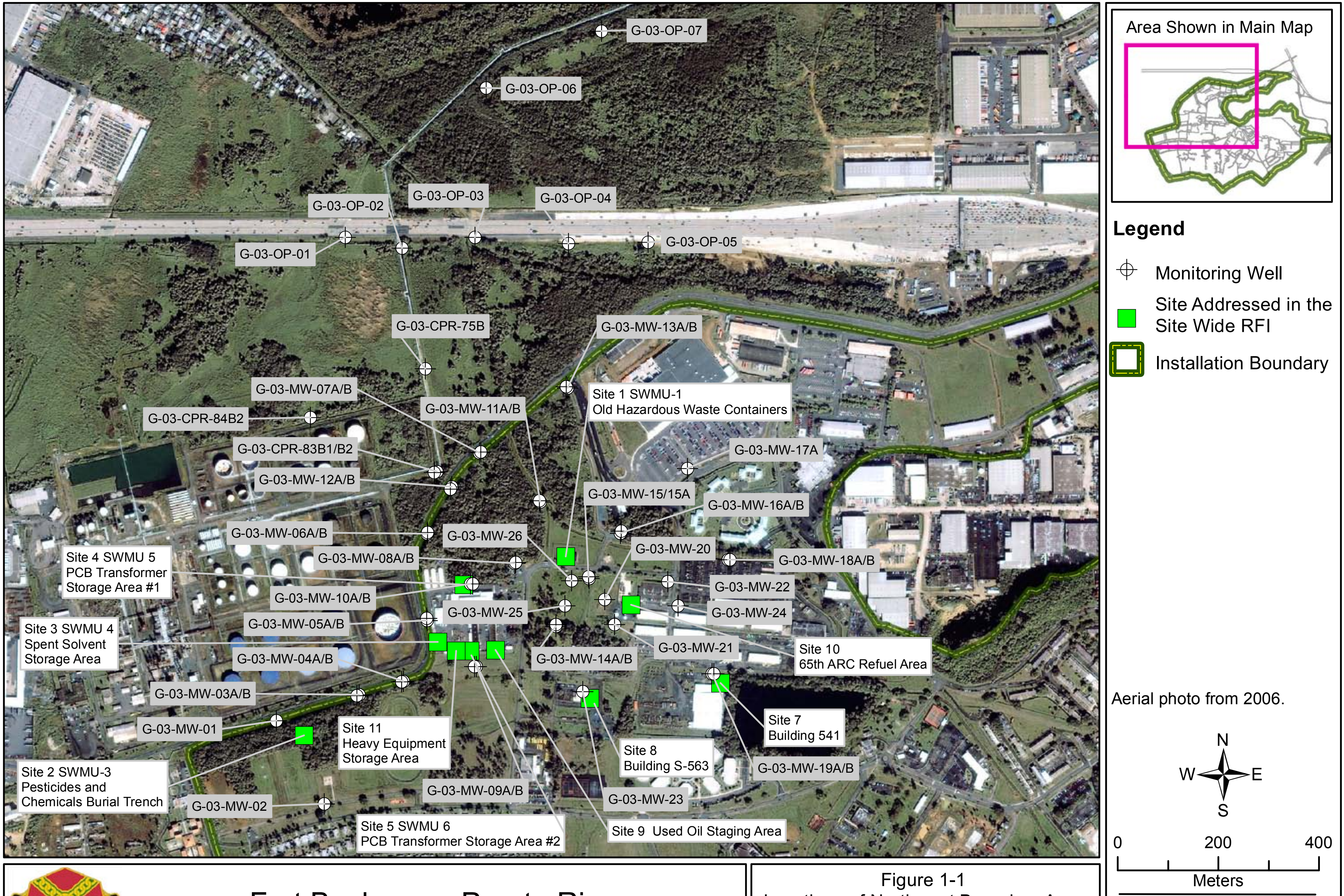
Several environmental investigations have been conducted at Fort Buchanan that helped direct the current RFI. These include an Army Installation Assessment in 1984 (McMaster 1984); a RCRA Facility Assessment (RFA) completed by the Commonwealth of Puerto Rico, Environmental Quality Board (PREQB) in 1991 (Cabrera 1991); RCRA Closure documents for the Pesticide Shop at Building 596 (USACE 1992); an Environmental Baseline Study (EBS) by the Army in 1997 (Woodward-Clyde 1997); and a geohydrological study of the Old Landfill completed by the Army in 1999 (USACHPPM 1999); among others. The RFA identified five Solid Waste Management Units (SWMUs), and one Area of Concern (AOC); the EBS identified nine more areas of potential contamination to the U.S. Environmental Protection Agency (USEPA). A number of previous investigations have been conducted specifically at Site 2, SWMU 3. These are discussed in detail in Section 5.2.

Of the 15 sites identified, 14 are addressed within the confines of this Site Wide investigation. One of the sites (Site 14: Small Arms Firing range) is being addressed within the confines of the Military Munitions Response Program (MMRP) and is known as the Camp Buchanan Training Area (ECC 2012). Figure 1-3 shows a map of the site locations.

1.3 REPORT ORGANIZATION

The Site Wide RFI is organized into the following sections:

- *Section 1.0* provides the reader with an introduction to the investigation, and discusses the purpose, project background, and report organization.
- *Section 2.0* provides information on the physical characteristics of the study area such as surface features, meteorology, geology, hydrogeology, etc.
- *Section 3.0* describes the specific methodology employed for each of the investigative activities of the RFI.
- *Section 4.0* presents the data quality and usability assessment.
- *Section 5.0* discusses the nature and extent of contamination detected in various media at each site.
- *Section 6.0* discusses the migration pathways associated with identified contamination.
- *Section 7.0* presents summaries of the human health and ecological risk assessments conducted as part of the RFI.
- *Section 8.0* presents a summary of the investigation findings and conclusions.
- *Section 9.0* includes a list of all references used in preparing the RFI report.



Aerial photo from 2006.

Fort Buchanan, Puerto Rico

Figure 1-1
Locations of Northwest Boundary Area Monitoring Wells and Sites Being Addressed in the Site Wide RFI

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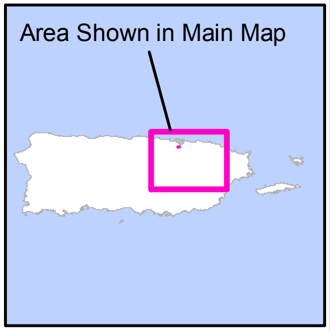
Area Shown in Main Map



Installation Data

🟪 Fort Buchanan

Base map was obtained from MapQuest

0 2 4 8
Kilometers

N
W E
S

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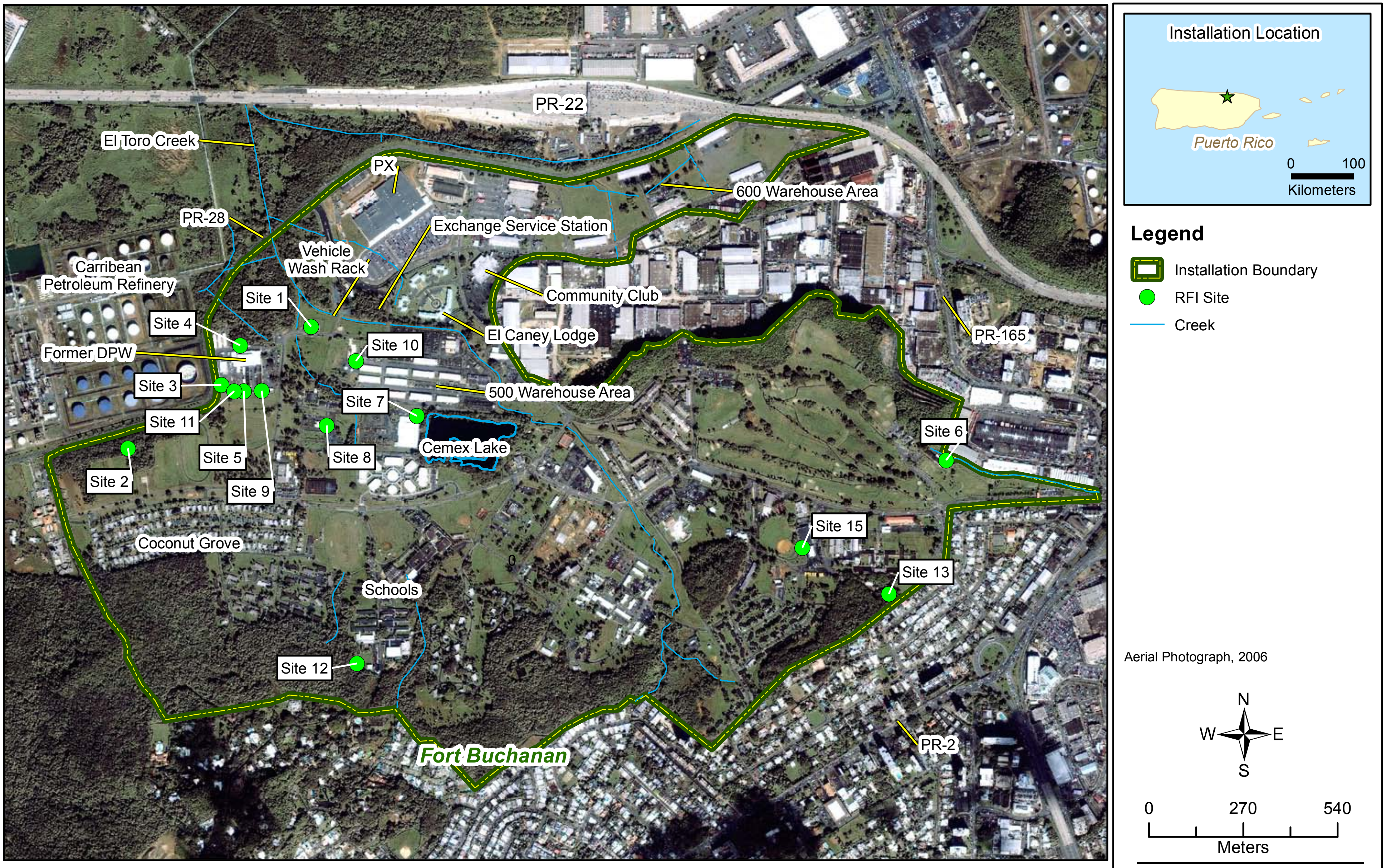
Fort Buchanan, Puerto Rico

Figure 1-1
Regional Location Map
for Fort Buchanan

\\Edgewood\fp\projects\Universal GIS\Buchanan\MXDs\Figure 1-1 Location Map_new.mxd



Fort Buchanan, Puerto Rico

Figure 1-3
Fort Buchanan Site Features and Locations of Site Wide RFI Sites

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2 PHYSICAL SETTING AND SITE GEOLOGY/HYDROGEOLOGY

2.1 PHYSICAL SETTING

Fort Buchanan is located in the North Coast physiographic province. The province's land use is characterized mostly by agriculture, largely as pasture and small family owned farms mixed with some industrial and residential uses. Farmland occupies much of the high, rolling plain in the northern third and western part of the province. Forests occupy most of the karst uplands, which are relatively inaccessible, particularly in the area adjacent to the Rio Guajataca, and in the southwestern North Coast area. Wetlands are not extensive in the western portion of the area, however large coastal wetlands are common on the coastal plain between Camuy and Manati.

Most residential areas, such as San Juan, are near the coast. While urban areas have expanded in recent years, they still occupy a small percentage of the land in the west and coastal portions of the province. Industrial development is not extensive in the western part of the province. It occurs mainly in association with military installations and urban areas, and as such characterizes the immediate vicinity of Fort Buchanan. Industrial areas are primarily concentrated in the urban areas along PR-No. 2, such as between Bayamon and Carolina. Residential, commercial, and industrial development will probably continue along the more level coastal areas throughout the North Coast province, especially near Guaynabo and Bayamon. The current and likely future land use of Fort Buchanan is a mixture of industrial, residential, and recreational. There are also child care and primary through secondary schooling facilities in the vicinity of and within Fort Buchanan.

2.2 GEOLOGY AND HYDROGEOLOGY

2.2.1 Regional Geology

Puerto Rico, the easternmost island of the Greater Antilles, is a volcanic island-arc terrane in which the geologic record spans about 150 million years. The island consists of volcaniclastic and epiclastic rocks of volcanic origin as well as other sedimentary rocks of Late Jurassic to Paleocene and Eocene age and intrusive mafic and felsic plutonic rocks of Late Cretaceous and early Tertiary age. These rocks are overlain unconformably by Oligocene and younger sedimentary rocks and sediments (Monroe 1973). Puerto Rico is bounded on the north by the Puerto Rico Trench, on the south by the Muertos Trough, on the east by the Anegada Passage and on the west by the Mona Canyon. The island is located in a seismically active region.

2.2.2 Regional Hydrogeology

The North Coast limestone aquifer system underlies Fort Buchanan and 700 square miles that extend eastward from Rincón, in western Puerto Rico, to Loíza, in northeastern Puerto Rico. The aquifer system consists of a highly karstified carbonate platform sequence of middle Tertiary age and is drained by eight major rivers, including the Río de Bayamón. The North Coast limestone aquifer system consists of three hydrogeologic units: an upper aquifer, consisting of Aymamón limestone, an intervening confining unit of Aguada limestone, and a lower aquifer of Mucarbones Sand. The system is underlain by Pre-Mid-Oligocene bedrock.

The Aguada and Aymamon Limestones, along with the upper portions of the Cibao Formation, form a prolific water-table aquifer, which extends in a narrow band along the coast. The upper member of the Cibao Formation constitutes the confining unit for the aquifer. The aquifer's extent is limited by the saltwater interface on the coastal side, landward thinning, and eventual absence of the limestones. At Fort Buchanan, these limestones have been mostly removed by erosion, existing only as isolated mogotes. Mogotes are comprised of eroded sedimentary limestone, and appear mostly as rounded hills within karstic environments.

The lower portion of the Cibao Formation constitutes another aquifer that is under confined conditions in much of the San Juan area. Transmissivity values of 1,000 square feet (sq ft) per day and a storage coefficient of 1.3 x 10^{-4} are typical for this aquifer (Fort Buchanan 2005).

2.2.3 Site Specific Geology

The surface geology of Fort Buchanan is described from two U. S. Geological Survey (USGS) Quadrangle Maps: the Geologic Map of the Bayamon Quadrangle, Puerto Rico (Monroe 1973); and the Geology of the San Juan Quadrangle, Puerto Rico (Pease 1977). The coastal plain, wherein Fort Buchanan lies, consists of sand, silt, and clay deposits overlying older formations of Tertiary age. Figure 2-1 shows the surface geology in and around the Fort Buchanan area, taken from the geologic maps described above. Figure 2-2 is a topographical map showing contour lines on Fort Buchanan.

The subsurface geology of Fort Buchanan is characterized by volcanic and sedimentary formations that span the full geologic past of Puerto Rico. The oldest underlying formations originated in the early Tertiary (65 to 2 million years ago) periods. These formations are dominated by sequences of pyroclastics, volcanic flows, and sedimentary rocks. The deposits have been highly deformed and faulted in some places. Miocene epoch (23 to 5 million years ago) formations consisting of sands, clays, marls, and limestone overlie the early Tertiary formations. Unconsolidated coastal plain and quaternary landslide deposits overlay these formations.

Unconsolidated deposits of Quaternary Age alluvium consisting primarily of sands, silts, and clays characterize the northern two-thirds of the surface geology of Fort Buchanan and most of the relatively flat central valley installation areas (varying thickness up to 25 meters). A range of tertiary age limestone outcrops, known as Montes de Caneja, occurs along the northern boundary of Fort Buchanan, and a second ridge, which is part of the same formation, forms the southern boundary. Quaternary Age landslide deposits are also located along the southern ridge of the installation.

2.2.4 Site Specific Hydrogeology

Fort Buchanan lies in the recharge zone for the North Coast limestone aquifer system (Cibao Formation), since both the Mucarabones Sand and Cibao Formation outcrop on the installation. Groundwater flow is toward the coast on a regional scale; however, local perturbations exist due to the irregular topography and variable lithology of the sediments.

At Fort Buchanan, the Aguada Limestone has been mostly removed by erosion, existing only as mogotes. The lower portion of the Cibao Formation constitutes a deeper aquifer, which is under confined conditions in much of the San Juan area. Regional groundwater flow is from the southwest to the northeast; however, local variations in the direction of groundwater flow exist due to irregular topography. Detailed information on the hydrogeology of Fort Buchanan was collected as part of the NWBA RFI (EA 2012). Carbonate sand aquifers underlying the clay overburden were the focus of that investigation. The U.S. Army Engineer Research and Development Center used boring logs from the NWBA RFI and from the adjacent CPR facility well installations to model the stratigraphic nature of the subsurface throughout the NWBA. The model indicated that the study area consists of old terrace materials and young terrace materials. Essentially, it is a two-aquifer system that is connected, with the older terrace being the source for the recharge of the younger terrace. The older terrace occupies the southern end of the NWBA in the uplands, while the younger terrace represents the northern lowlands. Both aquifers are in the carbonate sands. Overburden covers all of the area, with low permeability thereby preventing or limiting infiltration in the NWBA. The upland area to the south provides recharge to the NWBA and the overburden thins out in the southern uplands, which is where the aquifer surfaces and recharges.

The older terrace material consists of alternating sand and silt. Based on the results of transducer data, it was determined that the older terrace material has a strong, immediate response to rain events, and is not affected by tides. The younger terrace forms the northern half of the NWBA. It communicates with the older terrace, but not excessively. It is also an alternating sand/silt one-to-two aquifer system. Based on the results of transducer data, it was determined that wells within the younger terrace have a lesser response to rainfall, and are affected by tides (EA 2012).

2.2.5 Northwest Boundary Area Investigation Lithology and Groundwater

The investigation of the groundwater along the northwest boundary of Fort Buchanan (EA 2012) yielded some insight into the soil lithology found at Fort Buchanan. Throughout the investigation of the groundwater trichloroethene (TCE) plume, soils were logged and categorized prior to the installation of monitoring wells.

Generally, the wells were installed in gently rolling to basically flat terrain. While not uniform across the site, approximately 20 to 40 ft of clay overburden were logged prior to contact with the uppermost carbonate sand aquifer (the zones in which the wells screens were constructed). These clays were highly mottled, mostly stiff, and fairly impervious to infiltration of rainwater. Underlying the clays and silts were varying degrees and ranges of a carbonate sand unit comprised of fine to large gravel and coarse sands, mostly yellow to pale brown in color. The carbonate sand aquifers were confined. In addition, there were some very scattered and infrequent sand lenses contained in the clay overburden. However, no continuous shallow or water table aquifer has been encountered during the installation of monitoring wells at 26 different locations. These well locations are within the same vicinity as most of the 14 RFI sites.

Beneath the water table, these zones were mostly saturated. In many of the wells, two distinct carbonate zones were found separated by approximately two to 20 ft of fine material. Underlying the bottom carbonate layer was often a greenish gray silt material.

The underlying rock formations were not penetrated during both the NWBA RFI and the Site Wide RFI. Shallow soils, comprised mostly of silt and clay, and sediments, surface water, and groundwater from the water table were sampled during the current investigation. Detailed groundwater discussions are be presented in the NWBA RFI, including a groundwater model (EA 2012).

2.3 SURFACE HYDROLOGY AND DRAINAGE

Puerto Rico is divided into two distinct hydrologic regions (watersheds) based on differences in the distribution of rainfall, particularly between the northern and southern regions that are separated by the Cordillero Central Mountains. Most of the perennial streams flow from the interior of the island to the north coast hydrologic region, due to the predominance of rainfall on the north-facing mountain slopes. Fort Buchanan is located in the North Coast hydrologic area of the island. Figure 2-2 is a topographic map of Fort Buchanan.

Three creeks carry storm water flows across the installation. The largest of these, El Toro Creek (known as Quebrada Santa Catalina outside of Fort Buchanan), runs from southeast to northwest and carries most of the storm water from the installation and adjacent land areas. El Toro Creek is a rectangular, concrete-lined ditch that joins the Malaria Control Canal north and outside of the installation. The Malaria Control Canal runs southwest to north and discharges into the Bay of San Juan. Except for the eastern portion of the installation, all of the runoff on Fort Buchanan eventually discharges to the Malaria Control Canal via El Toro Creek and its tributaries, other drainage lines, or by draining directly into the canal. Río Puerto Nuevo drains the eastern portion of Fort Buchanan into San Juan Bay. It should be noted that Quebrada Santa Catalina originates in the town of Tintillo (south of Fort Buchanan); Tintillo discharges municipal storm water to the creek upstream of Fort Buchanan.

El Toro Creek and its tributaries receive all runoff from the maintenance shop areas, the vehicle wash racks, and the exchange service station (Figure 1-3). The northeast portion of Fort Buchanan, the 600 Warehouse Area, the Post Exchange (PX), Community Club, commissary buildings, part of the Class VI store, other warehouses, and adjoining Puerto Rican Cement Company property and industrial area, drain via surface ditches culverts to Malaria Control Canal. These surface ditches and culverts are subjected to severe erosion and flooding during significant rain events. A western tributary of El Toro Creek drains approximately 240 acres on Fort Buchanan and 60 acres offsite. The tributary drains Las Colinas, Buchanan Heights, most of Coconut Grove, the new high school, middle and elementary schools and the 500 Warehouse Area. This tributary flows into the El Toro Creek at the west end of the installation property.

The manmade CEMEX Lake receives minor discharges from the natural and man-made storm water systems serving the installation. Additionally, it is probable that the lake is recharged in part from the southern highlands, and any groundwater aquifers that surface there and run downgradient to the lake. The lake was pumped for water used in the production of cement in the past, but it is no longer used for that purpose.

2.4 SOILS

A soil survey was conducted to classify, categorize, describe, and map all soils by map unit. The survey was done in compliance with National Cooperative Soil Survey standards and procedures (USDA 2005).

Five soil series were delineated on Fort Buchanan (Almirante clay, Soller clay loam, Tanama clay, Vega Alta clay loam, and Vega Baja silty clay). These five series were further refined into their respective phases for a final delineation of seven soil types. The distribution of the soil types are summarized in Table 2-1 and presented in Figure 2-3.

2.4.1 Almirante Clay

The Almirante soils (2–12 percent slope) are deep, well-drained soils located on the rolling coastal plains between the limestone hills, derived from fine textured sediments (mostly clays). These soils are typically brown with variegated reds and gray and contain plinthite (a mixture of iron and aluminum oxides, clay, and sometimes quartz that changes irreversibly to “ironstone” upon exposure to repeated wetting and drying). Almirante soils are moderately limited for urban development by their clayey nature and shrink-swell potential.

2.4.2 Soller Clay Loam

The Soller soils (20–40 percent slope) are shallow (16–30 inches on Fort Buchanan), well-drained soils located on the hilltops and side slopes of the limestone hills. They are formed in fine textured residuum derived from the underlying limestone. Included in the mapping of the Soller soils are units of Colinas clay loam, as well as areas where erosion has left fragments of the underlying limestone bedrock exposed. Moderate to severe erosion is the primary limitation for possible development of Soller and Colinas soils.

2.4.3 Tanama Clay

The Tanama soils (20–60 percent slope) are shallow (4–16 inches on Fort Buchanan), well-drained soils formed in material weathered from underlying limestone occupying side slopes and hilltops of limestone hills. Controlling erosion of Tanama soils is of greatest concern relative to any development or management activities. Even minimal disturbance on these sensitive sites can have severe environmental implications.

2.4.4 Vega Alta Clay Loam

The Vega Alta soils (2–12 percent slope) are very deep, well-drained soils formed in iron-rich clays of the coastal plains. On Fort Buchanan, these soils occupy the coastal plain terrace adjacent to the nearly level drainage basin that bisects the installation. These soils, although somewhat lower in clay content than the Almirante soils, are still moderately limited for development by shrink-swell potential in addition to increased erosion hazard on slopes that are left unvegetated.

2.4.5 Vega Baja Silty Clay

The Vega Baja soils (0–2 percent slope), are very deep, and somewhat poorly drained soils on upper floodplain terraces in coastal plains. These soils have developed in the nearly level drainage basin of the installation in stratified loamy and clayey alluvial sediments. Vega Baja soils are moderately limited for development of soils.

2.5 BIOTA

Vegetation on Fort Buchanan consists of both ornamental plantings in the developed portions of the installation and semi-native forest located along the installation's southern and northeast perimeters. The areas of forested vegetation are of the tropical semi-evergreen forest (170.6 acres) and seasonal swamp forest (1 acre) types. Of these forested areas, 36.72 acres (21.4 %) are classified as high disturbance, 111.20 acres (64.8 %) as moderate disturbance, and 23.68 acres (13.8 %) as low disturbance.

Tree species prevalent in the developed areas, primarily occurring along roads and adjacent to buildings, include the African tuliptree (*Spathodea campanulata*), queen-of-flowers (*Lagerstroemia speciosa*), flamboyant-tree (*Delonix regia*), coconut (*Cocos nucifera*), silk cotton tree (*Ceiba pentandra*), and mango (*Mangifera indica*). Because of development over much of the installation, Puerto Rico's native wildlife species are not well represented at Fort Buchanan. The majority of wildlife inhabiting the installation occurs within the southern-forested areas.

Mammals observed or documented to occur on Fort Buchanan are the house mouse (*Mus musculus*), black rat (*Rattus rattus alexandrinus*), Indian mongoose (*Herpestes auropunctatus*), and bats (unknown spp.). Feral dogs (*Canis familiaris*) and cats (*Felis domesticus*) also occur on the installation. Bats are the only native mammals on the island of Puerto Rico.

Various species of birds have been identified on Fort Buchanan, including the Puerto Rican lizard cuckoo (*Saurotheca vieilloti*), red-legged thrush (*Turdus plumbeus*), bananaquit (*Coereba flaveola*), stripe-headed tanager (*Spindalis zena*), black-faced grassquit (*Tiaris bicolor*), Puerto Rican bullfinch (*Loxigilla portoricensis*), zenaida dove (*Zenaida aurita*), Adelaide's warbler (*Dendroica adelaidae*), Puerto Rican woodpecker (*Melanerpes portoricensis*), loggerhead kingbird (*Tyrannus caudifasciatus*), and red-tailed hawk (*Buteo jamaicensis*).

At least eight species of reptiles and four amphibian species are known to occur on Fort Buchanan. Reptiles include the common Puerto Rican anole (*Anolis cristatellus*), pasture anole (*Anolis pulchellus*), saddled anole (*Anolis stratulus*), siguana or Puerto Rican giant ameiva (Ameiva exsul), common salamanquita (*Sphaerodactylus macrolepis*), salamanca (*Hemidactylus mabouia*), Puerto Rican boa (*Epicrates inornatus*), Puerto Rican slider turtle (*Trachemys stejnegeri*), and Puerto Rican racer snake (Alsophis portoricensis). Turtles (unknown species, probably *Trachemys stejnegeri*) inhabit the CEMEX Lake. Amphibian species include the marine toad (*Bufo marinus*), white-lipped frog (*Leptodactylus albilabris*), pasture coquí (*Eleutherodactylus antillensis*), and common coquí (*Eleutherodactylus coqui*).

No fish species have been recorded in the streams at Fort Buchanan, however, the CEMEX Lake contains common species such as tilapia (*Tilapia nilotica*), catfish (unknown species), largemouth bass or lobina (*Micropterus salmoides*), and black bass (*Micropterus* sp.).

2.6 CLIMATE

Fort Buchanan has a tropical marine climate. It is somewhat modified by the Cordillera Central mountain range, which lies approximately 20 miles south of San Juan metropolitan area. Air circulation from the higher altitudes results in breezes that bring nighttime temperatures somewhat lower than those in daytime, especially during the winter. Temperatures are moderate and constant, with few very hot days or very cold nights. Average maximum temperatures range from 74 to 86 degrees Fahrenheit (^{o}F). Rainfall averages 59 to 75 inches annually and is seasonally distributed with a July to October maximum and January to April minimum. Wind patterns vary considerably, although winds generally come from the east and northeast during the day and the southeast at night.

Puerto Rico is in an area subject to hurricane activity. In the last 37 years, significant hurricanes have caused more than $2 billion in damages and 100 deaths on the island. Most recently, Hurricane Georges (October 1998) and Hurricane Irene (August 2011) passed over the island. Wind speeds during Hurricane Irene were recorded to be over 110 miles per hour and over twenty inches of rain fell on parts of the island.

2.7 Conceptual Site Model

A generalized conceptual site model was developed the Fort Buchanan Site Wide RFI and is presented in Figure 2-4. It should be noted that not all media are present at all sites and therefore not all pathways are applicable to all sites.

2.7.1 Soil

Soil could be impacted by direct disposal of wastes. Soil is present at all sites addressed in the RFI, although some sites are covered by concrete or asphalt and soil was collected by drilling below the impervious surface. Because of the lack of exposed soil at some sites, current exposure pathways are incomplete for some receptors (e.g. biota and commercial workers). However, there is a potential for these pathways to be complete in the future. In general, pathways for exposure to soil are considered potentially complete for recreational users/trespassers, hypothetical future residents, construction workers, commercial workers, and biota.

2.7.2 Surface Water

Surface water could be impacted by direct discharge into the surface water body, erosion of contaminated soil into the water body, or by receiving discharge from impacted groundwater. Surface water is present at Site 12. A perennial stream emerges from the walls of a ravine at the southern end of the site, flows north through the site, and enters a pipe at the northern end of the site. The stream is approximately 250 meters long and the area at the base of the ravine, where the stream flows, is relatively undisturbed habitat. Surface water is intermittently present in a drainage ditch at Site 6 that collects water during rain events. Because water is present in the ditch irregularly, it is not expected to provide habitat for aquatic organisms. Pathways for exposure to surface water are potentially complete for recreational users/trespassers, hypothetical future residents, construction workers, and biota.

2.7.3 Sediment

Sediment could be impacted by direct discharge or erosion of contaminated soil into the sediment bed of a water body. Sediment is present at Site 12 and periodically at Site 6. Sediment at Site 12 is associated with the perennial stream described in Section 2.7.2. A drainage ditch is present at Site 6 that collects water during rain events. This ditch is intermittently wet and therefore is not expected to provide habitat for aquatic organisms. Pathways for exposure to sediment are potentially complete for recreational users/trespassers, hypothetical future residents, construction workers, and biota.

2.7.4 Groundwater

The confined aquifer underlying Fort Buchanan is located 25 to 50 feet (ft) below ground surface (bgs) and could be impacted by the infiltration of chemicals released to soil. Available information indicates that the groundwater is not being used as a drinking water source, and the installation of wells in the area is not recommended by the USGS due to the water quality and the potential for saltwater intrusion. However, the potential for potable use cannot be ruled out because there is no legal restriction on the installation of wells in this area.

Based on communications with USGS water resource personnel in April 2009, no groundwater wells for human consumption are known to exist in the vicinity of Fort Buchanan. More recent research on adjacent wells, based on USGS documentation and personnel, indicates that there are no active wells downgradient of the installation, and in 2011, the Puerto Rico Aqueduct and Sewage Authority (PRASA) confirmed that they have no wells within or downgradient of Fort Buchanan. The three closest PRASA wells are over one mile east of the center of the installation and are not in use (either abandoned or structurally compromised). In addition, there is a real potential for saltwater intrusion into groundwater, which is expected to deter the installation of wells downgradient of Fort Buchanan. Copies of communications regarding well locations and a figure depicting the saltwater-freshwater interface (Figure A-1) are provided in Appendix A.

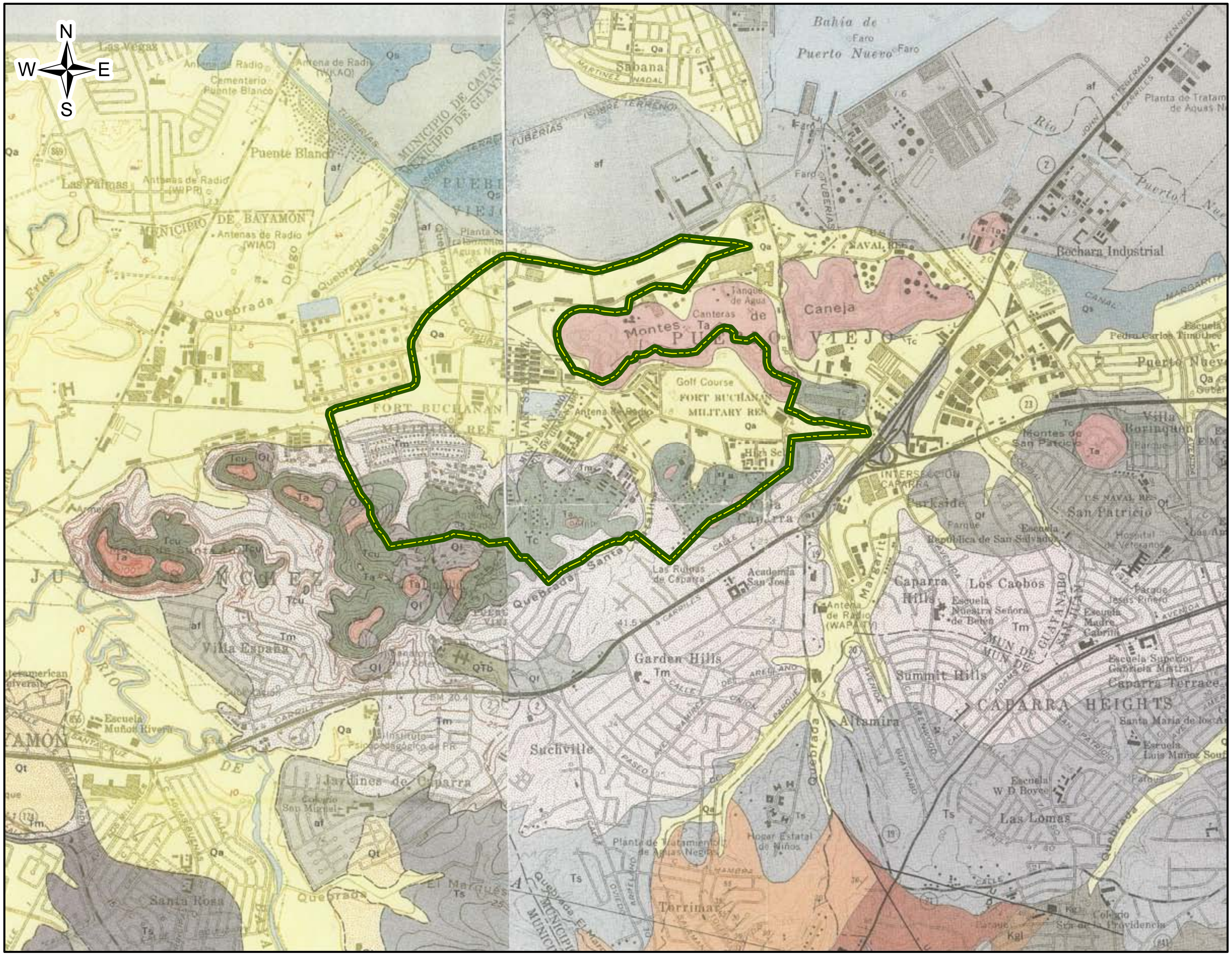
There is no evidence of a moratorium on well installation north of Fort Buchanan, and local groundwater may be used for irrigation purposes both on and off the installation. In addition to potential exposure to groundwater via ingestion or direct contact, volatilization of volatile organic compounds (VOCs) from their dissolved phase and adsorbed soil phase could give rise to a soil gas phase that could potentially pose risk to aboveground receptors from inhalation (primarily within enclosed buildings).

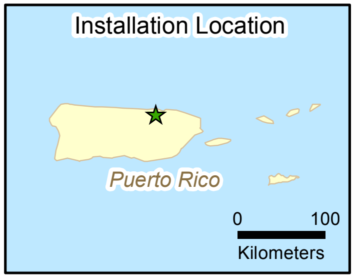
It should be noted that the majority of the sites included in the Site Wide RFI are located within the NWBA (Figure 1-1). A separate RFI for groundwater of the NWBA was completed in March 2012 (EA 2012) to evaluate an identified VOC plume. The NWBA RFI included a full HHRA with VI evaluation. Because the NWBA RFI looked at the aquifer as a whole, it provides a complete and holistic evaluation of the aquifer, potential sources, and contaminant movement. The individual site evaluations included in the Site Wide RFI will refer to and summarize the findings of the NWBA RFI and HHRA as they apply to each site. Sites 6, 12, 13, and 15 are not within the NWBA, and were not included in that RFI. Groundwater was not identified as a media of concern for Sites 6 and 15; therefore groundwater evaluations will be completed as part of the Site Wide RFI for Sites 12 and 13.

Currently, there are no deed restrictions prohibiting future development of the areas around Sites 12 and 13. Therefore, hypothetical scenarios including future residential use are potentially complete pathways. Exposure of industrial/construction workers and hypothetical future residents to groundwater via ingestion, dermal contact, and vapor intrusion are considered potentially complete exposure pathways.

Table 2-1
Soils Mapped on Fort Buchanan

Soil Type	Slope	Area (acres)	Percent of Installation
Almirante clay	2-5%	98	13%
Almirante clay	5-12%	45	6%
Soller clay loam	20-40%	103	14%
Tanama clay	20-60%	33	4%
Vega Alta clay loam	2-5%	280	38%
Vega Alta clay loam	5-12%	59	8%
Vega Baja silty clay	0-2%	127	17%





Installation Data

🟩 Installation Boundary

Geology

Holocene

Qa = Alluvium; sand, clay and sandy clay. 🟨

Ql = Landslide deposits; masses of soil, calcereous clay, and limestone rubble. 🟦

Tertiary

Tm = Mucarabones Sand, crossbedded coarse quartz sand, containing lenses of greenish-gray sandy clay. ▨

Tcu = Cibao formation; upper member. Chalk, soft limestone, and very pale orange sandy clay. 🟩

Ta = Aguada Limestone; alternating thick beds of indurated very pale orange to pink fine calcarenite and grayish-orange to very pale orange clayey and chalking limestone. 🟥

Sources:
USGS Bayamon Geologic Quadrangle (1973)
and San Juan Geologic Quadrangle (1977).

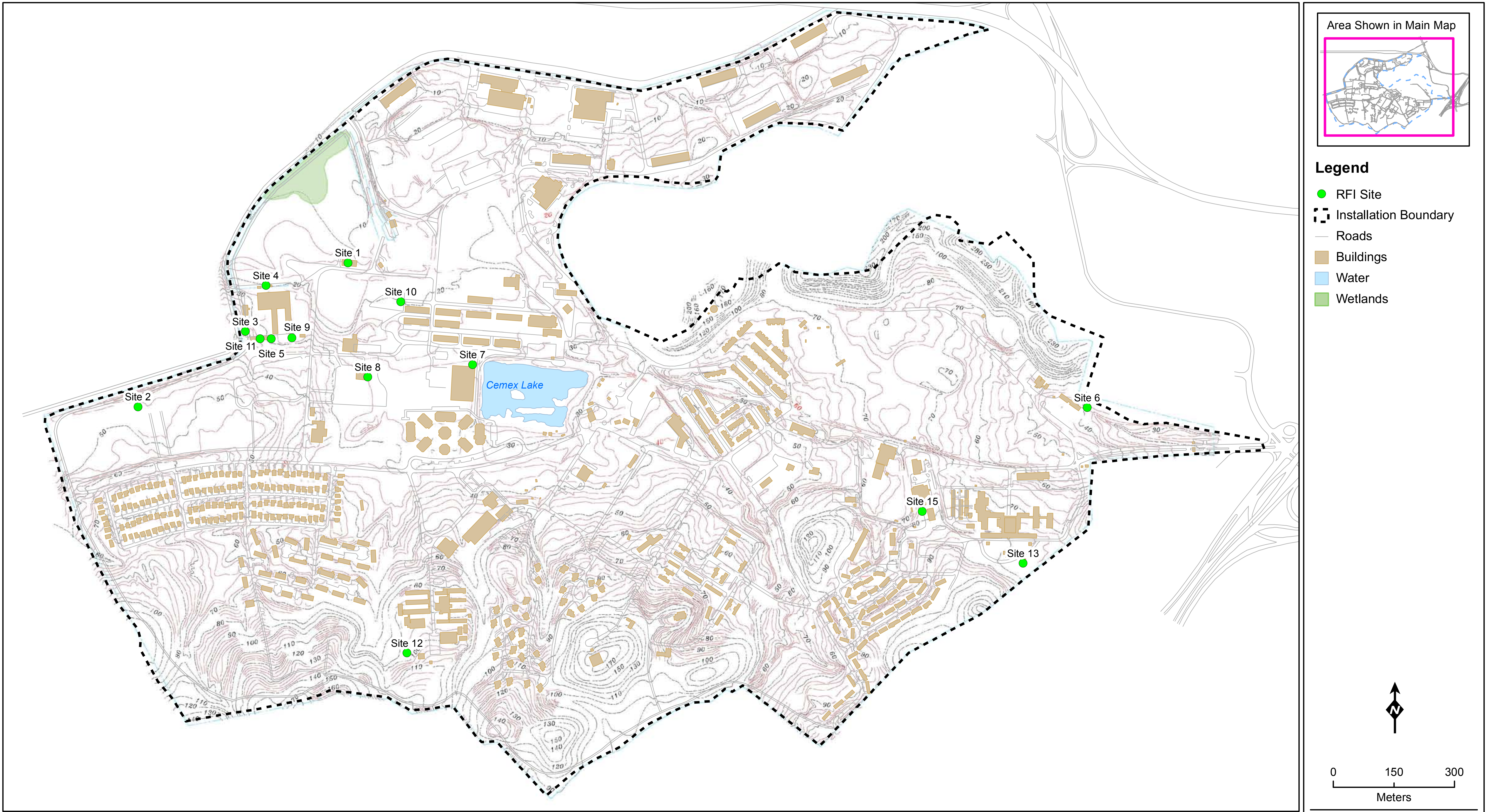
0 500 1,000
Meters

EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Figure 2-1
Geologic Map of Fort Buchanan and Surrounding Area

\\Edgewood\projects\Universal GIS\Buchanan\MXDs\RFI MXDs\Geologic Map.mxd

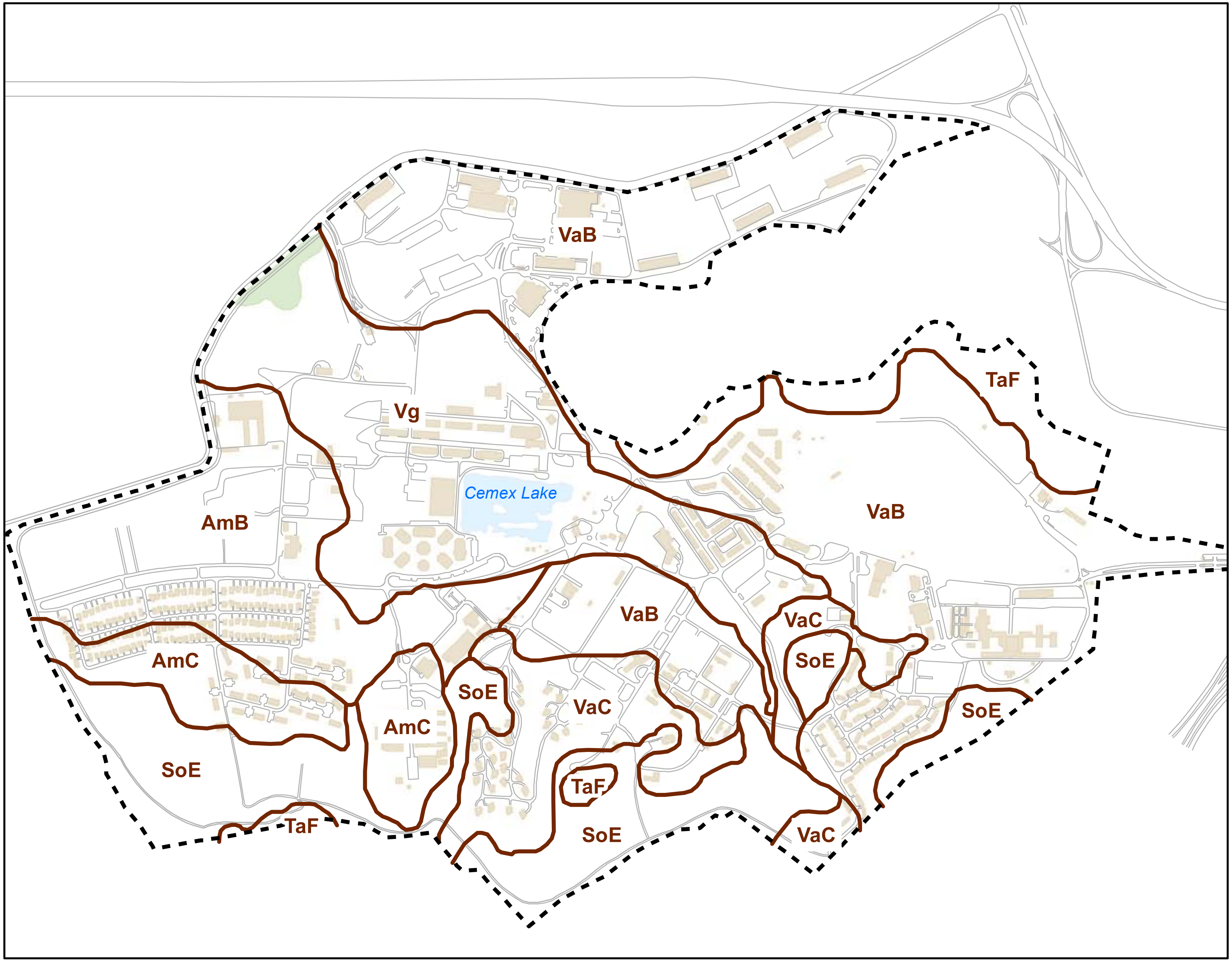


Fort Buchanan, Puerto Rico

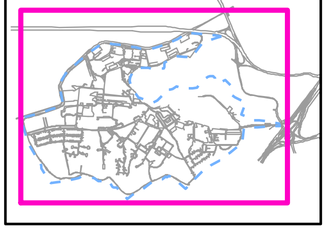
Figure 2-2
Topographic Map of Fort Buchanan

EA Engineering, Science, and Technology

\\Edgewood\projects\Universal GIS\Buchanan\MXDs\RFI MXDs\RFI Fig 2-1 topography - 11x17.mxd



Area Shown in Main Map



Legend

▭ Installation Boundary
— Soil Type Boundary
— Roads
🟫 Buildings
🟩 Wetlands
🟦 Water

Soil Key and % Slope
AmB = Almirante, 2-5%
AmC = Almirante, 5-12%
SoE = Soller, 20-40%
TaF = Tanama, 20-6-%
VaB = Vega Alta, 2-5%
VaC = Vega Alta, 5-12%
Vg = Vega Baja, 0-2%

0 175 350
Meters

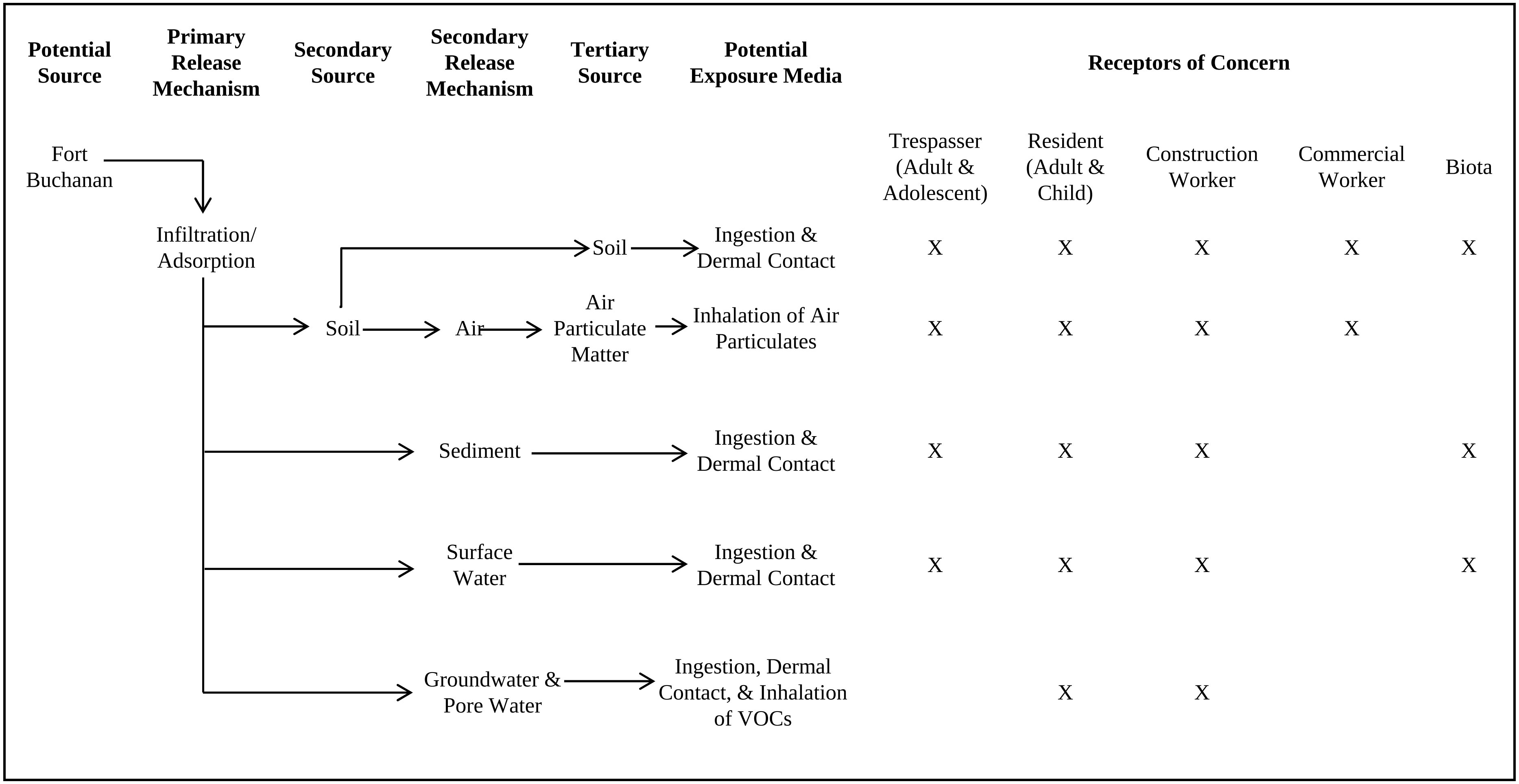
N

Fort Buchanan, Puerto Rico

Figure 2-3
Soil Types at Fort Buchanan

EA Engineering, Science, and Technology

\\Edgewoodfp\projects\ARMYBEST\PROJECTS\6191735 Ft Buchanan\GIS\RFI Fig 2-2 soil types.mxd



Potential Source	Primary Release Mechanism	Secondary Source	Secondary Release Mechanism	Tertiary Source	Potential Exposure Media	Trespasser (Adult & Adolescent)	Resident (Adult & Child)	Construction Worker	Commercial Worker	Biota
Fort Buchanan	Infiltration/ Adsorption	Soil		Soil	Ingestion & Dermal Contact	X	X	X	X	X
		Soil	Air	Air Particulate Matter	Inhalation of Air Particulates	X	X	X	X	
			Sediment		Ingestion & Dermal Contact	X	X	X		X
			Surface Water		Ingestion & Dermal Contact	X	X	X		X
			Groundwater & Pore Water		Ingestion, Dermal Contact, & Inhalation of VOCs		X	X		

Note: surface water was only sampled at Site 12, sediment was only sampled at Sites 6 and 12, and groundwater was only sampled at Sites 1, 2, 3, 4, 7, 8, 10, 12, and 13.

Fort Buchanan, Puerto Rico
Site Wide RFI

Figure 2-4
Generalized Conceptual Site Model
for Fort Buchanan

EA Engineering, Science, and Technology

3 FIELD ACTIVITIES AND METHODOLOGY

This section summarizes field activities that were performed as part of the Site Wide RFI. RFI activities were conducted in accordance with the Site Wide RFI Quality Assurance Project Plan (QAPP; EA 2010), Work Plan (EA 2008a), and addendums (EA 2011a, EA 2011b), which were reviewed and approved by the USEPA, Fort Buchanan, and the PREQB. RFI field activities began in April 2007 and were completed in September 2011.

Stakeholders (U.S. Army Environmental Command [AEC], Fort Buchanan Directorate of Public Works (DPW), USEPA, PREQB, U.S. Army Corps of Engineers–Waterways Experiment Station [USACE-WES], and EA Engineering, Science, and Technology, Inc. [EA]) were involved in the development of the Site Wide RFI Work Plan through field visits, meetings, and review of the document. The first Installation Action Plan (IAP) meeting was held 13-14 February 2007, and each of the RFI sites was visited by meeting attendees. One of the meeting objectives was for agreement to be reached regarding the sampling protocol for each RFI site to provide direction for the completion of the work plan. This meeting objective was met, and the RFI Work Plan (EA 2008a) reflects the decisions that were made at this IAP meeting. Meeting minutes and summaries of the sampling plan that was developed at the meeting are presented in Appendix B.

The work plan was discussed again at the February 2008 IAP meeting, and the document was finalized and approved in March 2008.

An overview of the site sampling plans, including media sampled, number of samples taken, depth of samples, and analyses is presented in Table 3-1. Analytical procedures used for this project are summarized by USEPA Method in Table 3-2. Copies of field notes, groundwater purge sheets, and boring logs are included in Appendix C.

Some data generated for the NWBA RFI are also included in this Site Wide RFI because some of the Sites overlie the NWBA aquifer. Details regarding the sampling activities and methodologies are provided in the work plan and associated addendums for that investigation (EA 2006, EA 2007a, EA 2007b, EA 2008b, EA 2008c, EA 2008d). Samples from the NWBA field efforts that are included in the Site Wide RFI are included in Table 3-1.

3.1 SITE 1, SWMU 1: OLD HAZARDOUS WASTE CONTAINERS

3.1.1 Site History

This site (Site 1, Figures 1-3 and 3-1) is associated with a 600 sq ft, concrete-floored building (Building 539) that stored various chemicals from 1968 to 1977 in the forms of acids, bases, solvents, and pesticides, including DDT. Previous sampling conducted during the EBS in 1989 (Woodward-Clyde 1997) reported concentrations of 42.5 micrograms per kilogram (ug/kg) of pesticides in the soil near the building. Additionally, a Phase II site investigation reported up to 5 ug/kg of DDT in the soil. A maintained grassy area surrounds the building to the east, north, and west, while a gravel strip approximately 10-ft wide separates the south side of the building from a paved road. No drainage outfalls from the building were discovered in the EBS report (Woodward-Clyde 1997). Currently the building is used as an armory storage area.

As part of the NWBA RFI, a monitoring well (MW) cluster was installed downgradient of the site (MW-11). The analytical results acquired from the sampling of this well cluster will be discussed to establish groundwater impacts near the site. The wells were sampled in June 2007 for VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), herbicides, and metals. They were resampled for VOCs in January and May 2008, January 2009, and August 2010 (MW-11A only).

3.1.2 RFI Site Sampling Strategy

Prior to soil sampling, an inspection of the building and surroundings was made to verify and access potential drain locations leading away from the building. Upon locating the drains, sample locations were decided upon. The sample locations two, three and four were placed near drain outlets; the sample location on the southern side of the building (one) was an upgradient location, for a total of four soil borings. The field work was accomplished on 23 October 2008.

Each soil boring consisted of two samples at two different depths (0-2 ft, and 2-4 ft). These were accomplished using a hand auger and a hand-held geoprobe for VOC sampling. The soil was analyzed for VOCs, SVOCs, PCBs, and pesticides.

3.2 SITE 2, SWMU 3: PESTICIDES AND CHEMICALS BURIAL TRENCH

As a result of the Installation Assessment (IA) conducted in 1982 at Fort Buchanan, a suspected disposal site for hazardous materials was identified, and is now identified as SWMU 3 (Figures 1-3 and 3-2). This disposal site was believed to be a trench 6 ft deep, 30 ft wide, and 100 ft long that was reported to be used to dispose of 1 ton of dry pesticides in 1977, along with construction debris and trees. The pesticides were suspected to be chlordane, p,p'-DDE, and heptachlor. The trench was rumored to be along the perimeter road on the northwest corner of Fort Buchanan. In 1980, PRASA installed a potable water supply main across the installation near SWMU 3. The main is 66 inches in diameter, buried 10 ft, and supported by packed gravel underlayment. In 1983 the U.S. Army Toxic and Hazardous Material Agency (USATHAMA) sampled soil from 17 shallow and 1 deep boring. No firm evidence for the burial of pesticides was found.

Subsequently, geophysical surveys using ground conductivity (quadrature, in-phase) and magnetic (total magnetic field, magnetic gradient) techniques were conducted.

In 1990, the PREQB completed a RFA of Fort Buchanan. On the basis of this RFA, the USEPA determined there was potential for risk at SWMU 3. Consequently, in 1992-93, USACE-WES collected fifty-two soil samples from eight test pits. No evidence of pesticide levels that indicate a large-scale burial trench was found, and only low concentrations of DDT to a maximum 3.28 micrograms per gram (ug/g) were found in composite samples at a depth of 4 ft on the northern end of one of the test pits. Copies of the USACE-WES report (Llopis 1993) and the USATHAMA report are included in Appendix F.

No new information was found to verify the correct depth of the alleged trench.

3.2.1 Groundwater Investigation

Chlorinated solvents, primarily TCE, have been detected at concentrations up to 154 micrograms per liter (ug/L) in groundwater monitoring well samples collected within the adjacent CPR property in 2004. The U.S. Army Fort Buchanan was notified by USEPA Region 2 that CPR had identified the presence of a TCE plume in the lower aquifer while conducting the required RFI. According to USEPA’s letter dated February 11, 2005, the plume exceeds the Maximum Contaminant Level (MCL) for TCE and is located beneath the eastern portion of the CPR facility and extends beyond the CPR facility boundary and may extend beyond the southwestern boundary of Fort Buchanan. The source of these TCE concentrations in groundwater had not been determined, but was originally suspected to be the pesticides and chemicals burial trench (SWMU 3).

USEPA recommended that the RFI Work Plan incorporate an investigation of the TCE contamination of the water table aquifer and a deeper semi-confined aquifer that is known to be present on the adjacent property to the north occupied by CPR. Thus, a RFI specifically for the groundwater of the NWBA was planned and executed (EA 2012), and included groundwater data generated from wells located throughout the NWBA and off-post. Six of the NWBA monitoring wells were installed in the vicinity of the suspected burial trench and are included in this Site Wide RFI.

The Site Wide RFI addresses Site 2 with respect to the pesticides and chemicals burial trench; this RFI does not address the TCE plume. Therefore, only samples located in the vicinity of the suspected burial trench are included with Site 2 in this RFI (Figure 3-2).

3.2.2 RFI Site Sampling Strategy

To determine whether SWMU 3 is a possible source of contamination in the groundwater along the northwest boundary of Fort Buchanan and identify the potential existence of the burial trench, four soil borings and six wells were installed (Figure 3-2) in October through December 2006. At each of the four soil borings, two samples were collected. At each boring, a soil sample was collected from 4-8 ft, and another sample approaching the carbonate sand aquifer, between 20 and 37 ft, depending on the borehole, was collected for laboratory analysis of VOCs, SVOCs, herbicides, pesticides, PCBs, sulfide, Total Petroleum Hydrocarbons (TPH) Diesel Range Organics (DRO) and Gasoline Range Organics (GRO), and metals. Additionally, each of the six wells was sampled twice, once for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals (January 2007); the second time for VOCs only (June 2007). Wells MW-1, MW-3A, MW-4A, and MW-4B were sampled a third time for VOCs and TPH in August 2010.

3.3 SITE 3, SWMU 4: SPENT SOLVENTS STORAGE AREA

3.3.1 Site History

According to the initial EBS report (Woodward-Clyde 1997) several 55-gallon drums containing spent solvents were stored on the southwest portion of the Building 556 yard (Figures 1-3 and 3-1). The containers were stored without any secondary release protection on asphalt, and supposedly contained hydrogen fluoride. Staining near the site was observed around 1990, after the area had been used for approximately 10 years. The area is flat, with runoff going to the storm water catch basins. Spent solvents are no longer stored at the site.

As part of the NWBA RFI, a monitoring well cluster was installed downgradient of the site (MW-5). The analytical results acquired from the sampling of this well cluster will be discussed to establish groundwater impacts near the site. The wells were sampled for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals in January 2007, were resampled in June 2007 and August 2010 (MW-5A only) for VOCs.

3.3.2 RFI Site Sampling Strategy

To characterize the extent of a potential release, four soil sample locations (Figure 3-1) were chosen near the old storage area. Two soil samples were collected from each location on 22 October 2008 using a hand auger at two different depths (1-2 ft, 2-4 ft) and a hand-held geoprobe for VOC sampling. The shallow samples were collected well below the asphalt. Each of the eight samples was analyzed for VOCs, SVOCs, pesticides, metals, and TPH.

3.4 SITE 4, SWMU 5: PCB TRANSFORMER STORAGE AREA #1

3.4.1 Site History

PCB transformers were stored over an asphalt yard immediately north of the DPW building. The area slopes away to the north and drains to El Toro Creek. Groundwater monitoring well cluster MW-10 was installed as part of the NWBA RFI and is in close proximity to Site 4. Therefore, data generated from these wells will be discussed with Site 4. The wells were sampled in June 2007 for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals, and were sampled for VOCs only in January 2008 and March 2009.

3.4.2 RFI Site Sampling Strategy

In order to investigate the potential for historical releases, six soil borings were performed immediately north of the DPW compound (Figure 3-1) on 20 October 2008. The borings were spaced approximately 20 to 25 ft apart to characterize approximately 100 to 125 ft along the edge of the asphalt area. Samples were collected at 0-2 ft using a hand auger and analyzed for PCBs.

3.5 SITE 5, SWMU 6: PCB TRANSFORMERS STORAGE AREA #2

3.5.1 Site History

An approximately 100 sq ft facility south of the DPW building was used in the early 1980s to store transformers. A spill of two gallons of transformer fluid reportedly occurred in June 1982, and the storage unit was destroyed in 1989 by Hurricane Hugo (Woodward-Clyde 1997). The area has a concrete floor and is now occupied by a metal structure. Transformers are currently not stored on the site, and the concrete slab is surrounded by an asphalt work area (Woodward-Clyde 1997).

3.5.2 RFI Site Sampling Strategy

Two shallow soil borings were performed at the site (Figure 3-1) on 20 October 2008. Both were collected at a sufficient depth beneath the asphalt to avoid contamination. Using a hand auger, two samples were collected at two different depths (1-2 ft, 2-4 ft) from each boring and were analyzed for PCBs.

3.6 SITE 6: PESTICIDE STORAGE AREA

3.6.1 Site History

A pesticide and herbicide mixing area located on a 5-by-5 ft unbermed concrete slab was used north of Building 138 from 1975 to approximately 1985. Various reports indicated that spills occurred during the mixing of pesticides at the location. Storm water runoff is to the north of the mixing area into an open-banked drainage ditch. In 1991, the PREQB recommended that soil samples be collected around the concrete slab and near the open drainage ditch; no sampling occurred prior to this RFI. The area currently includes a mixing area that drains to a 500 sq ft bermed concrete slab, which in turn drains to a holding tank.

3.6.2 RFI Site Sampling Strategy

Three soil borings were installed around the northeastern side of the concrete slab (Figure 3-3) on 2 December 2008. The soil borings were conducted using a hand auger, and two samples were collected at each location (0-2 ft, 2-4 ft). Additionally, three sediment samples were collected from the drainage ditch north of the site: one upstream, one in the vicinity of the pad, and one downstream. The soil and sediment samples were analyzed for pesticides and herbicides.

3.7 SITE 7: BUILDING 541

3.7.1 Site History

Building 541 historically housed a hazardous material storage area, and the drainage system discharged directly to a 55-gallon drum containment system located immediately north of the building. The drum was housed within a secondary containment system consisting of a concrete berm with an open polyvinyl chloride (PVC) pipe extending to the north. Any overflow from the drum would flow into the berm and subsequently out the pipe; however, no spills have been reported at Building 541. The area around the containment system is grass, relatively flat, and has no visible staining on the ground surface. No documentation has been found that identified the nature of the hazardous wastes (Woodward-Clyde 1997).

A monitoring well cluster (MW-19A, B) was installed at the site as part of the NWBA RFI (Figure 3-4). The analytical results acquired from the sampling of this well will be discussed to establish groundwater impacts near the site. However, it should be noted that MW-19B was installed in the deeper carbonate sand aquifer and may not be representative of the shallow water table. MW-19A was installed in a shallower aquifer, and has a total depth of 36 ft. The wells were sampled in January 2008 for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals, and were resampled in May 2008 for VOCs only.

3.7.2 RFI Site Sampling Strategy

The sampling strategy consisted of one soil boring installed (Figure 3-4) on 23 October 2008 adjacent and downgradient from the overflow pipe. Two soil samples from two different depths

(0-2 ft, 2-4 ft) were collected from the boring. An attempt was made to auger down deeper to obtain a grab groundwater sample, but refusal was encountered, so the boring was abandoned.

On 28 January 2009, a geoprobe was utilized in an attempt to obtain the grab groundwater sample from first encountered groundwater. A boring was installed to a depth of 15 ft, and a temporary 1-inch PVC screen and casing were installed in the boring. The boring was not installed deeper, because the monitoring well nearby (MW-19A) has a screened interval from 23-33 ft bgs. The temporary well was allowed to sit overnight. On 29 January 2009, the temporary well was gauged, indicating approximately 1.5 ft of water in the well. The temporary well was then sampled using a peristaltic pump. After sampling, the well casing was pulled and the borehole filled-in-place with soil cuttings.

The soil samples were analyzed for VOCs, SVOCs, metals, PCBs, pesticides, herbicides, and TPH. Given the limited volume of water obtained, the groundwater was sampled for VOCs, herbicides, pesticides, and PCBs.

3.8 SITE 8: BUILDING S-563

3.8.1 Site History

Building S-563 (Figure 3-1) was used as an automobile body shop from an undetermined date until a hobby shop began in 1988. Past inspections identified discarded car parts in the storm drains immediately to the west of the building. The building itself discharges along both sides of the building and empty into concrete storm water junction boxes located on the east side of the building. The EBS identified a PVC pipe extending from the southwest corner of the building and discharging directly into the storm water drain, with no origin for the pipe (Woodward-Clyde 1997). The building is currently used as a workout room for the National Guard. Two indoor floor drains were observed during a site walkthrough, and it is assumed to flow into the storm water system. No PVC pipe was observed during the RFI.

As part of the NWBA RFI, monitoring well MW-23 was installed on the north side of the building. The analytical results generated from the sampling of this well will be discussed to establish groundwater impacts near the site. The well was sampled for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals in May 2008, and was resampled in January 2009 for VOC only.

3.8.2 RFI Site Sampling Strategy

Prior to sampling, a walkthrough of the site was performed to assess effluent discharge locations from the building. On 22 October 2008, two soil borings were installed, one at the end of each storm water sump (Figure 3-1). Two soil samples were to be collected from each boring at two different depths (2-4 ft, 4-6 ft bgs) allowing the deeper sample to be collected beneath the level of the storm water sump. However, refusal was reached on the second boring, and one deep soil sample (4-6 ft) was not collected at that time. Sediment and surface water samples were not collected from the storm water sumps because it was determined that the basins captured water and sediment from locations to the north and south of the building, and were therefore not representative of the site itself.

On 28 January 2009, a geoprobe was utilized to collect the deep sample at the second boring location. Soil samples were analyzed for VOCs, SVOCs, metals (total and dissolved), and TPH.

3.9 SITE 9: USED OIL STAGING AREA

3.9.1 Site History

The EBS (Woodward-Clyde 1997) noted that a used oil staging area existed south of Building T-552 (DPW yard, Figure 3-1). During the inspection, eight 55-gallon drums of used oil were observed. Prior to secondary containment being installed around the drums, staining of the soils was observed. Historical photographs depict the site as being gravel-covered, with drums staged throughout the site.

3.9.2 RFI Site Sampling Strategy

The sampling strategy consisted of three soil borings installed on 21 October 2008 around the location of the former staging area (Figure 3-1). Two soil samples were collected from each boring at two different depths (2-4 ft, 4-6 ft) and were confirmed in the field to be below the asphalt layer. Soil samples were analyzed for VOCs, SVOCs, metals, PCBs, pesticides, herbicides and TPH.

3.10 SITE 10: 65TH ARMY RESERVE COMMAND REFUELING AREA

3.10.1 Site History

The EBS noted that a spill occurred in the refueling area in May 1995, causing an approximately 6 sq ft area of stained soil. Sampling conducted following the removal of the stained area reported TPH concentrations of up to 25,000 milligrams per kilogram (mg/kg), which exceeds PREQB’s recommended criteria for TPH in soil of 100 mg/kg. Currently, a concrete pad (Figure 3-1) approximately 3-6 ft thick exists over top of the stained soil location. No further sampling has occurred since the pad was installed, and no signs of a release are visible (Woodward-Clyde 1997). The area is relatively flat.

As part of the NWBA RFI, monitoring well MW-20 was installed west of the site. The analytical results generated from the sampling of this well will be discussed to establish groundwater impacts near the site. The well was sampled for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals in May 2008, and was resampled in January 2009 for VOCs only.

3.10.2 RFI Site Sampling Strategy

Sampling consisted of two soil borings on the southeast corner of the concrete pad (Borings 1 and 2), and one boring on the northern side of the pad (Boring 3) installed on 22 October 2008 (Figure 3-1). Two samples (0-2 ft, 2-4 ft) were collected from each boring and analyzed for VOCs and TPH-DRO.

3.11 SITE 11: HEAVY EQUIPMENT STORAGE AREA

3.11.1 Site History

Southwest of the DPW building (T-552) is a heavy equipment storage area. The EBS noted the release of various petroleum products from the equipment, which has resulted in obvious soil staining at the site. Additional investigation is warranted for the site to determine if soils have been impacted by petroleum hydrocarbons. No soil samples have been collected at the site prior to the current investigation. The site has been paved with asphalt.

3.11.2 RFI Site Sampling Strategy

The investigation of the site consisted of four soil borings installed on 21 October 2008, evenly spaced along the heavy equipment storage area (Figure 3-1). Each boring consisted of one soil sample (2-4 ft) and was analyzed for VOCs, metals, PCBs, and TPH-DRO.

3.12 SITE 12: OLD LANDFILL

3.12.1 Site History

The former waste disposal area is located in the southwest portion of Fort Buchanan, adjacent to and just southwest of the elementary school (Figure 1-3). The history of the old landfill dates back to the 1960s, and the site was likely used until the early 1990s. There is anecdotal evidence from former base employees that dumping of paint cans, oil drums, and other possibly hazardous materials occurred at the site, but that these materials were removed when observed (Woodward-Clyde 1997). In addition, in August 1979, sawdust was used to clean up a diesel spill. The contaminated sawdust was containerized in plastic bags and placed in this landfill (Woodward-Clyde 1997). During site visits made prior to and during field work related to this RFI, the debris observed at the site was construction rubble.

Currently, access to the disposal area is limited. The area is entirely enclosed within a fence; just inside the fence is a swath of thick vegetation approximately three meters wide, and the vegetation ends at a steep ravine with bedrock outcrops. The location and disposition of the rubble waste observed at the site suggest that the disposal method consisted of pushing material over the edge of the ravine.

3.12.2 Previous Investigations

A geohydrologic study performed by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) and published in 1999 showed a high level of metals detected in both water and soil media (Figure 3-5). A main impetus for the Army to further investigate the Old Landfill area was the high arsenic concentrations detected in both sediment and groundwater. The USEPA MCL of 10 ug/L was exceeded for arsenic in the groundwater in the vicinity of the Old Landfill, with reported concentrations of 140 ug/L found in MW-4 and 100 ug/L in MW-3. All four monitoring well samples exceeded the arsenic MCL. Sediment samples collected from the streambed running through the Old Landfill vicinity ranged as high as 200 mg/kg for arsenic, well above the risk-based concentration (RBC) issued by Region 3 at the time of the investigation of 27 mg/kg (USACHPPM 1999).

3.12.3 RFI Site Sampling Strategy

The first phase of sampling at the Old Landfill occurred in the spring and summer of 2007. This investigation provided groundwater data for: VOCs, SVOCs, herbicides, pesticides, PCBs, and total and dissolved metals. Sediment and surface water were analyzed for VOCs, SVOCs, Target Analyte List (TAL) metals (including dissolved metals in surface water) pesticides, and herbicides. Four surface soil samples were analyzed for SVOCs, metals, pesticides, herbicides, and polycyclic aromatic hydrocarbons (PAHs). The three groundwater monitoring wells around the Old Landfill were sampled on 13 June 2007 for SVOCs, VOCs, pesticides, PCBs, herbicides, and metals (total and dissolved). Figure 3-6 shows the sample locations.

A second sampling phase was performed to assess potential PCB or TPH contamination in the soil, sediment, and surface water. Based on the debris items reported during the 1999 landfill investigation, the potential exists for TPH and PCB impacts at the site. These analytes were not analyzed during the June 2007 investigation, therefore, resampling of the surface water, sediment, and soil were performed to assess TPH and PCB impacts. Four surface soil samples were collected on 2 December 2008 from 0-6 inches; six surface water and six sediment samples were collected on 4 February 2009. The surface water and sediment samples were collected at the same locations as the 2007 locations, as the locations had been marked in the field with flagging.

Groundwater was not resampled for TPH at the site because no petroleum-related VOC or SVOC detections were found in the soil, sediment, or surface water during the June 2007 sampling event. PCBs were also not detected in groundwater in the initial event.

Sediment pore water samples were collected from three locations in September 2011. These data were generated to characterize groundwater immediately downgradient of the Site 12 landfill. Installation of groundwater monitoring wells immediately downgradient of the landfill was not feasible due to the heavy vegetation at the Site and the fact that the area is protected habitat for the endangered species *Epicrates inornatus* (the Puerto Rican boa). Therefore, it was agreed among the Army and the USEPA that sediment pore water samples would be collected at the base of the landfill and used to represent groundwater conditions (EA 2011c, included in Appendix G).

3.13 SITE 13: POTENTIAL HAZARDOUS MATERIAL BURIAL SITE

3.13.1 Site History

A potential hazardous material disposal area (Figure 1-3) is located south of old building S-18 (which no longer exists). It was reported that unused chemicals from the high school may have been disposed of in the wooded area at this location. Earlier investigations of the area yielded a low area filled with trash, empty paint cans, fluorescent lamps, and construction debris. A Phase I investigation concluded that there was not a significant risk of contamination at the site. Based on site visits in 2006, the area is mostly wooded, with dense vegetation, and the drainage appears to head towards the low point just east of the wooded area. The Phase I recommended that the sampling analysis should focus on lead-based paints, chromium, nickel, zinc, barium, xylene and pesticides (Woodward-Clyde 1997).

3.13.2 RFI Site Sampling Strategy

Prior to collecting soil samples, the site was visually inspected for anomalies or areas of possible dumping. Six boring locations (Figure 3-3) inside the wooded area were installed on 2 December 2008 and biased towards locations were dumping was suspected. Each boring was sampled from 0-2 ft.

An additional downgradient boring was installed within the low area along the eastern edge of the wooded site, and sampled at two intervals (0-2 ft, 2-4 ft). An initial attempt to obtain a groundwater sample from this boring failed. On 28 January 2009, a geoprobe was utilized to install a one-inch PVC temporary monitoring well at this location. The well was sampled on 29 January 2009, and subsequently the well was removed and the borehole was properly abandoned immediately after sampling the groundwater. Soil samples were analyzed for VOCs, SVOCs, metals, PCBs, pesticides, herbicides, and TPH. Groundwater was analyzed for VOCs, SVOCs, herbicides and pesticides.

3.14 SITE 15: BUILDING S-159

3.14.1 Site History

The EBS identified potentially leaking drums as a source of possible contamination at this site. The area around Building S-159 contained approximately twenty 55-gallon drums of used oil, solvents, and coolant. Staining was observed beneath the drum locations, and any leakage was found to flow west across asphalt into a grassy area, down a small hill, and into the storm water system. The building currently has a used oil storage system in the form of a 1,000 gallon aboveground storage tank (AST) with secondary containment (Woodward-Clyde 1997). To date, no analysis of soil or any media has occurred at the site.

3.14.2 RFI Site Sampling Strategy

Sampling of the site on 20 October 2008 consisted of two soil borings installed along the drainage ditch to the west of the asphalt and before reaching the storm water system (Figure 3-3). A hand auger was used to sample each boring twice at two different depths (0-1 ft, 2-4 ft). The soil samples were analyzed for TPH and metals.

3.15 BACKGROUND

3.15.1 History

During the 2007 IAP meeting (Appendix B), concerns were raised regarding the need to characterize naturally elevated concentrations of certain metals found in Puerto Rico. Certain metals are thought to occur at naturally elevated concentrations (with respect to the mainland United States) due to the limestone and carbonate geology of Puerto Rico. In 2007, the Army directed and conducted an internal background study of metals concentrations to address these concerns. In 2011, the Army directed and conducted a second background investigation to characterize concentrations of chemicals of potential concern (COPCs) that could be anticipated in areas not influenced by releases from chemical sources.

3.15.2 Sampling Strategy

For the background metals investigation, thirty soil samples and three duplicates were collected from areas of the base where historic activities were not expected to result in any chemical releases to the environment (Figure 3-7). Samples were collected from the surface (0-0.5 ft bgs) using a hand auger and were analyzed for TAL metals using methods SW846 6010B and SW846

7471A. For the background pesticides investigation, twelve soil samples and one duplicate were collected from areas of the installation where specific pesticide-related historic activities (such as storage or mixing) did not occur. Samples were collected from the surface (0-0.5 ft bgs) using a hand auger and were analyzed for organochlorine pesticides (method SW846 8081A) and herbicides (method SW846 8151A, to measure pentachlorophenol, which had previously been identified as a COPC). The sample design and methods are described further in the work plan (EA 2011a).

3.15.3 Data Use

The 95% Upper Prediction Limits (UPL) of the background dataset were calculated using the USEPA's ProUCL software. The 95% UPL represents a cut-off value at the upper end of the range of the background data, and any onsite sample concentrations that are greater than the 95% UPL are statistically significantly different from the background dataset.

The comparison of onsite data to background data is perhaps the most effective way to identify site-related impacts. This is especially true for a site with unique geology, such as Fort Buchanan, where elevated concentrations of some compounds are naturally occurring. The screening levels used in this RFI do not take into account the natural concentrations of inorganic compounds found at the site, and thus can result in misleading conclusions.

Table 3-3 presents the range of concentrations detected in the background samples, the frequency of detection, and the 95% UPL. Appendix H presents the background technical memorandum, which describes in detail the statistical process for calculating background comparison values and includes the ProUCL outputs for the background dataset. Laboratory analytical reports and data validation reports are included in Appendix I.

3.16 MANAGEMENT OF INVESTIGATIVE DERIVED MATERIAL (IDM)

Investigative Derived Material (IDM) includes soil cuttings from borings, decontamination water, and personal protective equipment (PPE). IDM handling and disposal procedures are described extensively in Chapter 6 of the QAPP (EA 2010).

Soil cuttings from soil borings were either used to fill in boreholes or contained in 55-gallon drums. Soil drums were labeled, sampled, and staged at Fort Buchanan pending analytical results. Purge water from wells were containerized in separate drums, labeled, sampled, and staged at Buchanan. All drums were eventually removed and taken to a non-hazardous waste disposal facility.

Manifests for the shipped drums are provided in Appendix J.

Table 3-1. Summary of RFI Work Plan Field Activities.

	Number of Samples						Analyses Performed					
	Soil											
Site	# Samples	# Locations	Depth Interval (ft)	**Sediment**	**Surface Water**	**Groundwater**	**VOC**	**SVOC**	**Metals**	**PCBs**	**Pesticides/ Herbicides**	**TPH**
1: Old Hazardous Waste Containers	8	4	0-2, 2-4	0	0	10	x	x	x	x	x	x
2: SWMU 3	8	4	4-8, 20-24, 26-28, 37-36	0	0	17	x	x	x	x	x	x
3: Spent Solvent Storage Area	8	9	1-2, 2-4,	0	0	7	x	x	x	x	x	x
4: PCB Storage Area #1	6	6	0-2	0	0	6	x	x	x	x	x	
5: PCB Storage Area #2	4	2	1-2, 2-4	0	0	0				x		
6:Pesticide Storage Area	7	3	0-2, 2-4	3	0	0					x	
7: Building 541	3	1	0-2, 2-4	0	0	5	x	x	x	x	x	x
8: Building S-563	4	2	2-4, 4-6	0	0	2	x	x	x	x	x	x
9: Used Oil Staging Area	7	3	2-4, 4-6	0	0	0	x	x	x	x	x	x
10: 65th Army Reserve Command Refueling Area	6	3	0-2, 2-4	0	0	2	x	x	x	x	x	x
11: Heavy Equipment Storage Area	5	4	2-4	0	0	0	x		x	x		x
12: Old Landfill	9	8	0-0.5	8	6	7	x	x	x	x	x	x
13: Potential Hazardous Material Burial Site	9	7	0-2, 2-4	0	0	1	x	x	x	x	x	x
15: Building S-159	4	2	0-1, 2-4	0	0	0			x			x
Totals:	*88*	*58*		*12*	*6*	*58*						

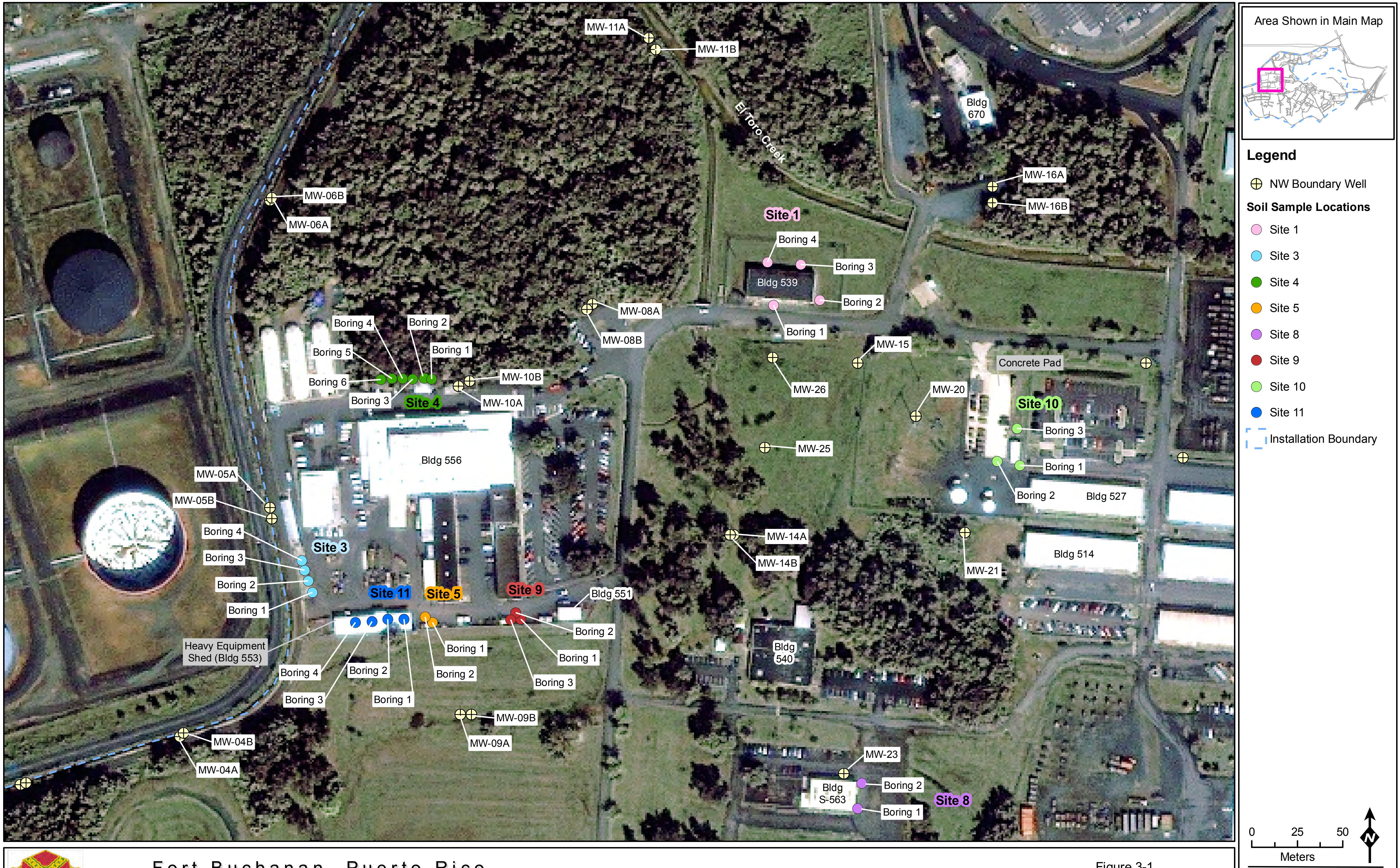
Table 3-2. RFI Analytical Procedures, Fort Buchanan

Analysis	Methodology
Target Analyte List Metals and Cyanide	SW-846 Methods 6010B and 7141A, 335.3, 335.4/LA, SW846 9012 M
Target Compound List volatile and semivolatile organic compounds	SW-846 Methods 8260B and 8270C
Chlorinated pesticides/herbicides	SW-846 Method 8081A and 8151A
Organophosphorus pesticides	SW-846 Method 8141B
Total Petroleum Hydrocarbons (TPH)	SW-846 Method 8015, SM20 5310B
Polychorinated Biphenyls (PCBs)	SW-846 Method 8082

Table 3-3
Upper Prediction Limits of Background Data
Fort Buchanan, Puerto Rico

Analyte	**Frequency of Detection**	**Chemical Concentration**		**95% UPL**
		Average	**Maximum**	
Metals (mg/kg)				
Aluminum	30/30	23063	34000	30027
Antimony	1/30	0.939	2.2	1
Arsenic	30/30	16.3	47.1	43.9
Barium	30/30	61.8	118	102
Beryllium	30/30	0.368	0.77	0.647
Cadmium	25/30	0.614	3.05	0.858
Calcium	30/30	27905	117000	105848
Chromium	30/30	43.8	89.7	69.8
Cobalt	30/30	11.1	28	16.6
Copper	30/30	43	111	83.7
Iron	30/30	30169	54300	47064
Lead	30/30	27.5	152	27.5
Magnesium	30/30	2997	8920	5131
Manganese	30/30	706.5	1280	1184
Mercury	30/30	0.184	1.1	0.32
Nickel	30/30	14.3	42.3	23.0
Potassium	30/30	848	1710	1459
Selenium	1/30	0.933	1	1
Silver	3/30	0.81	2	0.22
Sodium	20/30	165	271	238
Thallium	2/30	1.01	1.1	1.1
Vanadium	30/30	96.1	176	145
Zinc	30/30	84.2	603	81.0
Pesticides (mg/kg)				
4,4-DDD	1/12	0.502	0.0422	0.00051
4,4-DDE	6/12	0.65	0.0556	0.00337
4,4-DDT	6/12	0.198	0.0177	0.00265
alpha-Chlordane	1/12	0.009	0.00123	0.00064
Endosulfan II	1/12	0.0082	0.00118	0.00065
Endosulfan Sulfate	1/12	0.0022	0.00086	0.0009
trans-Chlordane	1/12	0.0085	0.00109	0.00051

UPL = Upper Prediction Limit calculated with EPA ProUCL.



Fort Buchanan, Puerto Rico

RCRA Facility Investigation

Figure 3-1

Sample Locations at Sites

in the Vicinity of the DPW Building

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\\Edgewood\fp\projects\Universal GIS\Buchanan\MXDs\RFI MXDs\sample locs_many sites.mxd

Fort Buchanan, Puerto Rico

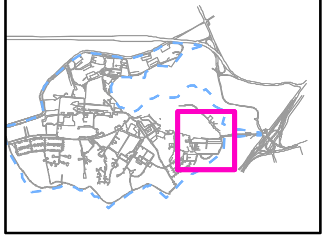
Site 2/SWMU 3
Pesticides and Chemicals Burial Trench

Figure 3-2
Sample Locations at Site 2/SWMU 3

EA Engineering, Science, and Technology

\\Edgewoodfp\projects\ARMY\BEST\PROJECTS\6191735 Ft Buchanan\GIS\site 2 RFI Sample Locations.mxd

Area Shown in Main Map



Legend

Sample Locations

Site, Media

● Site 6, Soil

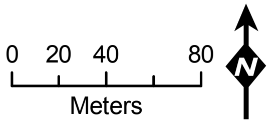
■ Site 6, Sediment

● Site 13, Soil

⊕ Site 13, Soil/Groundwater

● Site 15, Soil

┆ Installation Boundary



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Fort Buchanan, Puerto Rico

RCRA Facility Investigation

Figure 3-3
Sample Locations at
Sites 6, 13, and 15

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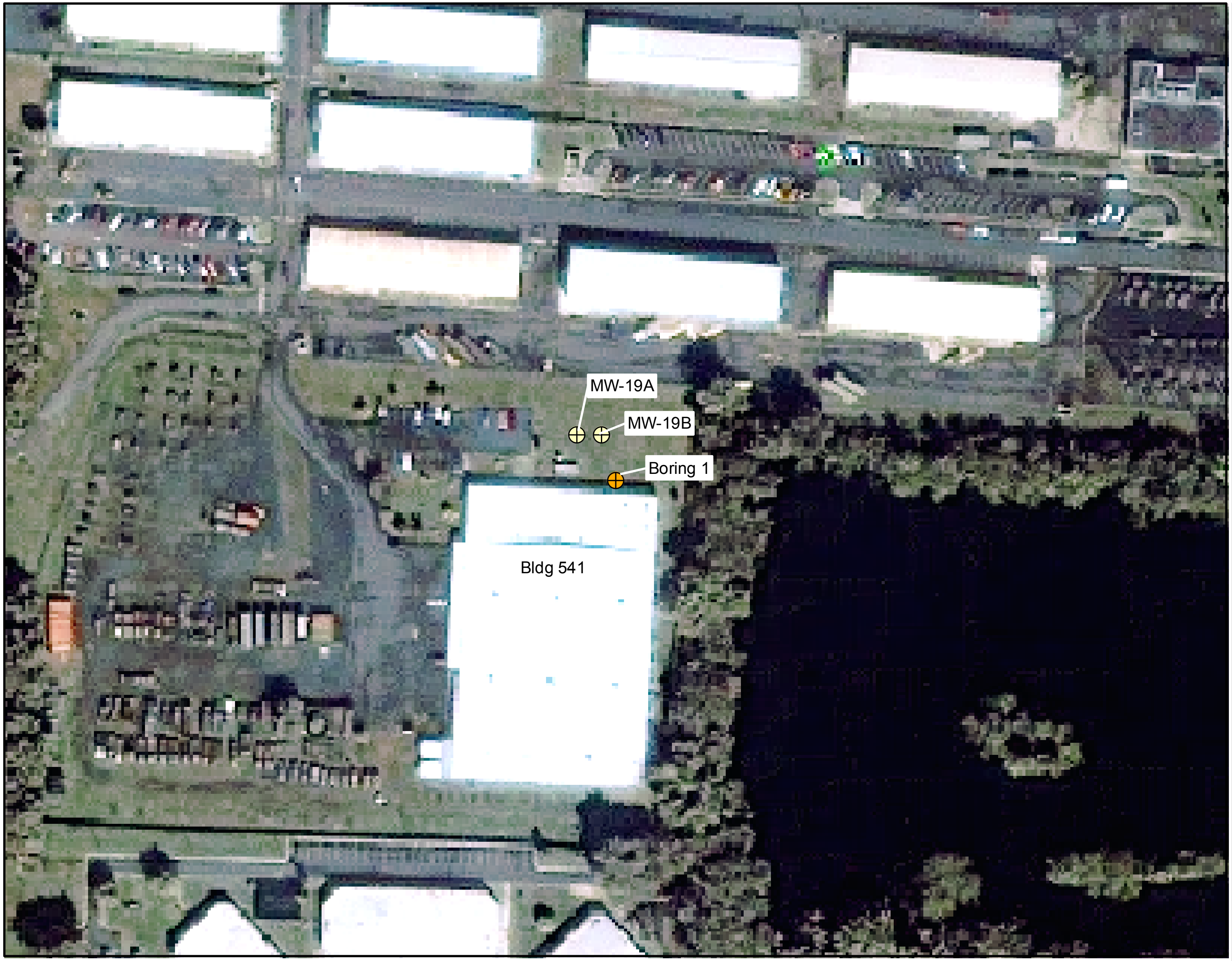
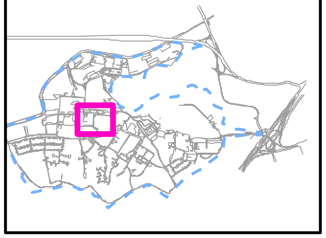


Area Shown in Main Map



Legend

⊕ NW Boundary Well

⊕ RFI Well/Soil Boring

0 20 40
Meters

N

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Fort Buchanan, Puerto Rico

Site 7
Building 541

Figure 3-4
Sample Locations at Site 7

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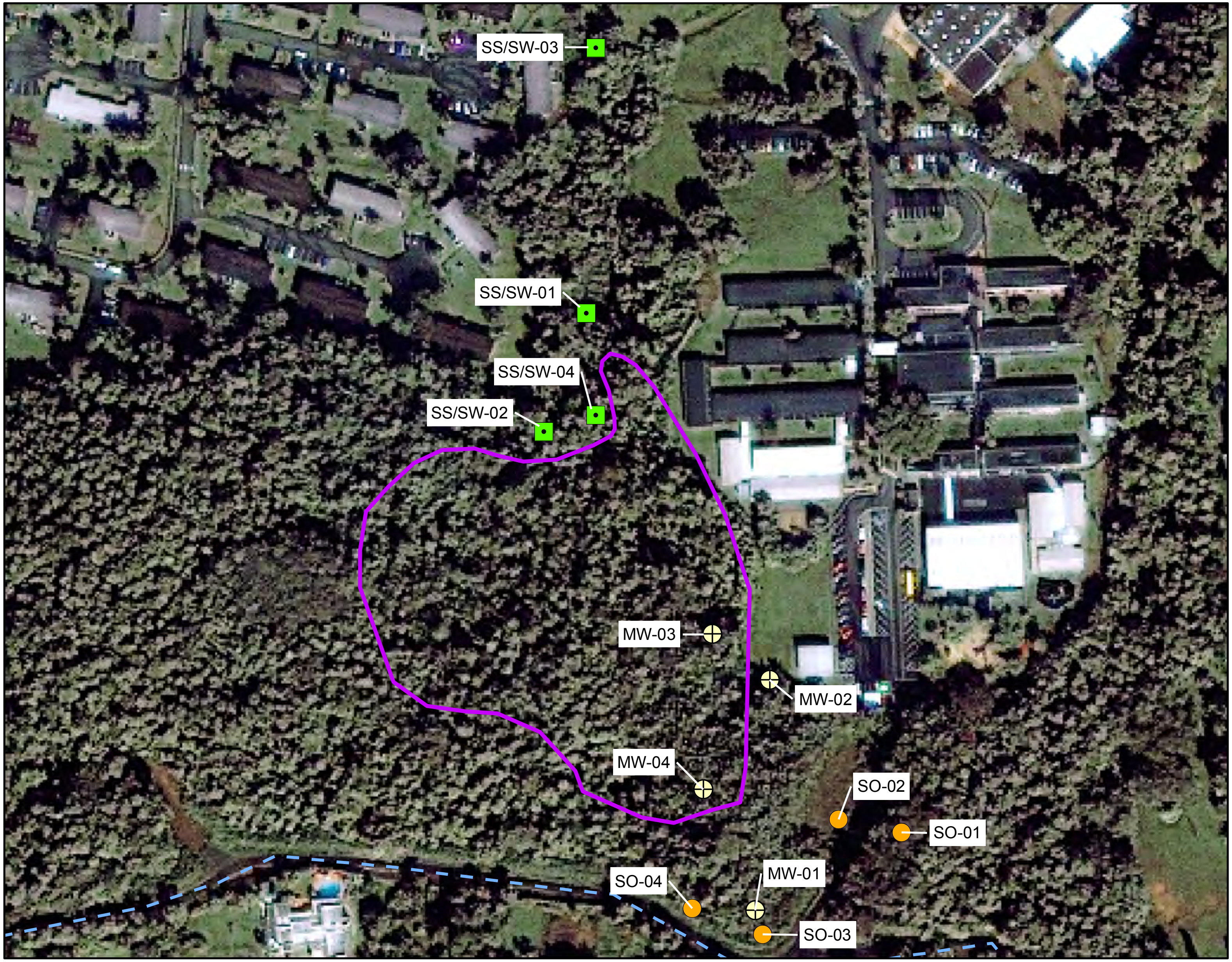

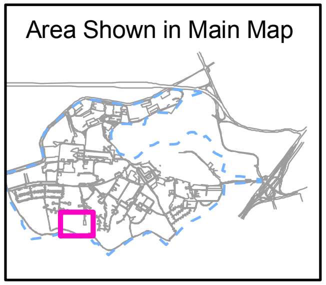

Legend

⊕ Groundwater

🟩 Sed/Surface Water

● Surface Soil

☐ Approximate Boundary of Disposal Area

☐ Installation Boundary

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Fort Buchanan, Puerto Rico

Site 12
Old Landfill

Figure 3-5
Sample Locations at Site 12
From 1999 CHPPM Investigation

\\Edgewoodfp\projects\ARMYBEST\PROJECTS\6191735 Ft Buchanan\GIS\site 12 previous sample locs.mxd

Fort Buchanan, Puerto Rico

Site 12
Old Landfill

Figure 3-6
RFI Sample Locations at Site 12

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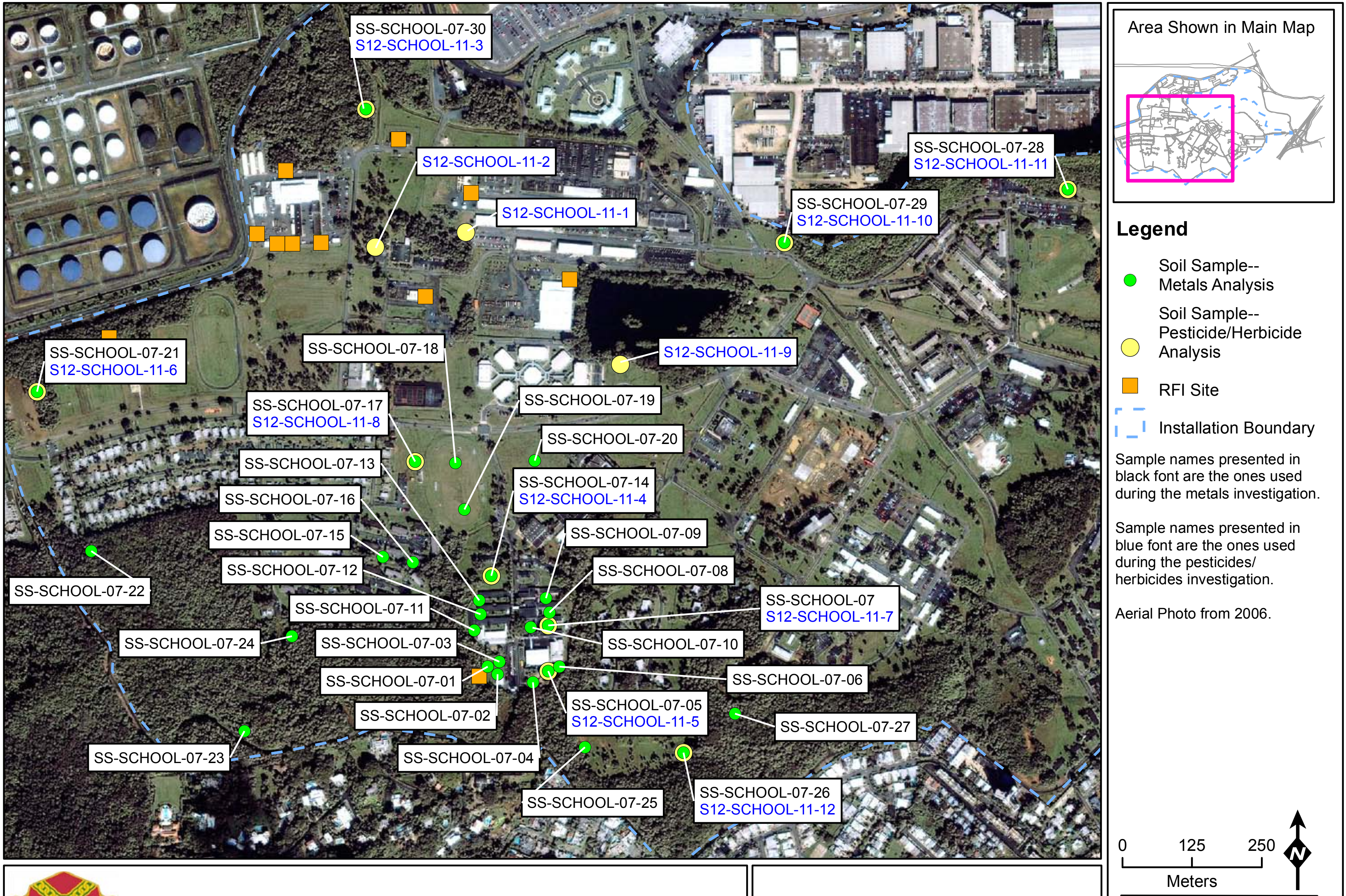

Sample names presented in black font are the ones used during the metals investigation.

Sample names presented in blue font are the ones used during the pesticides/ herbicides investigation.

Aerial Photo from 2006.

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Fort Buchanan, Puerto Rico

Figure 3-7
Background Sample Locations

\\Edgewoodfp\projects\Universal GIS\Buchanan\MXDs\RFI MXDs\RFI_bkg sample locs.mxd

4 DATA QUALITY, ASSURANCE, USABILITY, AND ADEQUACY

Soil, sediment, groundwater, sediment pore water and surface water samples were collected and analyzed at the RFI sites. Samples were collected from October 2008 through September 2009 at most of the sites; the exception being Site 12, the Old Landfill, which was sampled beginning in April 2007 and sediment pore water samples were collected in September 2011. Also some groundwater samples were collected in August 2010 at sites 1, 2, and 3. Samples were collected in accordance with the Site Wide RFI Work Plan and addendums (EA 2008a, EA 2011a, EA 2011b) and in accordance with the NWBA RFI Work Plan and addendums (EA 2006, EA 2007a, EA 2007b, EA 2008b, EA 2008c, EA 2008d).

A QAPP was also prepared to supplement and guide the RFI Work Plan (EA 2010). Laboratory analyses of soil, sediment, groundwater, sediment pore water, and surface water samples were conducted in accordance with the QAPP. A data quality review of laboratory analytical data was conducted to provide an independent assessment of analytical results, and to evaluate their usability with respect to the USEPA's guidelines.

The purpose of this section is to evaluate the soil, sediment, groundwater, sediment pore water and surface water data sets for inclusion in the RFI and Risk Assessments. The data set evaluation will include:

- Defining the data sets (Section 4.1)
- Identifying alterations from sampling plans (Section 4.2)
- Data quality evaluation (Section 4.3)
- Data management (Section 4.4)

The results of this section will be incorporated into the nature and extent evaluation of the RFI (Section 5.0) and the risk assessments (Section 7.0 and Appendices D and E).

4.1 DATA SETS

Data for the RFI were generated from soil, sediment, groundwater, sediment pore water, and surface water samples. Most samples were collected to define the nature and extent of impact in the various media and to provide input for the risk assessments. Some of the groundwater data were generated as part of the NWBA RFI and are included because the wells are located at or in close proximity to Sites investigated in this RFI. However, it should be noted that these groundwater samples were collected as part of the overall NWBA RFI with the objective of characterizing a VOC plume, and not with the specific objective of characterizing the Site Wide RFI Site. The following subsections summarize, by media, the data sets used for the Site Wide

RFI. Table 4-1 presents a list of all the samples included in this RFI.

4.1.1 Soil

Soil samples were collected at the RFI Sites from soil borings installed with a hand auger, hand-operated geoprobe, and geoprobe. Sample collection procedures are detailed in the RFI Work Plan (EA 2008a) and the QAPP (EA 2010). A total of 49 subsurface soil and 48 surface soil samples were collected, including duplicates. Soil samples collected from 0-1 ft bgs or 0-2 ft bgs are considered "surface" soil samples. Samples collected at depths beginning 1 ft or more bgs are considered "subsurface" samples. This division of soil samples into "surface" and "subsurface" groups is necessary for risk assessment purposes.

The analytical reports provided by the laboratory and the data validation reports are included in Appendix I.

In addition to the soil data that were generated specifically for this RFI, data that were generated for eight samples collected from four borings drilled as part of the NWBA RFI were also included. These borings were drilled at Site 2 during well installation, and soil samples were collected from 4-8 ft bgs from each boring, and a second sample was collected from the 2-ft interval immediately above the first encountered groundwater (see Table 5-4 for specific depths as they are different for each boring). All of these data are discussed in Section 5.

4.1.2 Sediment

A total of 11 sediment samples, including duplicates, were collected at Sites 6 and 12.   Sample collection procedures are detailed in the RFI Work Plan (EA 2008a) and the QAPP (EA 2010). Samples were collected from the top six inches with a hand auger.

The analytical reports provided by the laboratory and the data validation reports are included in Appendix I.

4.1.3 Groundwater and Sediment Pore Water

Data from 54 groundwater samples, including 3 duplicates, collected from 24 locations were included in the RFI. Samples were collected between January 2007 and August 2010. Some of these samples were collected specifically for the Site Wide RFI while others were collected as part of the NWBA RFI. Samples collected specifically for the Site Wide RFI came from three monitoring wells and two temporary piezometers. One of the wells was an existing well at Site 12 (G12-MW-01); the other two monitoring wells were installed at Site 12 as part of the Site Wide RFI field effort. The temporary piezometers were installed at sites 7 (G-07-01) and 13 (G-13-07).

As part of the NWBA RFI, monitoring wells were installed at strategic locations with respect to the groundwater plume and potential plume source areas. Some of these locations coincide with Sites 1, 3, 4, 7, 8, and 10. Because groundwater data from the NWBA RFI were available for these six sites, the data were included in the Site Wide RFI to provide a complete characterization of the extent of chemicals at each Site.

Four sediment pore water samples, including one duplicate, were collected at Site 12. These data were generated to characterize groundwater immediately downgradient of the Site 12 landfill. Installation of groundwater monitoring wells immediately downgradient of the landfill was not feasible due to the heavy vegetation at the Site and the fact that the area is protected habitat for the endangered species *Epicrates inornatus* (the Puerto Rican boa). Therefore, it was agreed among the Army and the USEPA that sediment pore water samples would be collected at the base of the landfill and used to represent groundwater conditions.

When metals analyses were run, both total and dissolved metals were measured. The analytical reports provided by the laboratory and the data validation reports are included in Appendix I.

4.1.4 Surface Water

Surface water sampling occurred at Site 12. Seven surface water samples, including one duplicate, were collected from a small stream adjacent to and downgradient of the historical location of the landfill. When metals analyses were run, both total and dissolved metals were measured. The analytical reports provided by the laboratory and the data validation reports are included in Appendix I.

4.2 ALTERATIONS FROM SAMPLING PLANS

The following subsections provide a summary of the sampling plan alterations for soil, sediment, groundwater, and surface water.

4.2.1 Soil

During the soil sampling of the fourteen RFI Sites, no changes were made in the number of soil samples collected. Certain sample locations were changed based on field observations. At Site 1, sampling locations were biased toward drain locations observed coming out of the storage facility. Refusal was encountered while attempting to obtain the deep (4-6 ft) sample at Site 8 in October 2008; a geoprobe was used to obtain the sample in January 2009.

The locations of four soil samples collected in December 2008 at Site 12 were based on the initial sample locations from April 2007. The re-sampling occurred in order to obtain analytical data for PCBs and TPH, which were not analyzed for during the initial sampling event. Between April 2007 and December 2008, construction occurred on the school grounds at Site 12. This required the 2008 samples to be collected proximate to their original locations.

4.2.2 Sediment and Surface Water

Sampling of sediment and surface water from sumps on the eastern/downgradient side of Building S-563 (Site 8) was included in the RFI work plan. However, a visual inspection of the two sumps during a field visit found that they contained cross connections from other areas; therefore, it was concluded that the sumps capture runoff from areas other than the building itself. Since the sumps did not solely represent the conditions at Site 8, samples from the sumps were not collected; this decision was made with agreement from the AEC, Fort Buchanan, and USEPA.

No other sediment or surface water sampling alterations occurred.

4.2.3 Groundwater

Groundwater sampling specifically for the Site Wide RFI and outlined in the Site Wide RFI work plan (EA 2008a) occurred at Sites 7, 12, and 13. Two monitoring wells were installed and sampled at Site 12 prior to the finalization of the Site Wide RFI work plan. Groundwater samples were not able to be obtained through the use of a hand auger at Sites 7 and 13 as described in the Site Wide RFI work plan. In order to obtain these samples, a geoprobe was utilized, and temporary 1-inch piezometers were installed at both locations. Additionally, based on the site lithology (stiff silt and clay overburden), sufficient sample volume could not be obtained from these locations for full-suite analyses. Therefore, groundwater analyses were biased toward analyte detections in the soil samples taken at Sites 7 and 13.

At Site 7, the Site Wide RFI groundwater sample (G-07-09-01) was analyzed for VOCs, herbicides, pesticides, and PCBs; therefore SVOCs, TPH, and metals were the excluded analyses based on what was proposed in the work plan. This is not considered a data gap however, because the groundwater underlying Site 7 has been fully evaluated in the NWBA RFI and HHRA, this well point is only one of three groundwater sampling locations at the site, and because SVOCs and metals were analyzed in samples collected from the other two sampling locations (G-03-08-MW-19A and G-03-08-MW-19B) in January 2008. Furthermore, TPH were only detected at low concentrations in soil, and the VOC analysis would indicate if compounds associated with TPH were potential issues.

At Site 13, the groundwater sample (G-13-09-07) was analyzed for VOCs, SVOCs, herbicides, pesticides, and PCBs. Therefore metals and TPH were the excluded analysis. No other groundwater data are available for this site. The lack of metals and TPH data is a data gap; however, the collection of additional groundwater was not warranted. No organic compounds were detected in the sample, which indicates that it is highly unlikely that TPH would be present, much less that it would be present at a concentration of concern.

The metals concentrations found in soil were similar to background metals concentrations and were not suggestive of a site related point source. Furthermore, when the subsurface soil metals data were compared to USEPA protection of groundwater soil screening levels (SSLs), concentrations of mercury and selenium were greater than the screening levels. However, subsurface soil data generated from monitoring well boring locations as part of the NWBA RFI had higher concentrations of selenium in subsurface soil and no detections in associated groundwater, and similar concentrations of mercury in subsurface soil and concentrations in groundwater that were below the tap water screening level and MCL. For these reasons, in conjunction with the overall findings for the site (summarized in Section 8) the collection of a groundwater sample for metals analysis at Site 13 was not required.

4.3 DATA QUALITY EVALUATION

This section presents the data quality assessment for the analytical data included in the Site Wide RFI. Data were generated by Accutest Laboratories and validated by one of two third-party validators, either Mr. Rafael Infante Mendez or Environmental Data Services (EDS). Data validation was completed in accordance with USEPA Region 2 data validation guidelines as cited in the data validation memoranda included in Appendix I. Guidance documents included but were not limited to:

- Evaluation of Metal Data for the Contract Laboratory Program (Revision 13, September 2005)
- USEPA National Functional Guidelines for Low Concentration organic Data Review (June 2001)
- USEPA National Functional Guidelines for Organic Data Review (October 1999)

Tables 4-2 through 4-5 present the specific results of the data quality evaluation as reported by the data validators. The laboratory and validation reports are contained in Appendix I. The following text discusses each of the Data Quality Indicators (DQIs) identified in the project QAPP (EA 2010): precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS).

4.3.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The duplicate sample is used to determine the precision of the analytical method. If the recoveries of analytes in the duplicate samples are within established control limits, then precision is within limits. *Total* precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

Matrix spike duplicate (MSD) samples and field duplicate samples are analyzed to assess analytical and total precision, respectively. The precision measurement is determined using the relative percent difference (RPD) between the parent and the duplicate sample results. RPD is calculated using the following equation, where X1 and X2 are the duplicate values:

$$RPD = \frac{|X1 - X2|}{(X1 + X2)/2} \times 100$$

Tables 4-2 and 4-3 present the specific results were RPD values between matrix spike (MS)/MSD samples and parent/field duplicate samples were outside of quality control criteria. As presented in Table 4-2, the RPD values that were outside criteria were generally within twice the criteria value. Exceptions are:

- 3, 3'-dimethylbenzidine in J80982-6
- hexachloropropene in J80982-6
- o-toluidine in J80982-6
- acetonitrile in JA13996-4 & JA14141-1
- 3,3'-dichlorobenzidine in J63708-8
- acenaphthylene in J63708-8
- benzo(a)anthracene in J63708-8 & J63708-2
- benzo(a)pyrene in J63708-8 &J63708-2
- benzo(b)fluoranthene in J63708-8
- benzo(g,h,i)perylene in J63708-8 &J63708-2
- benzo(k)fluoranthene in J63708-2
- chrysene in J63708-8 and J63708-2
- dibenzo(a,h)anthracene in J63708-8
- indeno(1,2,3-cd pyrene in J63708-8 &J63708-2
- 2-methylnaphthalene in J63708-8 &J63708-2
- phenanthrene in J63708-8 &J63708-2
- 3&4 methylphenol in J63708-2
- n-Nitrosodimethylamine in J63708-2
- naphthalene in J63708-2
- p-Phenylenediamine in JA3723-1 &JA3723-1
- aroclor 1016 in JA10986-1
- aroclor 1242 in JA3976-1

None of the RPD values for MS/MSD samples resulted in rejection of data; all data were sufficiently precise for use.

The RPD values for parent and field duplicate samples were within criteria for most analyte groups except for metals in five sample pairs and arsenic, SVOCs, pesticides, and TPH-DRO in one sample pair. Table 4-3 presents the samples and analytes with RPD values outside criteria. The RPD values for aluminum and iron found in samples J51095-9 and J51095-6 (G-03-07-MW-05B and 07-JA-09-DP) were extremely high and resulted in rejection of the data for those two samples.

Overall, the precision evaluation for the data included in the Site Wide RFI show a low proportion, approximately 3.5%, of qualified data due to RPD issues in the MS/MSD and parent/field duplicate samples.

4.3.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. Therefore, it reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. To determine accuracy, a sample that has been spiked with a known concentration is analyzed by the laboratory as the MS, MSD, Laboratory Control Spike (LCS), or Laboratory Control Spike Duplicate (LCSD). Both accuracy and precision are calculated for each analytical batch, and the associated sample results are interpreted by considering these specific measurements.

Accuracy is expressed as percent recovery (%R), and was evaluated by the data validator via the following equation where X is the found concentration, B is the background concentration, and T is the true or assumed concentration.

$$\%R = \frac{X - B}{T} \times 100$$

Table 4-4 presents the specific %R results that were outside criteria for the MS and MSD samples. Many of the compounds with %Rs outside of criteria were not detected. Acrolein consistently had %R outside criteria across numerous sample delivery groups (SDGs), although most samples were non-detect (and thus no action was taken) and one sample received a J qualifier. Other analytes sporadically had either high or low %Rs. Samples J63708-8 thru 12 had two SVOC values that were all non-detect and rejected due to low %R.

Table 4-5 presents the specific %R results that were outside criteria for the LCS samples. Data for four compounds in SDG J52214, ten compounds in SDG J46678, two compounds in SDG J48688, two compounds in SDG J80982, one compound in SDG J90784, four compounds in JA13996, twenty one compounds in SDG J63708, three compounds in SDG JA3723, one compound in SDG JA3810, two compounds in SDG JA6909, and 3 compounds in SDG JA1094 were R qualified because of low %Rs. High %Rs for acrolein resulted in the rejection of 17 data points in SDG J63697 and 14 data points in SDG J63716.

Overall, the accuracy evaluation for these data show that approximately 30% were qualified due to %R issues in the MS, MSD, and LCS samples.

4.3.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent site conditions, a characteristic of a population, or parameter variations at a sampling point. Representativeness is achieved through proper development of the field sampling program and use of standard and accepted Standard Operating Procedures (SOPs). All samples were collected and analyzed following appropriate and accepted SOPs and methods in order to generate sufficiently precise and accurate data. Samples were collected as outlined in the work plans and addenda identified at the beginning of Section 4, with the exceptions detailed in Section 4.2 (Alterations from the Sampling Plans). The alterations have minimal effect on the representativeness of the RFI, as they predominantly were the result of variations in sample collection methods (hand auger vs. geoprobe) or sampling locations due to field observations (i.e., construction at Site 12, sumps at Site 8). As discussed above, the wide majority of data met the data quality objectives for precision and accuracy. Therefore the data generated for the project are considered representative of conditions where these samples were collected. Data that may not be representative of the sample locations (R qualified data) were not used.

Sampling locations were selected in a biased manner, which is expected to impact the representativeness of the data set. Sampling points were located where releases were expected to have occurred and where the potential for contamination was considered to be highest. Therefore, the overall characterization of the Sites is likely to overestimate contaminant concentrations.

Since completion of the field work at Site 15 (October 2008), the area of investigation has been significantly reworked. In January 2009, the area was excavated for the installation of a drainpipe. Information regarding what was done with the excavated soil or if fill material was imported was not available; supporting information that is available is provided in Appendix K. As a result of this recent work at Site 15, the findings described in Section 5 may no longer be representative of the Site.

4.3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Percent completeness (%C) of the data set is determined by the following equation, where N is the number of valid data and S is the total number of results.

$$C = \frac{N}{S} \times 100$$

For completeness requirements, valid results are all results not qualified as unusable (not R qualified). For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported. The goal for completeness was 90 percent (EA 2010). There were a total of 29,210 analyte results included in this RFI, and 441 were rejected; therefore, the completeness indicator is 99.1 percent and the completeness measurement quality objective was met. Completeness was also calculated for each matrix and analyte group, and all indicators met the measurement quality objective:

Analyte Group	Percent Complete	Analyte Group	Percent Complete
Groundwater and Sediment Pore Water		Surface Water	
General Chemistry	100	Metals	100
Metals and Cyanide	99.5	Pesticides	100
TPH	100	Herbicides	100
Pesticides	99.5	VOCs	98
PCBs	100	SVOCs	95.5
Herbicides	100		
VOCs	99		
SVOCs	97		
Soil		Sediment	
General Chemistry	100	General Chemistry	100
Metals and Cyanide	100	Metals	100
TPH	100	TPH	100
Pesticides	100	Pesticides	100
PCBs	100	PCBs	100
Herbicides	100	Herbicides	100
VOCs	99	VOCs	100
SVOCs	99	SVOCs	90

4.3.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. For this RFI, standard methods for sampling and analyses were followed, as documented in the QAPP and work plans, and provide a technically sound basis for data comparisons in the future should additional information become available.

4.3.6 Sensitivity

Sensitivity is a measure of the screening criteria as they compare to detection limits. There are some laboratory quantitation limits that are not low enough to meet the project required quantitation limits (PRQLs) due to limitations of the analytical methods (bolded values shown in Table 4-5 of the QAPP, [EA 2010]). The laboratory and prime contractor worked together to try to meet the PRQLs for as many compounds as possible through accepted published analytical methods including trace inductively coupled argon plasma (ICAP) atomic emission spectroscopy (AES) and mass spectrometry (MS) for metals, and gas chromatography mass spectrometry (GCMS) using both full scan and selected ion monitoring (SIM) for organic chemicals. The laboratory reported detected analytes between the reporting limit (RL) and method detection limit (MDL) as estimated (J-flagged) results. Therefore, most of the screening levels were achieved.

Tables 4-6 through 4-10 present a comparison of MDLs of analytes that were never detected to selected screening criteria. In general, a low percentage of the compounds analyzed for in surface soil and sediment had maximum MDLs that were greater than screening criteria: 18 analytes in surface soil (9%) and 11 analytes in sediment (6%). A higher percentage of compounds analyzed for in subsurface soil, groundwater, and surface water had maximum MDLs greater than screening values: 110 analytes in subsurface soil (59%), 74 analytes in groundwater and pore water (36%), and 44 analytes in surface water (22%). In many instances, in the solid matrices the high MDLs are the result of dilutions due to matrix interference. While the data are usable, the results for these analytes do not achieve the DQI for this project. There is uncertainty regarding the potential presence of analytes that were reported as not detected but whose detection limits are above screening levels. Project decisions regarding extent, potential risks, and remedial alternatives that are recommended for consideration in a Corrective Measures Study (CMS) will be based on data for positively detected analytes.

The screening criteria that were used in this RFI differed slightly from the criteria identified in the QAPP (EA 2010). The QAPP indicated that screening criteria would be derived from:

- Groundwater – The lowest of the Federal Maximum Contaminant Levels or USEPA generic screening level, Tap water (September 2008).
- Soil/Sediment – The lower of the USEPA generic screening level, residential human health, or the USEPA region 4 ecological screening criteria (September 2008).

The Regional Screening Levels were used in the RFI as follows:

- *Groundwater and sediment pore water*: The Federal Maximum Contaminant Levels or USEPA Regional Tap water Screening Level (June 2011).
- *Soil/Sediment*: The USEPA Regional Residential and Industrial Soil Screening Levels and protection of groundwater soil screening levels (for subsurface soil only) (June 2011) and USEPA Region 4 ecological screening criteria.
- *Surface water*: USEPA Regional Tap water Screening Level (June 2011) and Region 4 ecological screening criteria.

The June 2011 USEPA Regional Screening Levels (RSLs) were downloaded from the USEPA website (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm), and are the numbers used in this report (USEPA 2011). The screening levels for non–carcinogenic compounds were divided by 10 to account for potential occurrence of adverse non-carcinogenic health effects due to exposure to multiple non-carcinogens. For sediment and surface water the soil and groundwater screening values were increased by 10 to account for the reduced exposure to these media. Residential soil screening levels were used for soil in addition to the industrial soil screening levels because land use restrictions limiting land use to industrial activities are not in place at the sites. Soil data were also compared to site-specific background comparison values (Appendix I) and subsurface soil data were compared to protection of groundwater soil screening levels.

4.4 DATA MANAGEMENT

Project field and laboratory data are stored using the EQuIS Environmental Data Management System, which is a Structured Query Language (SQL) database management system. EQuIS allows automatic import of electronic data deliverables (EDDs). This minimizes human error in transcribing analytical data. Only the database managers have writing permission to the database. This database is read-only to all other data users to avoid errors. Custom queries of analytical chemistry data can be written by all data users and tied into various data analysis tools to create various tables and figures as needed.

4.4.1 Analytical Chemical Data

Chemical data are submitted electronically via e-mail to the data manager by the laboratory. The

EDD is generated automatically by direct instrument download of data into the laboratory's data management system, which assists in the elimination of data transcription errors. The EDD file format is compatible with the project database.

EDD entries go through multiple quality assurance (QA) checks by the QA manager/data manager. The following EDD entries are compared to hardcopy laboratory data reports: sample identifications, sample matrix, sample collection date/time, sample beginning and ending depth, laboratory project reference, analytical method reference, analyte name, sample concentration, laboratory reporting limit, unit measurement, analytical fraction code, dilution fraction, and wet/dry reporting status. The sample identifications, collection dates/times, and matrices are crosschecked against the corresponding chain-of-custody records. Sample condition notes, sampling period reference, and field duplicate identifications, are added to the EDD file by the data manager.

Data collected as part of the RFI were validated in accordance with criteria specified in the QAPP and flagged with data qualifiers consistent with those defined in the USEPA Region 2 Guideline SOPs. After data validation is completed, the data qualifiers are entered into the EDD file. Site identifications are added by the data manager and compared 100 percent to site identifications listed in the project database. Only after completing these checks is the EDD file prepared for import into the project database by the data manager. During the import process, the new data are checked against existing data to maintain database integrity.

Table 4-1

Samples Included in the Fort Buchanan Site Wide RFI

Sample Count	Sampling Site	Location	Sample Name	Sample Date	Sample Depth	Field Duplicate Sample ID
Ground Water						
1	Site 01	G-03-MW-11A	G-03-07-MW-11A	6/12/2007		
2	Site 01	G-03-MW-11A	G-03-08-MW-11A	1/9/2008		
3	Site 01	G-03-MW-11A	G-03-08-MW-11A	5/14/2008		
4	Site 01	G-03-MW-11A	G-03-09-MW-11A	1/6/2009		
5	Site 01	G-03-MW-11A	G-03-09-MW-11A	1/7/2009		
6	Site 01	G-03-MW-11A	G-03-10-MW-11A	8/18/2010		
7	Site 01	G-03-MW-11A	10-AUG-18-DP2	8/18/2010		G-03-10-MW-11A
8	Site 01	G-03-MW-11B	G-03-07-MW-11B	6/12/2007		
9	Site 01	G-03-MW-11B	G-03-08-MW-11B	1/9/2008		
10	Site 01	G-03-MW-11B	G-03-08-MW-11B	5/14/2008		
11	Site 01	G-03-MW-11B	G-03-09-MW-11B	1/6/2009		
1	Site 02	G-03-MW-01	G-03-07-MW-01	1/10/2007		
2	Site 02	G-03-MW-01	G-03-07-MW-01	6/12/2007		
3	Site 02	G-03-MW-01	G-03-10-MW-01	8/17/2010		
4	Site 02	G-03-MW-02	G-03-07-MW-02	1/10/2007		
5	Site 02	G-03-MW-02	G-03-07-MW-02	6/13/2007		
6	Site 02	G-03-MW-02	07-JN-13-DP-3	6/13/2007		G-03-07-MW-02
7	Site 02	G-03-MW-03A	G-03-07-MW-03A	1/9/2007		
8	Site 02	G-03-MW-03A	G-03-07-MW-03A	6/12/2007		
9	Site 02	G-03-MW-03A	G-03-10-MW-03A	8/17/2010		
10	Site 02	G-03-MW-03B	G-03-07-MW-03B	1/9/2007		
11	Site 02	G-03-MW-03B	G-03-07-MW-03B	6/12/2007		
12	Site 02	G-03-MW-04A	G-03-07-MW-04A	1/9/2007		
13	Site 02	G-03-MW-04A	G-03-07-MW-04A	6/12/2007		
14	Site 02	G-03-MW-04A	G-03-10-MW-04A	8/18/2010		
15	Site 02	G-03-MW-04B	G-03-07-MW-04B	1/9/2007		
16	Site 02	G-03-MW-04B	G-03-07-MW-04B	6/12/2007		
17	Site 02	G-03-MW-04B	G-03-10-MW-04B	8/18/2010		
1	Site 03	G-03-MW-05A	G-03-07-MW-05A	1/9/2007		
2	Site 03	G-03-MW-05A	G-03-07-MW-05A	6/13/2007		
3	Site 03	G-03-MW-05A	G-03-09-MW-5A	3/11/2009		
4	Site 03	G-03-MW-05A	G-03-10-MW-05A	8/17/2010		
5	Site 03	G-03-MW-05B	07-JA-09-DP	1/9/2007		G-03-07-MW-05B
6	Site 03	G-03-MW-05B	G-03-07-MW-05B	1/9/2007		
7	Site 03	G-03-MW-05B	G-03-07-MW-05B	6/13/2007		
1	Site 04	G-03-MW-10A	G-03-07-MW-10A	6/13/2007		
2	Site 04	G-03-MW-10A	G-03-08-MW-10A	1/8/2008		
3	Site 04	G-03-MW-10A	G-03-09-MW-10A	3/10/2009		
4	Site 04	G-03-MW-10B	G-03-07-MW-10B	6/12/2007		
5	Site 04	G-03-MW-10B	G-03-08-MW-10B	1/8/2008		
6	Site 04	G-03-MW-10B	G-03-09-MW-10B	3/10/2009		
1	Site 07	G-03-MW-19A	G-03-08-MW-19A	1/8/2008		
2	Site 07	G-03-MW-19A	G-03-08-MW-19A	5/13/2008		
3	Site 07	G-03-MW-19B	G-03-08-MW-19B	1/8/2008		
4	Site 07	G-03-MW-19B	G-03-08-MW-19B	5/13/2008		
5	Site 07	G-07-01	G-07-09-01	1/29/2009		
1	Site 08	G-03-MW-23	G-03-08-MW-23	5/13/2008		
2	Site 08	G-03-MW-23	G-03-09-MW-23	1/7/2009		
1	Site 10	G-03-MW-20	G-03-08-MW-20	5/13/2008		
2	Site 10	G-03-MW-20	G-03-09-MW-20	1/7/2009		

Table 4-1
Samples Included in the Fort Buchanan Site Wide RFI

Sample Count	Sampling Site	Location	Sample Name	Sample Date	Sample Depth	Field Duplicate Sample ID
1	Site 12	G-12-MW-01	G-12-07-MW-01	6/13/2007		
2	Site 12	G-12-MW-02	G-12-07-MW-02	6/13/2007		
3	Site 12	G-12-MW-03	G-12-07-MW-03	6/13/2007		
4	Site 12	S12-PW-11-01	S12-PW-11-1	9/20/2011		
5	Site 12	S12-PW-11-02	S12-PW-11-2	9/20/2011		
6	Site 12	S12-PW-11-03	S12-PW-11-3	9/20/2011		
7	Site 12	S12-PW-11-03	S12-PW-11-DP	9/20/2011		S12-PW-11-3
1	Site 13	G-13-07	G-13-09-07	1/29/2009		
Subsurface Soil						
1	Site 01	Boring 1	S-01-08-01-2-4	10/23/2008	2-4 ft	
2	Site 01	Boring 2	S-01-08-02-2-4	10/23/2008	2-4 ft	
3	Site 01	Boring 3	S-01-08-03-2-4	10/23/2008	2-4 ft	
4	Site 01	Boring 4	S-01-08-04-2-4	10/23/2008	2-4 ft	
1	Site 02	Boring 1	SB-03-06-01-(4-8)	12/1/2006	4-8 ft	
2	Site 02	Boring 1	SB-03-06-01-(20-24)	12/1/2006	20-24 ft	
3	Site 02	Boring 2	SB-03-06-02-(4-8)	12/6/2006	4-8 ft	
4	Site 02	Boring 2	SB-03-06-02-(26-28)	12/6/2006	26-28 ft	
5	Site 02	Boring 3	SB-03-06-03-(4-8)	10/20/2006	4-8 ft	
6	Site 02	Boring 3	SB-03-06-03-(20-22)	10/20/2006	20-22 ft	
7	Site 02	Boring 4	SB-03-06-04-(4-8)	11/13/2006	4-8 ft	
8	Site 02	Boring 4	SB-03-06-04-(37-36)	11/13/2006	37-36 ft	
1	Site 03	Boring 1	S-03-08-01-1-2	10/22/2008	1-2 ft	
2	Site 03	Boring 1	S-03-08-01-2-4	10/22/2008	2-4 ft	
3	Site 03	Boring 2	S-03-08-02-1-2	10/22/2008	1-2 ft	
4	Site 03	Boring 2	S-03-08-02-2-4	10/22/2008	2-4 ft	
5	Site 03	Boring 3	S-03-08-03-1-2	10/22/2008	1-2 ft	
6	Site 03	Boring 3	S-03-08-03-2-4	10/22/2008	2-4 ft	
7	Site 03	Boring 4	08-OC-22-DP1	10/22/2008	1-2 ft	
8	Site 03	Boring 4	S-03-08-04-1-2	10/22/2008	1-2 ft	
9	Site 03	Boring 4	S-03-08-04-2-4	10/22/2008	2-4 ft	
1	Site 05	Boring 1	S-05-08-01-1-2	10/20/2008	1-2 ft	
2	Site 05	Boring 1	S-05-08-01-2-4	10/20/2008	2-4 ft	
3	Site 05	Boring 2	S-05-08-02-1-2	10/20/2008	1-2 ft	
4	Site 05	Boring 2	S-05-08-02-2-4	10/20/2008	2-4 ft	
1	Site 06	Boring 1	S-06-08-01-2-4	12/2/2008 & 2/4/2009	2-4 ft	
2	Site 06	Boring 2	S-06-08-02-2-4	12/2/2008 & 2/4/2009	2-4 ft	
3	Site 06	Boring 3	S-06-08-03-2-4	12/2/2008 & 2/4/2009	2-4 ft	
1	Site 07	Boring 1	08-OC-23-DP1	10/23/2008	2-4 ft	S-07-08-01-2-4
2	Site 07	Boring 1	S-07-08-01-2-4	10/23/2008	2-4 ft	
1	Site 08	Boring 1	S-08-08-01-2-4	10/22/2008	2-4 ft	
2	Site 08	Boring 1	S-08-08-01-4-6	10/22/2008	4-6 ft	
3	Site 08	Boring 2	S-08-08-02-1-2	10/22/2008	1-2 ft	
4	Site 08	Boring 2	S-08-09-02-4-6	1/28/2009	4-6 ft	
1	Site 09	Boring 1	S-09-08-01-2-4	10/21/2008	2-4 ft	
2	Site 09	Boring 1	S-09-08-01-4-6	10/21/2008	4-6 ft	
3	Site 09	Boring 2	S-09-08-02-2-4	10/21/2008	2-4 ft	
4	Site 09	Boring 2	S-09-08-02-4-6	10/21/2008	4-6 ft	
5	Site 09	Boring 3	08-OC-21-DP1	10/21/2008	2-4 ft	S-09-08-03-2-4
6	Site 09	Boring 3	S-09-08-03-2-4	10/21/2008	2-4 ft	
7	Site 09	Boring 3	S-09-08-03-4-6	10/21/2008	4-6 ft	
1	Site 10	Boring 1	S-10-08-01-2-4	10/22/2008	2-4 ft	

Table 4-1
Samples Included in the Fort Buchanan Site Wide RFI

Sample Count	Sampling Site	Location	Sample Name	Sample Date	Sample Depth	Field Duplicate Sample ID
2	Site 10	Boring 2	S-10-08-02-2-4	10/22/2008	2-4 ft	
3	Site 10	Boring 3	S-10-08-03-2-4	10/22/2008	2-4 ft	
1	Site 11	Boring 1	S-11-08-01-2-4	10/21/2008	2-4 ft	
2	Site 11	Boring 2	S-11-08-02-2-4	10/21/2008	2-4 ft	
3	Site 11	Boring 3	S-11-08-03-2-4	10/21/2008	2-4 ft	
4	Site 11	Boring 4	08-OC-21-DP2	10/21/2008	2-4 ft	S-11-08-04-2-4
5	Site 11	Boring 4	S-11-08-04-2-4	10/21/2008	2-4 ft	
1	Site 13	Boring 7	08-12-02-DP2	12/2/2008	2-4 ft	S-13-08-07-2-4
2	Site 13	Boring 7	S-13-08-07-2-4	12/2/2008 & 2/5/2009	2-4 ft	
1	Site 15	Boring 1	S-15-08-01-2-4	10/20/2008	2-4 ft	
2	Site 15	Boring 2	S-15-08-02-2-4	10/20/2008	2-4 ft	
Surface Soil						
1	Site 01	Boring 1	S-01-08-01-0-2	10/23/2008	0-2 ft	
2	Site 01	Boring 2	S-01-08-02-0-2	10/23/2008	0-2 ft	
3	Site 01	Boring 3	S-01-08-03-0-2	10/23/2008	0-2 ft	
4	Site 01	Boring 4	S-01-08-04-0-2	10/23/2008	0-2 ft	
1	Site 04	Boring 1	S-04-08-01-0-2	10/20/2008	0-2 ft	
2	Site 04	Boring 2	S-04-08-02-0-2	10/20/2008	0-2 ft	
3	Site 04	Boring 3	S-04-08-03-0-2	10/20/2008	0-2 ft	
4	Site 04	Boring 4	S-04-08-04-0-2	10/20/2008	0-2 ft	
5	Site 04	Boring 5	S-04-08-05-0-2	10/20/2008	0-2 ft	
6	Site 04	Boring 6	S-04-08-06-0-2	10/20/2008	0-2 ft	
1	Site 06	Boring 1	S-06-08-01-0-2	12/2/2008 & 2/4/2009	0-2 ft	
2	Site 06	Boring 2	S-06-08-02-0-2	12/2/2008 & 2/4/2009	0-2 ft	
3	Site 06	Boring 3	08-12-02-DP1	12/2/2008	0-2 ft	S-06-08-03-0-2
4	Site 06	Boring 3	S-06-08-03-0-2	12/2/2008 & 2/4/2009	0-2 ft	
1	Site 07	Boring 1	S-07-08-01-0-2	10/23/2008	0-2 ft	
1	Site 10	Boring 1	S-10-08-01-0-2	10/22/2008	0-2 ft	
2	Site 10	Boring 2	S-10-08-02-0-2	10/22/2008	0-2 ft	
3	Site 10	Boring 3	S-10-08-03-0-2	10/22/2008	0-2 ft	
1	Site 12	Location 1	SS-12-07-01-0.5	4/24/2007 & 12/2/2008	0-0.5 ft	
2	Site 12	Location 2	SS-12-07-02-0.5	4/24/2007 & 12/2/2008	0-0.5 ft	
3	Site 12	Location 3	07-AP-24-DP	4/24/2007	0-0.5 ft	SS-12-07-03-0.5
4	Site 12	Location 3	SS-12-07-03-0.5	4/24/2007 & 12/2/2008	0-0.5 ft	
5	Site 12	Location 4	SS-12-07-04-0.5	4/24/2007 & 12/2/2008	0-0.5 ft	
6	Site 12	Location 5	SS-12-07-05-0.5	4/24/2007	0-0.5 ft	
7	Site 12	Location 6	SS-12-07-06-0.5	4/24/2007	0-0.5 ft	
8	Site 12	Location 7	SS-12-07-07-0.5	4/24/2007	0-0.5 ft	
9	Site 12	Location 8	SS-12-07-08-0.5	4/24/2007	0-0.5 ft	
1	Site 13	Boring 1	S-13-08-01-0-2	12/2/2008 & 2/5/2009	0-2 ft	
2	Site 13	Boring 2	S-13-08-02-0-2	12/2/2008 & 2/5/2009	0-2 ft	
3	Site 13	Boring 3	S-13-08-03-0-2	12/2/2008 & 2/5/2009	0-2 ft	
4	Site 13	Boring 4	S-13-08-04-0-2	12/2/2008 & 2/5/2009	0-2 ft	
5	Site 13	Boring 5	S-13-08-05-0-2	12/2/2008 & 2/5/2009	0-2 ft	
6	Site 13	Boring 6	S-13-08-06-0-2	12/2/2008 & 2/5/2009	0-2 ft	
7	Site 13	Boring 7	S-13-08-07-0-2	12/2/2008 & 2/5/2009	0-2 ft	
1	Site 15	Boring 1	S-15-08-01-0-1	10/20/2008	0-1 ft	
2	Site 15	Boring 2	S-15-08-02-0-1	10/20/2008	0-1 ft	
Sediment						
1	Site 06	Boring 1	SED-06-08-01	12/2/2008 & 2/4/2009		

Table 4-1

Samples Included in the Fort Buchanan Site Wide RFI

Sample Count	Sampling Site	Location	Sample Name	Sample Date	Sample Depth	Field Duplicate Sample ID
2	Site 06	Boring 2	SED-06-08-02	12/2/2008 & 2/4/2009		
3	Site 06	Boring 3	SED-06-08-03	12/2/2008 & 2/4/2009		
1	Site 12	Location 1	SD-12-07-01	6/12/2007 & 2/4/2009		
2	Site 12	Location 2	SD-12-07-02	6/12/2007 & 2/4/2009		
3	Site 12	Location 3	SD-12-07-03	6/12/2007 & 2/4/2009		
4	Site 12	Location 4	07-JN-12-DP4	6/12/2007		SD-12-07-04
5	Site 12	Location 4	SD-12-07-04	6/12/2007 & 2/4/2009		
6	Site 12	Location 5	SD-12-07-05	6/12/2007 & 2/4/2009		
7	Site 12	Location 6	09-FE-04-DP2	2/4/2009		SD12-09-6
8	Site 12	Location 6	SD-12-07-06	6/12/2007 & 2/4/2009		
Surface Water						
1	Site 12	Location 1	SW-12-07-01	6/12/2007 & 2/4/2009		
2	Site 12	Location 2	SW-12-07-02	6/12/2007 & 2/4/2009		
3	Site 12	Location 3	SW-12-07-03	6/12/2007 & 2/4/2009		
4	Site 12	Location 4	07-JN-12-DP3	6/12/2007		SW-12-07-04
5	Site 12	Location 4	SW-12-07-04	6/12/2007 & 2/4/2009		
6	Site 12	Location 5	SW-12-07-05	6/12/2007 & 2/4/2009		
7	Site 12	Location 6	SW-12-07-06	6/12/2007 & 2/4/2009		

Table 4-2
Compounds with Relative Percent Difference Values Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS Result	MSD Result	Result Units	RPD	RPD Criteria	Affected Samples	Validator's Action
SDG J51095								
J51095-5 MS/MSD	gamma-chlordane	0.21	0.34	ug/L	47	≤ 25	1 thru 9	No action based on RPD alone
	4,4'-DDE	1.8	1.4	ug/L	25	≤ 21		None, sample ND
SDG J44840								
J44840-1 MS/MSD	Antimony	35.3	36.3	mg/kg	32	≤ 20	1 thru 2	J/UJ
SDG J48688								
J48688-1 MS/MSD	Vanadium	427	324	mg/kg	27.4	≤ 20	1 thru 2	J
SDG J63697								
J63697-5 MS/MSD	Benzo (b) fluoranthene	46.7	27.7	ug/l	53	≤ 31	1 thru 9 and 15,16	No Action Based on MS/MSD Results
	Benzo (k) Fluoranthene	15.9	28.7	ug/l	57	≤ 31		
SDG J63716								
J63708-8 MS/MSD	Hexachlorocyclopentadiene	185	118	ug/l	44	≤ 38	10,12,13	No Action Based on MS/MSD Results
J63709-1 MS/MSD	trans-1,4-dichloro-2-Butene	31	18.6	ug/l	50	≤ 31	1,3,4,5,6,8	
SDG J80982								
J80982-6 MS/MSD	3,3'-dimethylbenzidine	14.8	19.2	ug/l	26	≤ 10	1 thru 6, 8,14,15,26,27	J
	Famphur	245	273	ug/l	11	≤ 10		None, sample ND
	Hexachloropropene	23.4	22.9	ug/l	35	≤ 10		J
	Methapyrilene	31.7	36.7	ug/l	15	≤ 10		J
	o-toluidine	54	39.9	ug/l	30	≤ 10		None, sample ND
SDG JA13996								
JA13996-4 MS/MSD	Acetonitrile	543	933	ug/l	53	≤ 18	4 thru 14 and 1,2	Accept NDs
JA14171-1 MS/MSD	Acetonitrile	10900	16900	ug/l	43	≤ 18	15,16	Accept NDs
SDG J59410								
J59410-1AMS/1AMSD	2,4-D	23.9	8.1	ug/kg	99	≤ 53	1-9	None, sample ND
	2,4,5-TP	6.8	2.2	ug/kg	102	≤ 59		
SDG J63708								
J63708-8 MS/MSD	3,3'-Dichlorobenzidine	3.2	9.4	ug/l	98	≤ 34	8	J
	Hexachlorocyclopentadiene	185	118	ug/l	44	≤ 38		

Table 4-2
Compounds with Relative Percent Difference Values Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS Result	MSD Result	Result Units	RPD	RPD Criteria	Affected Samples	Validator's Action
J63708-2 MS/MSD	2-Chlorophenol	1620	2260	ug/kg	33	≤ 20	2	J
	1-Chloro-3-methylphenol	2070	2980	ug/kg	36	≤ 20		
	2,4-Dichlorophenol	2130	2700	ug/kg	24	≤ 18		
	2,4-Dimethylphenol	2030	2460	ug/kg	19	≤ 18		
	2,4-Dinitrophenol	2740	4190	ug/kg	42	≤ 36		
	2,6-Dichlorophenol	2070	2580	ug/kg	22	≤ 15		
	2-Methylphenol	1230	1740	ug/kg	34	≤ 20		
	3&4 Methylphenol	1640	2640	ug/kg	40	≤ 19		
	4-Nitrophenol	2280	3090	ug/kg	30	≤ 29		
	Phenol	1510	2290	ug/kg	40	≤ 21		
	2,3,4,6-Tetrachlorophenol	2230	2890	ug/kg	26	≤ 21		
	Acetophenane	1930	2500	ug/kg	25	≤ 22		
	Benzyl Alcohol	1800	2540	ug/kg	34	≤ 23		
	1,2-Dichlorobenzene	1420	2040	ug/kg	36	≤ 22		
	1,3-Dichlorobenzene	1240	2000	ug/kg	47	≤ 23		
	1,4-Dichlorobenzene	1310	2080	ug/kg	45	≤ 23		
	2,4-Dinitrotoluene	2660	3320	ug/kg	22	≤ 21		
	Diethylphthalate	2220	2780	ug/kg	22	≤ 20		
	Hexachloroethane	1290	1980	ug/kg	42	≤ 27		
	3-Nitroaniline	1920	2510	ug/kg	27	≤ 24		
	4-Nitroaniline	2190	3030	ug/kg	32	≤ 29		
	n Nitrosodimethylamine	709	2430	ug/kg	110	≤ 26		
	N-Nitro-di-n-propylamine	1940	2440	ug/kg	23	≤ 22		
	Acenaphthylene	2050	1680	ug/kg	20	≤ 18		
SDG J63709								
J63708-8 MS/MSD	Hexachlorocyclopentadiene	185	118	ug/l	44	≤ 38	1 thru 3	J
SDG JA3723								
JA3723-1 MS/MSD	Hexachlorophene	172	103	ug/kg	50	≤ 34	1	J
	Methapyrilene	98	129	ug/kg	27	≤ 16		
	p-Phenylenediamine	29.6	63.8	ug/kg	73	≤ 36		
	Mercury	0.57	0.41	mg/kg	33	≤ 32		No Action Based on MS/MSD Results
JA3499-1 MS/MSD	d-BHC	0.12	0.21	ug/l	55	≤ 41	1	None, sample ND
	Endosulfan sulfate	0.16	0.24	ug/l	40	≤ 36		

Table 4-2
Compounds with Relative Percent Difference Values Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	**Compound**	**MS Result**	**MSD Result**	**Result Units**	**RPD**	**RPD Criteria**	**Affected Samples**	**Validator's Action**
SDG JA3810								
JA4175-1 MS/MSD	Acetone	54.3	48.9	ug/kg	33	≤ 31	1	None, sample ND
JA3723-1 MS/MSD	Hexachlorophene	172	103	ug/kg	50	≤ 34	1	None, sample ND
	Methapyrilene	98	129	ug/kg	27	≤ 16		
	p-Phenylenediamine	29.6	63.8	ug/kg	73	≤ 36		
SDG JA3952								
JA3976-1 MS/MSD	Aroclor 1242	5.1	4.4	ug/l	15	≤ 4	13	None, sample ND
JA4325-16 MS/MSD	Aroclor 1016	185	112	ug/kg	49	≤ 39	1,6	
JA3952-5 MS/MSD	Methyl Parathion	129	90	ug/kg	36	≤ 30	1 thru 7, and 9 thru 12	
SDG JA6909								
JA8520-6 MS/MSD	Endosulfan Sulfate	12	4.6	ug/kg	89	≤ 48	8	None, sample ND
	Endrin aldehyde	9.3	21	ug/kg	86	≤ 49		
	Endosulfan II	12.9	7.8	ug/kg	49	≤ 43		
	Methoxychlor	16	8.8	ug/kg	59	≤ 48		
	Endrin ketone	14.4	8.1	ug/kg	56	≤ 46		
SDG JA11448								
JA10986-1 MS/MSD	Aroclor 1016	204	74.9	ug/kg	93	≤ 39	1 thru 6, and 14	None, sample ND
	Aroclor 1260	185	112	ug/kg	81	≤ 39		

ND = Not Detected
MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
SDG = Sample Delivery Group

Table 4-3
Compounds with Relative Percent Difference Values Outside of Quality Control Limits
Parent and Field Duplicate Samples

Parent Sample/ Duplicate Sample	**Compound**	**Parent Sample Result**	**Duplicate Sample Result**	**Result Units**	**RPD**	**Validator Action**
SDG J51095						
J51095-9 / J51095-6	Aluminum	394	1790	ug/L	127.84	R
	Iron	1890	457	ug/L	122.11	
SDG JA3723						
JA3723-5/ JA3723-7	Arsenic	138	239	mg/kg	53.58	J
	Calcium	1470	2180	mg/kg	38.9	
	Manganese	592	1020	mg/kg	53.1	
	Nickel	12.2	21.4	mg/kg	54.76	
	Zinc	51	74.3	mg/kg	37.19	
JA3723-11/ JA3723-12	Calcium	18000	9830	ug/kg	58.71	J
SDG JA3952						
JA3952-2/ JA3952-3	Vanadium	13.3	45.8	mg/kg	109.98	J
SDG JA6909						
JA6909-18/ JA6908-19	Aluminum	14000	22300	mg/kg	46	J
	Barium	47.9	72.3	mg/kg	41	
	Calcium	76900	15900	mg/kg	131	
	Copper	30.6	53.1	mg/kg	54	
	Lead	71	185	mg/kg	89	
	Mangesium	2270	3540	mg/kg	44	
	Vanadium	53.2	90.1	mg/kg	52	
	Zinc	68.5	159	mg/kg	79	
	Acenapthylene	13.7	ND	ug/kg	100	
	Benzo(a)anthracene	80.3	ND	ug/kg	100	
	Benzo(a)pyrene	87.8	ND	ug/kg	100	
	Benzo(b)fluoranthene	174	ND	ug/kg	100	
	Benzo(g,h,i)perylene	24.7	ND	ug/kg	100	
	Benzo(k)fluoranthene	118	ND	ug/kg	100	
	Chrysene	106	ND	ug/kg	100	
	Dibenso(a,h)anthracene	12.5	ND	ug/kg	100	
	Indeno(1,2,3-cd)pyrene	29.1	ND	ug/kg	100	
	Pentachlorophenol	4	7.4	ug/kg	60	No Action based on RPD alone
	a-chlordane	ND	7.1	ug/kg	100	J
	g-chlordane	ND	7.9	ug/kg	100	
	4,4'-DDD	ND	22.6	ug/kg	100	
	4,4'-DDE	ND	365	ug/kg	100	
	4,4'-DDT	ND	136	ug/kg	100	
	TPH-DRO	196	37.7	mg/kg	136	

RPD Criteria ± 35% for solid matrix (measured in kg), ± 20% for aqueous matrix (measured in L)
RPD = Relative Percent Difference
SDG = Sample Delivery Group

Table 4-4
Compounds with Percent Recoveries Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
SDG J51095						
J51095-5 MS/MSD	delta-BHC	60	68	66-153	1 thru 9	J/UJ
	4,4'-DDE	720	560	55-148		None, sample ND
	Heptachlor epoxide	172	152	66-141		
	Acrolein	382	368	42-201	2 thru 10	
SDG J52214						
J52214-2 MS/MSD	2,6-Dichlorophenol	68	69	76-93	1 thru 8	J/UJ
SDG J44840						
J44840-1 MS/MSD	Antimony	30.4	31.6	75-125	1 thru 2	J/UJ
SDG J46678						
J46678-1 MS/MSD	Antimony	25.4	22.1	75-125	1 thru 2	J/UJ
	Arsenic	71.7	70.1	75-125		
	Cadmium	69.5	67.3	75-125		
	Chromium	51.4	64	75-125		
	Cobalt	67.2	70.2	75-125		
	Lead	73.9	73.1	75-125		
	Selenium	72.6	69.2	75-125		
	Silver	74	71	75-125		
	Thallium	74.5	73	75-125		
	Tin	73.4	69.7	75-125		
	Vanadium	66.6	68.9	75-125		
SDG J48395						
J48395-2 MS/MSD	Antimony	30.5	30.6	75-125	5	J/UJ
	Zinc	69.1	69.2	75-125	1 thru 5	
SDG J48688						
J48688-1 MS/MSD	Antimony	32.4	27.8	75-125	1 thru 3	J/UJ
	Chromium	180.5	114.1	75-125		J
	Vanadium	177.2	93.2	75-125		
SDG J63697						
J63697-5 MS/MSD	Benzo(k) fluoranthene	32	57	39-116	1 thru 9 and 15,16	No Action based on MS/MSD
	7,12-Dimethylbenz(a)	88	84	1-71		
	Acrolein	362	370	50-170		
	Trichloroethene	14	18	60-138		
	Mercury	55	50	75-125		J
SDG J63716						
OP28091-MD/MSD	3,3-Dichlorobenzidine	3	8	12-125	10,12,13	No Action based on MS/MSD
J63930-3 MS/MSD	Acrolein	296	284	50-170	2	
	Ethylbenzene	-22	-38	48-140		
	Toluene	47	37	48-141		
J63709-1 MS/MSD	Acrolein	232	240	50-170	1,3,4,5,6,8	
	Dichlorodifluorometha	19	20	32-171		
	Trichlorofluoromethar	35	33	42-169		
J63708-14 MS/MSD	Acrolein	264	258	50-170	12 thru 14	
J64414-1 MS/MSD	Acrolein	314	296	50-170	7,8,10,11	

Table 4-4
Compounds with Percent Recoveries Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
SDG J80982						
J80829-16 MS/MSD	Trichloroethene	28	30	60-138	16 thru 24 and 26	No Action based on MS/MSD
J80982-25 MS/MSD	Trichloroethene	52	38	60-138	25	J
J80982-6 MS/MSD	3,3'-Dimethylbenzidin	30	38	70-130	1 thru 6, 8,14,15,26,27	J
	Hexachloropropene	47	46	46-102		
	Kepone	113	6	46-102		
	Methapyrilene	31.7	36.7	70-130		
	1,4-Naphthoquinone	111	119	59-103		
	N-nitrosomethylethyla	59	62	62-114		
	2-picoline	69	71	70-130		
	Thionazin	92	99	1-56		None, sample ND
	7,12-Dimethylbenz(a)	90	94	1-17		
SDG J90784						
J90784-25 MS/MSD	Acrolein	296	NA	43-188	24 thru 29	Accept NDs
J90784-1 MS/MSD	Acrolein	330	334	43-188	1	J
J90784-19 MS/MSD	Acrolein	292	304	43-188	2 thru 15 and 19	Accept NDs
	7,12-Dimethylbenzo(a	92	89	1-71		None, sample ND
	Mercury	130	95	75-125		J
J90810-7 MS/MSD	Acrolein	324	314	43-188	2,3,4,11	Accept NDs
J91278-2 MS/MSD	Acrolein	278	281	43-188	16,17,18,20,21,22,23	Accept NDs
SDG JA9388						
JA9388-17 MS/MSD	4-Methyl-2-pentanone	154	152	55-148	1 thru 7 and 17	Accept NDs
	Trichloroethene	53	40	56-145		No Action based on MS/MSD
	Calcium	100	68	75-125		
	Manganese	84	72	75-125		
OP36417 MS/MSD	MCPA	42	43	51-183	17	J
	Dalapon	275	338	5-158		
OP36433-MS/MSD	4,4'-DDT	166	138	43-150	17	J
	Endosulfan I	116	158	39-145		
SDG JA13996						
JA13996-4 MS/MSD	Acetonitrile	109	187	45-141	4 thru 14 and 1,2	Accept NDs
	Allyl chloride	144	152	45-136		
	Chloroprene	158	138	47-149		
JA14171-3 MS/MSD	Acetonitrile	128	148	45-141	17 thru 25 and 11	
	Isobutyl Alcohol	528	536	49-152		
JA12315-9A MS/MSD	4,4'-DDT	34	22	43-150	11,17	
	Metoxychlor	34	32	45-160		
SDG J59410						
J59613-8 MS/MSD	2,4,5-TP	49	16	19-108	5	Accept NDs
J59434-11 MS/MSD	Dieldrin	389	384	50-149		

Table 4-4
Compounds with Percent Recoveries Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
J59410-6 MS/MSD	Aluminum	170	134	75-125	1-9	J
	Antimony	44	45	75-125		
	Calcium	162	148	75-125		
	Iron	134	145	75-125		
SDG J63708						
J63709-1 MS/MSD	Acrolein	232	240	50-170	8 thru 12	No Action based on MS/MSD
	Dichlorodifluorometha	19	20	32-171		Reject NDs
	Trichlorofluorometha	35	33	42-169		
J63708-14 MS/MSD	Acrolein	264	258	50-170	13,14	None, sample ND
J63708-1 MS/MSD	Acrolein	413	372	50-170	1	
J63708-7 MS/MSD	Acrolein	394	402	50-170	7	
J64446-1 MS MSD	Acrolein	284	264	50-170	1	
J63708-2 MS/MSD	1,3-Dichlorobenzene	37	60	39-99	2	J
	7,12-Dimethylbenz (a	43	56	50-150		
J63708-8 MS/MSD	Napthalene	33	27	28-137	8	J
J63708-5 MS/MSD	Antimony	48	48	75-125	1 thru 8	J
SDG J63709						
J63708-8 MS/MSD	3,3'-Dichlorobenzidin	3	8	12-125	1 thru 3	None, sample ND
	Acrolein	232	240	50-170		
SDG JA3626						
JA3626-11 MS/MSD	Antimony	51.9	42.5	75-125	11 thru 14	J
	Calcium	-20.5 [a]	-560.9 [a]	75-125		No Action based on MS/MSD
	Iron	8.2 [a]	-1.6 [a]	75-125		
	Magnesium	-13.6 [a]	86.8 [a]	75-125		
	Zinc	29.9	19.1	75-125		J
SDG JA3723						
JA3723-1	Acrolein	399	445	9-164	1	Accept NDs
	4-Aminobiphenyl	58	50	70-130		J
	A,A-Dimethyphenethy	0	0	70-130		
	m-Dinitrobenzene	80	78	95-103		
	Hexachlorophene	9	5	70-130		
	Kepone	77	64	70-130		
	Methapyrilene	5	7	70-130		
	Methyl methasulfonat	58	57	90-90		
	1,4-Naphthoquinone	63	69	70-130		
	1-Naphtylamine	58	57	70-130		
	2-Naphthylamine	73	69	70-130		
	4-Nitroquinoline-1-ox	53	52	70-130		
	N-nitrosopyrolidine	142	126	70-130		
	2-Picoline	63	64	70-130		
	Pyridine	109	53	11-88		
	p-Phenylenediamine	1	3	70-130		

Table 4-4

Compounds with Percent Recoveries Outside of Quality Control Limits

Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
JA3723-1 continued	syn-Trinitrobenzene	62	61	70-130		
	Aluminum	332	332	75-125		
	Antimony	34	33	75-125		
	Iron	-13.4 [a]	119	75-125		No Action based on MS/MSD
	Vanadium	70	78	75-125		J
JA4562-2	Acrolein	210	214	43-188	2	None, sample ND
JA3499-1 MS/MSD	Endosulfan Sulfate	30	45	45-156	1	
	Endrin aldehyde	2	3	39-142		
JA4730-1 MS/MSD	Aluminum	125	131	75-125	1	No Action based on MS/MSD
	Calcium	456	240	75-125		
	Iron	160	140	75-125		
	Sodium	-80 [a]	1360 [a]	75-125		
SDG JA3810						
JA3723-1 MS/MSD	Acrolein	399	445	9-164	1 thru 9, 16 thru 18	No Action based on MS/MSD
	4-Aminobiphenyl	58	50	70-130		
	A,A-Dimethyphenethy	0	0	70-130		
	Disulfotone	40	38	59-143		
	m-Dinitrobenzene	80	78	95-103		
	Famophur	70	56	70-130		
	Hexachlorophene	9	5	70-130		
	Kepone	77	64	70-130		
	Methapyrilene	5	7	70-130		
	Methyl methasulfonat	58	57	90-90		
	1,4-Naphthoquinone	63	69	70-130		
	1-Naphtylamine	58	57	70-130		
	2-Naphthylamine	71	69	70-130		
	4-Nitroquinoline-1-ox	53	52	70-130		
	N-nitrosopyrolidine	142	126	70-130		
	2-picoline	63	64	70-130		
	Pyridine	109	53	11-88		
	p-Phenylenediamine	1	3	70-130		
	syn-Trinitrobenzene	62	61	70-130		
JA4181-3 MS/MSD	Acrolein	331	335	9-164	3	None, sample ND
JA4175-1 MS/MSD	Acrolein	199	200	9-164	1	
JA4562-2 MS/MSD	Acrolein	210	214	43-188	2	
JA3810-5 MS/MSD	Aluminum	124	186	75-125	5	J
	Antimony	53	49	75-125		
	Calcium	212 [a]	817.7 [a]	75-125		No Action based on MS/MSD
	Copper	137	137	75-125		J
	Iron	184	177	75-125		No Action based on MS/MSD
	Magnesium	126	224	75-125		
	Manganese	115	285	75-125		J

Table 4-4
Compounds with Percent Recoveries Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
JA4613-2 MS/MSD	TPH-DRO	199	310	5-137	2	None, sample ND
JA3810-9 MS/MSD	Cyanide	45	NA	48-144	9	J
SDG JA3952						
JA4562-2 MS/MSD	Acrolein	210	214	43-188	2	None, sample ND
JA3952-5 MS/MSD	Acrolein	186	178	9-164	1 thru 7, 9 thru 12	J
	4-Aminobiphenyl	33	36	70-130		
	A,A-Dimethyphenethy	25	34	70-130		
	m-Dinitrobenzene	69	70	95-103		
	Hexachlorophene	39	35	70-130		
	Hexachlorpropene	61	60	70-130		
	Isodrin	69	65	70-130		
	Isosafrole	62	60	70-130		
	Kepone	55	69	70-130		
	Methapyrilene	68	61	70-130		
	Methyl methasulfonat	58	55	90-90		
	1,4-Naphthoquinone	59	59	70-130		
	1-Naphtylamine	39	39	70-130		
	2-Naphthylamine	50	49	70-130		
	5-nitro-o-toluidine	69	71	70-130		
	4-Nitroquinoline-1-ox	45	44	70-130		
	2-Picoline	66	65	70-130		
	Pentachlorobenzene	67	64	70-130		
	p-Phenylenediamine	61	62	70-130		
	Safrole	69	68	70-130		
	o-Toluidine	56	58	70-130		
	syn-Trinitrobenzene	57	55	70-130		
	Benzo(k) fluoranthene	210	172	31-120		
	7,12-Dimethylbenz(a)	110	101	50-150		
	MCPA	132	125	31-123		
	4,4'-DDE	0	0	35-141	2 thru 5,7,9 thru 12	No Action based on MS/MSD
	4,4'-DDT	610	576	31-166		
JA3976-1 MS/MSD	Aroclor 1016	189	176	47-170	1	None, sample ND
JA4325-16 MS/MSD	Aroclor 1016	73	44	64-166	6	
	Aroclor 1260	53	39	40-163		
JA3723-1 MS/MSD	Aluminum	332	332	75-125	1-3	No Action based on MS/MSD
	Antimony	33.6	33.2	75-125		J
	Iron	-13	86	75-125		No Action based on MS/MSD
	Vanadium	70	78	75-125		J
JA3810-9 MS/MSD	Cyanide	82	45	48-144	1-3	No Action based on MS/MSD

Table 4-4
Compounds with Percent Recoveries Outside of Quality Control Limits
Matrix Spike and Matrix Spike Duplicate Samples

QC Sample ID	Compound	MS %R	MSD %R	%R Criteria	Affected Samples	Validator's Action
SDG JA6909						
JA7350-2 MS/MSD	Acetone	233	NA	28-182	11 thru 15	No Action based on MS/MSD
	MEK	174	NA	35-164		
	2-Hexanone	167	NA	28-162		
JA7129-1 MS/MSD	Acrolein	0	0	9-164	16 thru 19	None, sample ND
	Methyl methacrylate	0	0	27-151		
	Iodomethane	35	41	46-139		
	Vinyl acetate	0	0	19-157		
JA7313-1 MS/MSD	Acrolein	195	194	43-188	20	
JA6909-6 MS/MSD	2,4,5-TP	116	111	19-108	6	J
	2,4,5-T	97	131	2-121		
	Dichloroprop	119	106	15-110		
	Dinoseb	0	0	8-90		
	Pentachlorophenol	157	207	18-153		
JA8251-1 MS/MSD	Calcium	75	9	75-125	11 thru 19	No Action based on MS/MSD
	Manganese	45	48	75-125		
	Aluminum	131	107	75-125		
	Antimony	43	44	75-125		
SDG JA10946						
JA10899-2 MS/MSD	3,3'-Dichlorobenzidine	0	0	6-122	3	None, sample ND
SDG JA11429						
JA11429-3 MS/MSD	Disulfoton	0	0	33-107	1 thru 9	None, sample ND
	Methyl Parathion	63	53	57-128		
	Phorate	62	51	53-114		
SDG JA11448						
JA11474-1 MS/MSD	TPH-DRO	0	0	5-137	1 thru 6, and 14	No Action based on MS/MSD
JA10986-1 MS/MSD	Aroclor 1016	123	45	64-166		None, sample ND

% R = Percent Recovery
MS = Matrix Spike
MSD = Matrix Spike Duplicate
ND = Not Detected
SDG = Sample Delivery Group
a = Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery

Table 4-5
Compounds with Percent Recoveries Outside of Quality Control Limits
Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
SDG J51095					
OP26156-BS1	2-Methylphenol	94	40-92	1 thru 9	None, all samples ND
	4-Nitrophenol	68	3-64		
	Anthracene	117	64-110		
	4-Bromophenylphenylether	117	61-115		
	Hexachlorobenzene	127	61-119		
	n-Nitrosodiphenylamine	113	59-112		
	Pyrene	115	58-114		
VA4010-BS	Acrolein	268	30-220	2 thru 10	None, all samples ND
SDG J52214					
OP26159-BS2	delta-BHC	68	72-143	1 thru 8	R
OP26179-BS1	1,2-Dichlorobenzene	54	55-104	1 thru 8	R
	1,4-Dichlorobenzene	51	54-102		
	1,2,4-Trichlorobenzene	49	53-105		
VA4014-BS	Acrolein	340	30-220	1 thru 9	None, all samples ND
	1,1,2-Trichloroethane	122	83-120		
SDG J46678					
OP25502-BS2	2-Chlorophenol	55	65-107	1 thru 2	J/R
	2,4-Dichlorophenol	64	65-112		
	2,6-Dichlorophenol	62	70-130		
	2-Merhylphenol	61	61-105		
	Phenol	57	61-109		
	2,4,6-Trichlorophenol	64	69-111		
	1,2-Dichlorobenzene	54	60-100		
	1,3-Dichlorobenzene	52	59-98		
	1,4-Dichlorobenzene	53	59-99		
	Hexachloroethane	55	56-103		
VD4790-BS	Acrolein	202	17-200	1 thru 3	None, all samples ND
SDG J48395					
VV2480-BS	Bromodichloromethane	126	80-125	1 thru 6	None, all samples ND
	Chloroform	127	78-123		
	Chloroprene	138	66-136		
	1,1-Dichloroethane	125	76-123		

Table 4-5
Compounds with Percent Recoveries Outside of Quality Control Limits
Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
SDG J48688					
VA3975-BS	Acrolein	250	30-220	1 thru 4	None, all samples ND
OP25810-BS-1	Hexachlorobutadiene	46	48-114	3	J/R
	1,2,4-Trichlorobenzene	47	53-105		
SDG J63697					
OP28089-BS11	Diphenylamine	69	82-128	1 thru 16	No Action Taken based on LCS results
	m-Dinitrobenzene	62	90-147		
	Ethyl methanesulfonate	50	66-111		
	Hexachlorophene	128	70-124		
	Isosafrole	42	51-144		
	Methapyrilene	12	68-121		
	Merhylparathion	82	94-145		
	1,4-Naphthoquinone	35	46-117		
	1-Naphthylamine	164	53-97		
	2-Naphthylamine	200	66-103		
	p-Phenylenediamine	79	85-134		
	Safrole	51	74-111		
	Sym-Trinitrobenzene	54	107-164		
	2-Methylnaphthalene	116	17-114		
V3A1617-BS	Acrolein	372	37-179	1 thru 17	R
SDG J63716					
OP28091-BS11	Diphenylamine	72	82-128	10,12,13	No Action Taken based on LCS results
	m-Dinitrobenzene	64	90-147		
	Ethyl methanesulfonate	50	66-111		
	Hexachlorophene	147	70-124		
	Hexachlorocyclopentadiene	101	16-97		
	Isosafrole	50	51-144		
	Methapyrilene	8	68-121		
	Merhylparathion	91	94-145		
	1,4-Naphthoquinone	35	46-117		
	Safrole	55	74-111		
	Sym-Trinitrobenzene	59	107-164		
OP28092-BS12	2-Methylnaphthalene	128	17-114	10,12,13	

Table 4-5
Compounds with Percent Recoveries Outside of Quality Control Limits
Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
VU3539-BS	Acrolein	324	37-179	2	R
VU3543-BS	Acrolein	244	37-179	1,3,4,5,6,8	
VU3544-BS	Acrolein	195	37-179	12,13,14	
VU3545-BS	Acrolein	266	37-179	7,9,10,11	
SDG J80982					
V1C1960-BS	Chloroethane	140	64-139	16 thru 24 and 26	No Action Taken based on LCS results
OP30829-BS1	3,3'-Dimethylbenzidine	129	18-116	1,2,3,4,5,6,8,14,15,26,27	
	5-Nitro-o-toluidine	135	88-123		
	p-Phenylenediamine	51	85-134		R
	O-Toluidine	126	60-101		No Action Taken based on LCS results
	Sym-Trinitrobenzene	99	109-164		R
SDG J90784					
V3C1692-BS2	Acrolein	364	46-188	1	Accept NDs
	Styrene	128	79-126		
V3C1693-BS	Acrolein	412	46-188	2 thru 5	
V3C1693-BS2	Acrolein	310	46-188	2 thru 5	
V3C1694-BS	Acrolein	310	46-188	2 thru 4 and 11	
V3C1695-BS	Acrolein	332	46-188	16,17,18,20,21,22,23	
V3C1696-BS	Acrolein	342	46-188	24 thru 29	
OP32758-BS	Famphur	101	31-79	19 thru 24 and 28, 29	
	Hexachlorophene	154	70-124		
	p-Phenylenediamine	7	20-128	19 thru 20	R
SDG JA9388					
OP36413A-BS12	Benzo(b)fluoranthene	138	32-136	12 thru 18 and 1,2,3,20	Accept NDs
OP36417-BS1	Dalapon	183	16-156		
OP36433-BS1	4,4'-DDT	152	63-142		
SDG JA13996					
VU4588-BS	Acetonitrile	204	53-136	4 thru 10 and 12 thru 14 and 1,2	Accept NDs
VU4589-BS	Acetonitrile	188	53-136	17 thru 25 and 11	
	Allyl Chloride	138	57-130		
VU4590-BS	Acetonitrile	146	53-136	15,16	
OP37258-BS11	Hexachlorophene	58	70-124	11,17	Reject NDs
	1-Naphthylamine	41	53-97		

Table 4-5

Compounds with Percent Recoveries Outside of Quality Control Limits

Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
OP37258A-BS12	7,12-Dimethylbenzoanthracene	0	40-98	11,17	Reject NDs
	3-Methylchloranthene	0	33-152		
SDG J59410					
OP27532-BS1	2-Chlorophenol	61	62-100	1 thru 4,9	No Action Taken based on LCS results
	3,4-methylphenol	59	63-108		
	4-Nitrophenol	20	35-134		
	2,4,5-trichlorophenol	62	64-113		
	Aniline	21	24-81		
	1,3-dichlorobenzene	57	59-100		
	2,4-dinitrotoluene	61	63-121		
	1,4-Dichlorobenzene	56	58-98		
	Dibenzofuran	64	65-107		
	4-nitroaniline	32	44-124		
OP27532-BS13	3,3'-dichlorobenzidine	81	25-42		
	m-Dinitrobenzene	53	84-106		
	Ethyl methanesulfonate	51	64-84		
	Isosafrole	97	69-92		
	kepone	5	7-87		
	1-napthylamine	103	38-75		
	2-napthylamine	146	39-80		
	4-nitroquinoline 1-oxide	89	68-87		
	n-Nitrosodiphenylamine	53	70-130		
	2-picoline	79	53-72		
	p-Phenylenediamine	91	70-130		
	Safrole	54	61-111		
	1,2,4,5-tetrachlorbenzene	103	67-99		
	o-Toluidine	122	19-78		
	Sym-Trinitrobenzene	52	60-150		

Table 4-5
Compounds with Percent Recoveries Outside of Quality Control Limits
Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
SDG J63708					
OP28094-BS11	Aramite	80	81-172	1 thru 7	R
	3,3'-Diphenylamine	54	20-42		No Action Taken based on LCS results
	Diphenylamine	64	81-88		R
	m-Dinitrobenzene	54	84-160		
	Ethyl methanesulfonate	44	64-84		
	Famphur	22	28-91		
	Isosafrole	52	60-129		
	Methapyrilene	48	57-125		
	Methyl methanesulfonate	33	40-86		
	Methyl parathion	73	87-124		
	2-picoline	52	53-72		
	p-Phenylenediamine	317	70-130		No Action Taken based on LCS results
	Safrole	49	61-111		R
	Sym-Trinitrobenzene	44	60-150		
OP28091-BS1	Hexachlorocyclopentadiene	101	16-97	8 thru 14	No Action Taken based on LCS results
OP28091-BS11	Diphenylamine	72	82-128	8 thru 14	R
	m-Dinitrobenzene	64	90-147		
	Ethyl methanesulfonate	50	66-111		
	Hexachlorophene	147	70-124		No Action Taken based on LCS results
	Hexachlorocyclopentadiene	101	16-97		
	Isosafrole	50	51-144		R
	Methapyrilene	8	68-121		
	Merhylparathion	91	94-145		
	1,4-Naphthoquinone	35	46-117		
	Safrole	55	74-111		
	Sym-Trinitrobenzene	59	107-164		
OP28092-BS12	2-Methylnaphthalene	128	17-114	10,12,13	No Action Taken based on LCS results

Table 4-5

Compounds with Percent Recoveries Outside of Quality Control Limits

Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
SDG J63709					
OP28091-BS1	Hexachlorocyclopentadiene	101	16-97	10,12,13	No Action Taken based on LCS results
OP28091-BS11	Diphenylamine	50	82-128		
	m-Dinitrobenzene	50	90-147		
	Ethyl methanesulfonate	50	66-111		
	Hexachlorophene	50	70-124		
	Isosafrole	50	51-144		
	Methapyrilene	50	68-121		
	Methyl parathion	50	94-145		
	1,4-Naphthoquinone	50	46-117		
	Safrole	50	74-111		
	Sym-Trinitrobenzene	50	107-164		
	2-Methylnaphthalene	128	17-114		
VU3543-BS	Acrolein	244	37-179	1,2,3	J
SDG JA3723					
VU4369-BS	Acrolein	202	46-188	13,14	Accept NDs
VV3429-BS	2-Hexanone	142	61-132	2 thru 5	Accept NDs
OP35360-1	Chlorobenzilate	110	74-110	7 thru 14	Accept NDs
	Dimethoate	112	70-110		
	Disulfoton	148	65-121		
	Kepone	2	9-104		Reject NDs
	Methapyrilene	131	57-128		Accept NDs
	N-nitrosodiethylamine	100	60-99		
	N-nitrosomorpholine	105	65-97		
	N-nitrosopyrrolidine	157	75-105		
	Phorate	163	27-145		
	Thionazin	109	81-108		
OP35329-BS11	Aramite	150	55-141	13	Accept NDs
	Chlorobenzilate	126	75-117		
	Dillate	110	49-107		
	Hexachlorophene	62	70-124		Reject NDs
	Hexachloropropene	97	22-79		Accept NDs
	N-nitrosodi-n-buthylamine	114	58-111		
	p-Phenylenediamine	18	20-128		Reject NDs
OP26963-BS	Phorate	122	61-118	13	Accept NDs

Table 4-5

Compounds with Percent Recoveries Outside of Quality Control Limits

Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
SDG JA3810					
VU4369-BS	Acrolein	202	46-188	19	Accept NDs
OP35360-BS1	Chlorobenzilate	110	74-110	1 thru 3, 5 thru 9, 16 thru 18	Accept NDs
	Dimethoate	112	70-110		
	Disulfoton	148	65-121		
	Kepone	2	9-104		Reject NDs
	Methapyrilene	131	57-128		Accept NDs
	N-nitrosodiethylamine	100	60-99		
	N-nitrosomorpholine	105	65-97		
	N-nitrosopyrrolidine	157	75-105		
	Phorate	163	27-145		
	Thionazin	109	81-108		
OP35360-BS2	Kepone	110	9-104	4	Accept NDs
	N-nitrosodiethylamine	106	60-99		
	N-nitrosomorpholine	98	65-97		
	N-nitrosopyrrolidine	140	57-105		
SDG JA3952					
VU4369-BS1	Acrolein	202	46-188	8,13	Accept NDs
VV3436-BS	Acrolein	230	30-192	1 thru 12	Accept NDs
OP35387-BS1	Aramite	109	70-105	1 thru 12	Accept NDs, J for Detects
	N-nitrosopyrrolidine	142	57-105		
	Pronamide	16	31-201		Reject NDs
	Tetraethyl Dithiopyrosphosphate	62	78-112		
OP35384-BS11	Chlorobenzilate	122	75-117	13	Accept NDs, J for Detects
	Dillate	108	49-107		J
	p-(Dimethylamine) azobenzene	131	70-130		
	Hexachlorophene	82	22-79		
	N-nitrosodi-n-buthylamine	116	58-111		
	N-nitrosodiethylamine	108	63-103		
OP35387A-BS12	Benzo(b)fluoranthene	131	49-124	1 thru 12	
	Benzo(g,h,i)perylene	106	41-103		

Table 4-5

Compounds with Percent Recoveries Outside of Quality Control Limits

Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
OP35348-BS2	2,4-D	145	52-124	13	No Action Taken based on LCS results
	Silvex	205	54-124		
	2,4,5-T	173	58-131		
	Dicamba	198	45-131		
	Dichloroprop	185	54-132		
	Dinoseb	135	18-111		
	Pentachlorophenol	180	38-119		
	2,4-DD	215	50-141		
OP35413-BS1	Silvex	124	58-121	1 thru 7, 9 thru 12	Accept NDs
	Dalapon	162	17-107		
SDG JA6909					
VV3493-BS1	Acrolein	236	30-182	11 thru 15	Accept NDs
VV3494-BS1	Acrolein	242	30-182	17,18	Accept NDs
	trans-1,3-dichloropropane	129	77-128		
VV3494-BS2	Acrolein	270	30-182	16,19	Accept NDs
OP35981-BS1	Aramite	139	70-105	11 thru 14, 15 thru 19	J
	Chlorobenzilate	116	74-110		
	Diallate	133	48-118		
	Hexachlrorphene	10	39-143		R
	Isodrin	116	60-110		J
	N-nitrosodi-n-buthylamine	133	65-113		
	N-nitrosodiethylamine	125	60-99		
	N-nitrosomorpholine	106	65-97		
	N-nitrosopiperidine	107	66-101		
	2-picoline	109	39-105		
	Phenacetin	144	71-128		
	Thionazin	128	81-108		
	Tetraethyl Dithiophosphate	124	78-112		

Table 4-5
Compounds with Percent Recoveries Outside of Quality Control Limits
Lab Control Samples

QC Sample ID	Compound	LCS %R	%R Criteria	Affected Samples	Validator's Action
OP35981-BS21	Aramite	127	70-105	15	J
	Dillate	127	48-118		
	Hexachlorophene	9	39-143		R
	Kepone	142	9-104		J
	N-nitrosodiethylamine	118	60-99		
	N-nitrosomorpholine	104	65-97		
	N-nitrosopyrrolidine	139	57-105		
	Phenacetin	131	71-128		
	Thionazin	119	81-108		
	Tetraethyl Dithiophosphate	114	78-112		
OP35980-BS1	2,4,5-TP	126	58-121	1 thru 19	J
	Dalapon	127	17-107		
	Dicamba	140	47-132		
	Dinoseb	122	9-117		
GP47092/GN21757	Cyanide	113	90-110		No Action Taken based on LCS results
SDG JA10946					
VD6082-BS	Acrolein	270	30-192	1	Accept NDs
OP36719-BS2	4,6-dinitro-o-cresol	127	48-122	3	Accept NDs
OP36719-BS22	Hexachlorophene	51	70-124	3	Reject NDs
	Hexachloropropene	87	22-79		Accept NDs
	Kepone	114	9-105		Accept NDs
	p-Phenylenediamine	5	20-128		Reject NDs
OP36735-BS11	p-Phenylenediamine	3	14-178	3	Reject NDs
OP36719A-BS21	Benzo(g,h,i)perylene	154	43-124	3	Accept NDs
	Dibenzo(a,h)anthracene	138	43-125		
	Indeno(1,2,3-cd)pyrene	141	44-127		
OP36735A-BS12	Benzo(g,h,i)perylene	120	41-103	3	Accept NDs
	Dibenzo(a,h)anthracene	108	45-105		
	Indeno(1,2,3-cd)pyrene	111	44-103		
OP36757-BS1/OP36757-BSD	Dinoseb	83	18-111	2,3	No Action Taken based on LCS results
	MCPA	82	32-169		
	MCPP	32	47-169		

% R = Percent Recovery

ND = Not Detected

LCS = Lab Control Sample

Table 4-6
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Subsurface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL Res	EPA RSL Ind	EPA SSL
	Pesticides						
309-00-2	Aldrin	0.3 - 1	ug/kg	NSA	29	100	0.65
319-84-6	alpha-BHC	0.27 - 0.96	ug/kg	NSA	77	270	0.062
319-85-7	Beta-BHC	0.33 - 1.7	ug/kg	NSA	270	960	0.22
319-86-8	delta-BHC	0.27 - 0.95	ug/kg	NSA	77	270	0.062
33213-65-9	Endosulfan II	0.4 - 1.7	ug/kg	0.65	37000 *	3700000 *	3000
1031-07-8	Endosulfan sulfate	0.31 - 1.1	ug/kg	0.9	37000 *	3700000 *	3000
72-20-8	Endrin	0.32 - 1.1	ug/kg	NSA	1800 *	180000 *	440
7421-93-4	Endrin aldehyde	0.34 - 1.2	ug/kg	NSA	1800 *	180000 *	440
53494-70-5	Endrin ketone	0.29 - 1	ug/kg	NSA	1800 *	180000 *	440
58-89-9	Gamma-BHC (Lindane)	0.31 - 1.3	ug/kg	NSA	520	2100	0.36
1024-57-3	Heptachlor epoxide	0.29 - 1	ug/kg	NSA	53	190	0.15
72-43-5	Methoxychlor	0.39 - 1.4	ug/kg	NSA	31000 *	3100000 *	9900
8001-35-2	Toxaphene	7.3 - 49	ug/kg	NSA	440	1600	9.4
	PCBs						
12674-11-2	Aroclor 1016	7.1 - 8.7	ug/kg	NSA	390 *	21000 *	92
11104-28-2	Aroclor 1221	23 - 27	ug/kg	NSA	140	540	0.12
11141-16-5	Aroclor 1232	12 - 25	ug/kg	NSA	140	540	0.12
53469-21-9	Aroclor 1242	12 - 24	ug/kg	NSA	220	740	5.3
12672-29-6	Aroclor 1248	13 - 16	ug/kg	NSA	220	740	5.2
11097-69-1	Aroclor 1254	8.1 - 22	ug/kg	NSA	110 *	740	8.8
11096-82-5	Aroclor 1260	7.4 - 9.2	ug/kg	NSA	220	740	24
	Herbicides						
75-99-0	2,2-dichloropropionic acid	2 - 2.5	ug/kg	NSA	180000 *	18000000 *	230
93-76-5	2,4,5-T	0.91 - 2.4	ug/kg	NSA	61000 *	6200000 *	150
93-72-1	2,4,5-TP (silvex)	0.91 - 2.4	ug/kg	NSA	49000 *	4900000 *	160
94-75-7	2,4-D	8.2 - 11	ug/kg	NSA	69000 *	7700000 *	95
94-82-6	2,4-DB	6.7 - 8.1	ug/kg	NSA	49000 *	4900000 *	120
1918-00-9	Dicamba	2.3 - 2.8	ug/kg	NSA	180000 *	18000000 *	280
88-85-7	Dinoseb	7.1 - 8.7	ug/kg	NSA	6100 *	620000 *	320
94-74-6	MCPA (2-methyl-4-chlorophenoxyacetic acid)	750 - 910	ug/kg	NSA	3100 *	310000 *	4.7
93-65-2	MCPP	610 - 740	ug/kg	NSA	6100 *	620000 *	11
	Organosphosphorus Compounds						
60-51-5	Dimethoate	18 - 22	ug/kg	NSA	1200 *	120000 *	1.6
298-04-4	Disulfoton	37 - 45	ug/kg	NSA	240 *	25000 *	2.7
52-85-7	Famphur	18 - 22	ug/kg	NSA	NSA	NSA	NSA
298-00-0	Methyl Parathion	18 - 22	ug/kg	NSA	1500 *	150000 *	15
126-68-1	O,O,O-Triethyl Phosphorothioat	18 - 22	ug/kg	NSA	NSA	NSA	NSA
56-38-2	Parathion	18 - 22	ug/kg	NSA	37000 *	3700000 *	1100
298-02-2	Phorate	18 - 22	ug/kg	NSA	1200 *	120000 *	8.2
3689-24-5	Tetraethyl Dithiopyrophosphate	18 - 22	ug/kg	NSA	3100 *	310000 *	13
297-97-2	Thionazin	18 - 22	ug/kg	NSA	NSA	NSA	NSA
	Volatile Organic Compounds						
630-20-6	1,1,1,2-tetrachloroethane	0.28 - 86	ug/kg	NSA	1900	9300	0.2
71-55-6	1,1,1-trichloroethane	0.28 - 86	ug/kg	NSA	870000	38000000	3200
79-34-5	1,1,2,2-tetrachloroethane	0.14 - 60	ug/kg	NSA	560	2800	0.026
79-00-5	1,1,2-trichloroethane	0.14 - 56	ug/kg	NSA	160 *	5300 *	0.078
75-34-3	1,1-dichloroethane	0.21 - 64	ug/kg	NSA	3300	17000	0.69
96-18-4	1,2,3-trichloropropane	1.2 - **360**	ug/kg	NSA	5	95	0.00031
96-12-8	1,2-Dibromo-3-chloropropane	0.81 - **250**	ug/kg	NSA	5.4	69	0.00014
106-93-4	1,2-dibromoethane	0.22 - **66**	ug/kg	NSA	34	170	0.0018
107-06-2	1,2-dichloroethane	0.23 - 70	ug/kg	NSA	430	2200	0.042
78-87-5	1,2-dichloropropane	0.21 - 64	ug/kg	NSA	940	4700	0.13
123-91-1	1,4-dioxane	26 - **7900**	ug/kg	NSA	4900	17000	0.14
591-78-6	2-hexanone	0.89 - 310	ug/kg	NSA	21000 *	1400000 *	11

Table 4-6
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Subsurface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL Res	EPA RSL Ind	EPA SSL
107-05-1	3-Chloropropene	0.41 - **280**	ug/kg	NSA	180 *	3400 *	0.21
108-10-1	4-methyl-2-pentanone	1.3 - 390	ug/kg	NSA	530000	53000000	450
75-05-8	Acetonitrile	8.9 - 2800	ug/kg	NSA	87000 *	3700000 *	26
107-02-8	Acrolein	3.9 - **1800**	ug/kg	NSA	15 *	650 *	0.0084
107-13-1	Acrylonitrile	0.72 - **360**	ug/kg	NSA	240	1200	0.0099
75-27-4	Bromodichloromethane	0.14 - 47	ug/kg	NSA	270	1400	0.032
75-25-2	Bromoform	0.18 - 54	ug/kg	NSA	62000	220000	2.3
74-83-9	Bromomethane	0.24 - 140	ug/kg	NSA	730 *	32000 *	2.2
56-23-5	Carbon tetrachloride	0.5 - 150	ug/kg	NSA	610	3000	0.17
108-90-7	Chlorobenzene	0.16 - 48	ug/kg	NSA	29000 *	1400000	62
75-00-3	Chloroethane	0.37 - 180	ug/kg	NSA	1500000	61000000	5900
67-66-3	Chloroform	0.25 - 75	ug/kg	NSA	290	1500	0.053
74-87-3	Chloromethane	0.3 - 110	ug/kg	NSA	12000 *	500000 *	49
126-99-8	Chloroprene	0.18 - **55**	ug/kg	NSA	9.4	47	0.0085
156-59-2	Cis-1,2-dichloroethene	0.19 - 59	ug/kg	NSA	16000 *	2000000 *	21
10061-01-5	Cis-1,3-dichloropropene	0.13 - 43	ug/kg	NSA	1700	8300	0.15
124-48-1	Dibromochloromethane	0.14 - 57	ug/kg	NSA	680	3300	0.039
74-95-3	Dibromomethane	0.19 - 59	ug/kg	NSA	2500 *	110000 *	2
75-71-8	Dichlorodifluoromethane	0.52 - 260	ug/kg	NSA	9400 *	400000 *	310
97-63-2	Ethyl Methacrylate	0.32 - 230	ug/kg	NSA	150000	7500000	120
74-88-4	Iodomethane	0.18 - 65	ug/kg	NSA	NSA	NSA	NSA
126-98-7	Methacrylonitrile	1.4 - **430**	ug/kg	NSA	320 *	18000 *	0.24
80-62-6	Methyl Methacrylate	0.64 - 250	ug/kg	NSA	480000	21000000	310
75-09-2	Methylene Chloride	0.16 - 72	ug/kg	NSA	11000	53000	1.2
76-01-7	Pentachloroethane	0.16 - 99	ug/kg	NSA	5400	19000	0.36
107-12-0	Propane Nitrile (Propionitrile)	2.8 - 2300	ug/kg	NSA	NSA	NSA	NSA
100-42-5	Styrene	0.15 - 47	ug/kg	NSA	630000	36000000	1800
127-18-4	Tetrachloroethene	0.25 - 85	ug/kg	NSA	550	2600	0.049
156-60-5	trans-1,2-dichloroethene	0.17 - 71	ug/kg	NSA	15000 *	690000 *	31
10061-02-6	trans-1,3-dichloropropene	0.13 - 41	ug/kg	NSA	1700	8300	0.15
110-57-6	trans-1,4-dichloro-2-butene	1.3 - **400**	ug/kg	NSA	6.9	35	0.00054
79-01-6	Trichloroethene	0.16 - 54	ug/kg	NSA	2500 *	14000 *	0.72
75-69-4	Trichlorofluoromethane	0.48 - 250	ug/kg	NSA	79000 *	3400000	830
108-05-4	Vinyl acetate	0.95 - 290	ug/kg	NSA	97000 *	4100000	88
75-01-4	Vinyl chloride	0.34 - **100**	ug/kg	NSA	60	1700	0.0056
	Semivolatile Organic Compounds						
95-94-3	1,2,4,5-tetrachlorobenzene	4.1 - 31	ug/kg	NSA	1800 *	180000 *	51
120-82-1	1,2,4-trichlorobenzene	19 - 28	ug/kg	NSA	6200 *	99000 *	6.8
95-50-1	1,2-dichlorobenzene	17 - 29	ug/kg	NSA	190000	9800000	360
99-35-4	1,3,5-Trinitrobenzene	13 - 35	ug/kg	NSA	220000 *	27000000 *	3900
541-73-1	1,3-dichlorobenzene	15 - 24	ug/kg	NSA	2400	12000	0.41
99-65-0	1,3-Dinitrobenzene	18 - 31	ug/kg	NSA	610 *	62000 *	3.3
106-46-7	1,4-dichlorobenzene	14 - 21	ug/kg	NSA	2400	12000	0.41
130-15-4	1,4-Naphthoquinone	11 - 17	ug/kg	NSA	NSA	NSA	NSA
134-32-7	1-Naphthylamine	11 - 37	ug/kg	NSA	NSA	NSA	NSA
108-60-1	2,2-oxybis(1-chloropropane)	19 - 33	ug/kg	NSA	4600	22000	0.12
58-90-2	2,3,4,6-tetrachlorophenol	43 - 63	ug/kg	NSA	180000 *	18000000 *	6700
95-95-4	2,4,5-trichlorophenol	39 - 67	ug/kg	NSA	610000 *	62000000 *	14000
88-06-2	2,4,6-trichlorophenol	33 - 71	ug/kg	NSA	6100 *	160000 *	23
120-83-2	2,4-dichlorophenol	38 - 75	ug/kg	NSA	18000 *	1800000 *	130
105-67-9	2,4-dimethylphenol	45 - 110	ug/kg	NSA	120000 *	12000000 *	860
51-28-5	2,4-dinitrophenol	59 - 570	ug/kg	NSA	12000 *	1200000 *	82
121-14-2	2,4-dinitrotoluene	20 - 52	ug/kg	NSA	1600	5500	0.29
87-65-0	2,6-Dichlorophenol	8.2 - 17	ug/kg	NSA	18000 *	1800000 *	130
606-20-2	2,6-dinitrotoluene	16 - 51	ug/kg	NSA	6100 *	620000 *	50

Table 4-6
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Subsurface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL Res	EPA RSL Ind	EPA SSL
53-96-3	2-Acetylaminofluorene	9.2 - 17	ug/kg	NSA	130	450	0.082
91-58-7	2-chloronaphthalene	16 - 62	ug/kg	NSA	630000	82000000	15000
95-57-8	2-chlorophenol	30 - 44	ug/kg	NSA	39000 *	5100000 *	150
534-52-1	2-Methyl-4,6-dinitrophenol	34 - 56	ug/kg	NSA	490 *	49000 *	5
95-48-7	2-methylphenol	38 - 57	ug/kg	NSA	310000 *	31000000 *	1500
91-59-8	2-Naphthylamine	9.9 - 21	ug/kg	NSA	270	960	0.19
88-74-4	2-nitroaniline	24 - 39	ug/kg	NSA	61000 *	6000000 *	150
88-75-5	2-nitrophenol	38 - 56	ug/kg	NSA	2900	13000	0.29
109-06-8	2-Picoline	6.6 - 16	ug/kg	NSA	NSA	NSA	NSA
34MP	3&4-methylphenol	49 - 71	ug/kg	NSA	31000 *	3100000 *	150
91-94-1	3,3-dichlorobenzidine	37 - 92	ug/kg	NSA	1100	3800	0.98
119-93-7	3,3'-Dimethylbenzidine	20 - **56**	ug/kg	NSA	44	160	0.04
99-09-2	3-nitroaniline	15 - 35	ug/kg	NSA	610 *	62000 *	3.4
92-67-1	4-Aminobiphenyl	7.8 - 14	ug/kg	NSA	23	82	0.016
101-55-3	4-bromophenyl phenyl ether	20 - 29	ug/kg	NSA	NSA	NSA	NSA
59-50-7	4-chloro-3-methylphenol	44 - 64	ug/kg	NSA	610000 *	62000000 *	4300
106-47-8	4-chloroaniline	15 - 28	ug/kg	NSA	2400	8600	0.14
7005-72-3	4-chlorophenyl phenyl ether	18 - 35	ug/kg	NSA	NSA	NSA	NSA
100-01-6	4-nitroaniline	23 - 33	ug/kg	NSA	24000	86000	1.4
100-02-7	4-nitrophenol	47 - 68	ug/kg	NSA	24000 *	110000	3.9
56-57-5	4-Nitroquinoline 1-Oxide	29 - 43	ug/kg	NSA	NSA	NSA	NSA
99-55-8	5-Nitro-O-Toluidine	8.9 - 19	ug/kg	NSA	54000	190000	4.2
122-09-8	A,A-Dimethylphenethylamine	45 - 75	ug/kg	NSA	NSA	NSA	NSA
83-32-9	Acenaphthene	19 - 28	ug/kg	NSA	340000 *	33000000 *	22000
98-86-2	Acetophenone	18 - 28	ug/kg	NSA	780000	100000000	1100
62-53-3	Aniline	9.7 - 18	ug/kg	NSA	43000 *	300000	4
140-57-8	Aramite	28 - 170	ug/kg	NSA	19000	69000	30
100-51-6	Benzyl alcohol	21 - 37	ug/kg	NSA	610000 *	62000000 *	890
85-68-7	Benzyl butyl phthalate	18 - 34	ug/kg	NSA	260000	910000	510
111-91-1	Bis(2-chloroethoxy) methane	18 - 29	ug/kg	NSA	18000 *	1800000 *	25
111-44-4	Bis(2-chloroethyl) ether	17 - 25	ug/kg	NSA	210	1000	0.0031
510-15-6	Chlorobenzilate	6.8 - 20	ug/kg	NSA	4400	16000	2
2303-16-4	Diallate	19 - 29	ug/kg	NSA	8000	28000	1.6
84-66-2	Diethyl phthalate	16 - 24	ug/kg	NSA	4900000 *	490000000	12000
60-51-5	Dimethoate	9.9 - 12	ug/kg	NSA	1200 *	12000 *	1.6
131-11-3	Dimethyl phthalate	17 - 25	ug/kg	NSA	NSA	NSA	NSA
84-74-2	Di-n-butyl phthalate	23 - 33	ug/kg	NSA	610000 *	62000000 *	9200
117-84-0	Di-n-octyl phthalate	16 - 38	ug/kg	NSA	610000 *	62000000 *	9200
88-85-7	Dinoseb	13 - 17	ug/kg	NSA	6100 *	62000 *	320
122-39-4	Diphenylamine	17 - 33	ug/kg	NSA	150000 *	15000000 *	1700
298-04-4	Disulfoton	5.6 - 12	ug/kg	NSA	240 *	2500 *	2.7
62-50-0	Ethyl Methanesulfonate	5.7 - 21	ug/kg	NSA	NSA	NSA	NSA
52-85-7	Famphur	54 - 100	ug/kg	NSA	NSA	NSA	NSA
87-68-3	Hexachloro-1,3-butadiene	17 - 29	ug/kg	NSA	6100 *	22000	1.7
118-74-1	Hexachlorobenzene	21 - 30	ug/kg	NSA	300	1100	0.53
77-47-4	Hexachlorocyclopentadiene	28 - 50	ug/kg	NSA	37000 *	3700000 *	680
67-72-1	Hexachloroethane	19 - 34	ug/kg	NSA	6100 *	120000 *	2.9
70-30-4	Hexachlorophene	6.5 - 20	ug/kg	NSA	1800 *	180000 *	15000
1888-71-7	Hexachloropropene	5 - 28	ug/kg	NSA	NSA	NSA	NSA
465-73-6	ISODRIN	11 - 23	ug/kg	NSA	NSA	NSA	NSA
78-59-1	Isophorone	19 - 47	ug/kg	NSA	510000	1800000	23
120-58-1	Isosafrole	4.8 - 33	ug/kg	NSA	NSA	NSA	NSA
143-50-0	Kepone	92 - **210**	ug/kg	NSA	49	170	0.24
91-80-5	Methapyrilene	32 - 46	ug/kg	NSA	NSA	NSA	NSA
66-27-3	Methyl Methanesulfonate	10 - 15	ug/kg	NSA	4900	17000	0.14

Table 4-6
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Subsurface Soil

CAS	**Compound**	**Range of MDLs**	**Units**	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**
298-00-0	Methyl Parathion	14 - 18	ug/kg	NSA	1500 *	15000 *	15
98-95-3	Nitrobenzene	16 - 31	ug/kg	NSA	4800	24000	0.079
55-18-5	N-Nitrosodiethylamine	8.9 - **23**	ug/kg	NSA	0.77	11	NSA
62-75-9	n-Nitrosodimethylamine	22 - **47**	ug/kg	NSA	2.3	34	0.0001
924-16-3	N-Nitrosodi-N-Butylamine	16 - 32	ug/kg	NSA	87	400	0.005
621-64-7	N-nitrosodi-n-propylamine	23 - 33	ug/kg	NSA	69	250	0.0072
86-30-6	N-nitrosodiphenylamine	16 - 36	ug/kg	NSA	99000	350000	75
10595-95-6	N-Nitrosomethylethylamine	22 - **66**	ug/kg	NSA	22	78	0.00088
59-89-2	N-Nitrosomorpholine	7.5 - 15	ug/kg	NSA	73	260	0.0025
100-75-4	N-Nitrosopiperidine	14 - **55**	ug/kg	NSA	52	180	0.0038
930-55-2	N-Nitrosopyrrolidine	16 - 27	ug/kg	NSA	230	820	0.012
126-68-1	O,O,O-Triethyl Phosphorothioat	9.6 - 17	ug/kg	NSA	NSA	NSA	NSA
95-53-4	O-TOLUIDINE	10 - 18	ug/kg	NSA	NSA	NSA	NSA
60-11-7	P-(Dimethylamine)Azobenzene	11 - 17	ug/kg	NSA	110	370	0.062
56-38-2	Parathion	15 - 17	ug/kg	NSA	37000 *	370000 *	1100
608-93-5	Pentachlorobenzene	6.8 - 30	ug/kg	NSA	4900 *	490000 *	220
82-68-8	Pentachloronitrobenzene	29 - 43	ug/kg	NSA	1900	6600	3.2
87-86-5	Pentachlorophenol	43 - 60	ug/kg	NSA	890	2700	1.7
62-44-2	PHENACETIN	8.5 - 20	ug/kg	NSA	220000	780000	8.6
108-95-2	Phenol	28 - 55	ug/kg	NSA	1800000 *	180000000	6300
298-02-2	Phorate	7.5 - 20	ug/kg	NSA	1200 *	12000 *	8.2
106-50-3	P-Phenylenediamine	16 - 270	ug/kg	NSA	1200000 *	120000000	1900
23950-58-5	Pronamide	2.5 - 20	ug/kg	NSA	460000 *	46000000 *	2800
110-86-1	Pyridine	21 - 31	ug/kg	NSA	7800 *	1000000 *	13
94-59-7	Safrole	8.2 - 26	ug/kg	NSA	520	7800	0.06
3689-24-5	Tetraethyl Dithiopyrophosphate	10 - 19	ug/kg	NSA	3100 *	31000 *	13
297-97-2	Thionazin	14 - 20	ug/kg	NSA	NSA	NSA	NSA
	Semivolatile Organic Compounds (PAH)						
56-49-5	3-Methylcholanthrene	7.3 - **11**	ug/kg	NSA	5.2	78	1.9
57-97-6	7,12-Dimethylbenz[a]anthracene	7.3 - **11**	ug/kg	NSA	0.43	6.2	0.27

Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
MDL = Method detection Limit
NSA = No Screening Criteria Available
Maxium MDLs > the EPA RSL Res are bolded.
Maxium MDLs > the EPA RSL Iind are shaded gray.
Maxium MDLs > the EPA SSL printed in blue font.

Table 4-7

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL RES	EPA RSL IND	Eco SSL
Pesticides							
309-00-2	Aldrin	0.29 - 1.6	ug/kg	NSA	29	100	2.5
319-84-6	alpha-BHC	0.27 - 1.5	ug/kg	NSA	77	270	2.5
319-85-7	Beta-BHC	0.38 - 2.6	ug/kg	NSA	270	960	1
319-86-8	delta-BHC	0.27 - 1.4	ug/kg	NSA	77	270	NSA
959-98-8	Endosulfan I	0.3 - 1.6	ug/kg	NSA	37000 *	370000 *	NSA
33213-65-9	Endosulfan II	0.46 - 2.6	ug/kg	0.65	37000 *	370000 *	NSA
1031-07-8	Endosulfan sulfate	0.31 - 1.7	ug/kg	0.9	37000 *	370000 *	NSA
72-20-8	Endrin	0.31 - 1.7	ug/kg	NSA	1800 *	18000 *	1
7421-93-4	Endrin aldehyde	0.34 - 1.9	ug/kg	NSA	1800 *	18000 *	1
53494-70-5	Endrin ketone	0.29 - 1.6	ug/kg	NSA	1800 *	18000 *	1
58-89-9	Gamma-BHC (Lindane)	0.35 - 1.9	ug/kg	NSA	520	2100	0.05
76-44-8	Heptachlor	0.39 - 2.1	ug/kg	NSA	110	380	NSA
1024-57-3	Heptachlor epoxide	0.29 - 1.6	ug/kg	NSA	53	190	NSA
72-43-5	Methoxychlor	0.39 - 2.1	ug/kg	NSA	31000 *	310000 *	NSA
8001-35-2	Toxaphene	8.3 - 74	ug/kg	NSA	440	1600	NSA
	PCBs						
12674-11-2	Aroclor 1016	6.8 - 23	ug/kg	NSA	390 *	3700 *	NSA
11104-28-2	Aroclor 1221	22 - 71	ug/kg	NSA	140	540	NSA
11141-16-5	Aroclor 1232	11 - 65	ug/kg	NSA	140	540	NSA
53469-21-9	Aroclor 1242	11 - 38	ug/kg	NSA	220	740	NSA
12672-29-6	Aroclor 1248	12 - 41	ug/kg	NSA	220	740	NSA
11097-69-1	Aroclor 1254	7.6 - 56	ug/kg	NSA	110 *	740	NSA
	Herbicides						
75-99-0	2,2-dichloropropionic acid	2.1 - 12	ug/kg	NSA	180000 *	1800000 *	NSA
93-76-5	2,4,5-T	0.9 - 12	ug/kg	NSA	61000 *	620000 *	NSA
93-72-1	2,4,5-TP (silvex)	1 - 12	ug/kg	NSA	49000 *	490000 *	NSA
94-82-6	2,4-DB	6.9 - 39	ug/kg	NSA	49000 *	490000 *	NSA
1918-00-9	Dicamba	2.4 - 14	ug/kg	NSA	180000 *	1800000 *	NSA
120-36-5	Dichlorprop	12 - 69	ug/kg	NSA	NSA	NSA	NSA
88-85-7	Dinoseb	7.4 - 42	ug/kg	NSA	6100 *	62000 *	NSA
94-74-6	MCPA (2-methyl-4-chlorophenoxyacetic acid)	780 - **4400**	ug/kg	NSA	3100 *	31000 *	NSA
93-65-2	MCPP	630 - 3600	ug/kg	NSA	6100 *	62000 *	NSA
	Organosphosphorus Compounds						
60-51-5	Dimethoate	18 - 21	ug/kg	NSA	1200 *	12000 *	NSA
298-04-4	Disulfoton	37 - 43	ug/kg	NSA	240 *	2500 *	NSA
52-85-7	Famphur	18 - 21	ug/kg	NSA	NSA	NSA	NSA
298-00-0	Methyl Parathion	18 - 21	ug/kg	NSA	1500 *	15000 *	NSA
126-68-1	O,O,O-Triethyl Phosphorothioat	18 - 21	ug/kg	NSA	NSA	NSA	NSA
56-38-2	Parathion	18 - 21	ug/kg	NSA	37000 *	370000 *	NSA
298-02-2	Phorate	18 - 21	ug/kg	NSA	1200 *	12000 *	NSA
3689-24-5	Tetraethyl Dithiopyrophosphate	18 - 21	ug/kg	NSA	3100 *	31000 *	NSA
297-97-2	Thionazin	18 - 21	ug/kg				
	Volatile Organic Compounds						
630-20-6	1,1,1,2-tetrachloroethane	0.35 - 0.88	ug/kg	NSA	1900	9300	NSA
71-55-6	1,1,1-trichloroethane	0.35 - 0.88	ug/kg	NSA	870000	3800000	NSA
79-34-5	1,1,2,2-tetrachloroethane	0.17 - 0.42	ug/kg	NSA	560	2800	NSA
79-00-5	1,1,2-trichloroethane	0.17 - 0.42	ug/kg	NSA	160 *	680 *	NSA
75-34-3	1,1-dichloroethane	0.26 - 0.65	ug/kg	NSA	3300	17000	NSA
96-18-4	1,2,3-trichloropropane	1.4 - 3.6	ug/kg	NSA	5	95	NSA
96-12-8	1,2-Dibromo-3-chloropropane	1 - 2.5	ug/kg	NSA	5.4	69	NSA
106-93-4	1,2-dibromoethane	0.27 - 0.67	ug/kg	NSA	34	170	NSA
107-06-2	1,2-dichloroethane	0.28 - 0.71	ug/kg	NSA	430	2200	400
78-87-5	1,2-dichloropropane	0.26 - 0.65	ug/kg	NSA	940	4700	700000
123-91-1	1,4-dioxane	32 - 80	ug/kg	NSA	4900	17000	NSA
78-93-3	2-butanone	1.5 - 3.7	ug/kg	NSA	2800000 *	20000000	NSA

Table 4-7

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL RES	EPA RSL IND	Eco SSL
591-78-6	2-hexanone	1.3 - 3.2	ug/kg	NSA	21000 *	140000 *	NSA
107-05-1	3-Chloropropene	1.1 - 2.8	ug/kg	NSA	180 *	750 *	NSA
108-10-1	4-methyl-2-pentanone	1.6 - 4	ug/kg	NSA	530000	5300000	NSA
75-05-8	Acetonitrile	11 - 27	ug/kg	NSA	87000 *	370000 *	NSA
107-02-8	Acrolein	7.1 - **18**	ug/kg	NSA	15 *	65 *	NSA
107-13-1	Acrylonitrile	0.89 - 2.2	ug/kg	NSA	240	1200	NSA
71-43-2	Benzene	0.23 - 0.59	ug/kg	NSA	1100	5400	50
75-27-4	Bromodichloromethane	0.17 - 0.43	ug/kg	NSA	270	1400	NSA
75-25-2	Bromoform	0.22 - 0.56	ug/kg	NSA	62000	220000	NSA
74-83-9	Bromomethane	0.58 - 1.5	ug/kg	NSA	730 *	3200 *	NSA
75-15-0	Carbon disulfide	0.33 - 0.83	ug/kg	NSA	82000	370000	NSA
56-23-5	Carbon tetrachloride	0.62 - 1.6	ug/kg	NSA	610	3000	1000000
108-90-7	Chlorobenzene	0.2 - 0.49	ug/kg	NSA	29000 *	140000	50
75-00-3	Chloroethane	0.45 - 1.1	ug/kg	NSA	1500000	6100000	NSA
67-66-3	Chloroform	0.31 - 0.77	ug/kg	NSA	290	1500	1
74-87-3	Chloromethane	0.47 - 1.2	ug/kg	NSA	12000 *	50000 *	NSA
126-99-8	Chloroprene	0.22 - 0.56	ug/kg	NSA	9.4	47	NSA
156-59-2	Cis-1,2-dichloroethene	0.24 - 0.6	ug/kg	NSA	16000 *	200000 *	NSA
10061-01-5	Cis-1,3-dichloropropene	0.16 - 0.4	ug/kg	NSA	1700	8300	NSA
124-48-1	Dibromochloromethane	0.18 - 0.45	ug/kg	NSA	680	3300	NSA
74-95-3	Dibromomethane	0.24 - 0.6	ug/kg	NSA	2500 *	11000 *	NSA
75-71-8	Dichlorodifluoromethane	1.1 - 2.7	ug/kg	NSA	9400 *	40000 *	NSA
97-63-2	Ethyl Methacrylate	0.92 - 2.3	ug/kg	NSA	150000	750000	NSA
100-41-4	Ethylbenzene	0.27 - 0.67	ug/kg	NSA	5400	27000	50
74-88-4	Iodomethane	0.22 - 0.55	ug/kg	NSA	NSA	NSA	NSA
78-83-1	Isobutyl Alcohol	8.1 - 20	ug/kg	NSA	2300000	31000000	NSA
126-98-7	Methacrylonitrile	1.7 - 4.4	ug/kg	NSA	320 *	1800 *	NSA
80-62-6	Methyl Methacrylate	1 - 2.6	ug/kg	NSA	480000	2100000	NSA
75-09-2	Methylene Chloride	0.19 - 0.48	ug/kg	NSA	11000	53000	2000
76-01-7	Pentachloroethane	0.19 - 0.48	ug/kg	NSA	5400	19000	NSA
107-12-0	Propane Nitrile (Propionitrile)	3.5 - 8.7	ug/kg	NSA	NSA	NSA	NSA
100-42-5	Styrene	0.19 - 0.48	ug/kg	NSA	630000	3600000	NSA
127-18-4	Tetrachloroethene	0.31 - 0.77	ug/kg	NSA	550	2600	10
108-88-3	Toluene	0.22 - 0.55	ug/kg	NSA	500000	4500000	50
156-60-5	trans-1,2-dichloroethene	0.21 - 0.53	ug/kg	NSA	15000 *	69000 *	NSA
10061-02-6	trans-1,3-dichloropropene	0.16 - 0.41	ug/kg	NSA	1700	8300	NSA
110-57-6	trans-1,4-dichloro-2-butene	1.6 - 4.1	ug/kg	NSA	6.9	35	1000000
79-01-6	Trichloroethene	0.19 - 0.49	ug/kg	NSA	2500 *	10000 *	1
75-69-4	Trichlorofluoromethane	1 - 2.5	ug/kg	NSA	79000 *	340000	NSA
108-05-4	Vinyl acetate	1.2 - 2.9	ug/kg	NSA	97000 *	410000	NSA
75-01-4	Vinyl chloride	0.42 - 1.1	ug/kg	NSA	60	1700	10
1330-20-7	Xylenes, Total	0.2 - 0.5	ug/kg	NSA	63000	270000	50
	Semivolatile Organic Compounds						
95-94-3	1,2,4,5-tetrachlorobenzene	4.1 - 35	ug/kg	NSA	1800 *	18000 *	NSA
120-82-1	1,2,4-trichlorobenzene	19 - 31	ug/kg	NSA	6200 *	27000 *	NSA
95-50-1	1,2-dichlorobenzene	19 - 23	ug/kg	NSA	190000	980000	NSA
99-35-4	1,3,5-Trinitrobenzene	13 - 39	ug/kg	NSA	220000 *	2700000 *	NSA
541-73-1	1,3-dichlorobenzene	15 - 26	ug/kg	NSA	2400	12000	NSA
99-65-0	1,3-Dinitrobenzene	20 - 25	ug/kg	NSA	610 *	6200 *	NSA
106-46-7	1,4-dichlorobenzene	14 - 21	ug/kg	NSA	2400	12000	NSA
130-15-4	1,4-Naphthoquinone	11 - 14	ug/kg	NSA	NSA	NSA	NSA
134-32-7	1-Naphthylamine	11 - 41	ug/kg	NSA	NSA	NSA	NSA
108-60-1	2,2-oxybis(1-chloropropane)	19 - 37	ug/kg	NSA	4600	22000	NSA
58-90-2	2,3,4,6-tetrachlorophenol	43 - 57	ug/kg	NSA	180000 *	1800000 *	NSA
95-95-4	2,4,5-trichlorophenol	39 - 74	ug/kg	NSA	610000 *	6200000 *	4000
88-06-2	2,4,6-trichlorophenol	37 - 58	ug/kg	NSA	6100 *	62000 *	10000

Table 4-7
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Soil

CAS	Compound	Range of MDLs	Units	Background	EPA RSL RES	EPA RSL IND	Eco SSL
120-83-2	2,4-dichlorophenol	38 - 83	ug/kg	NSA	18000 *	180000 *	2000
105-67-9	2,4-dimethylphenol	44 - 130	ug/kg	NSA	120000 *	1200000 *	NSA
51-28-5	2,4-dinitrophenol	67 - 470	ug/kg	NSA	12000 *	120000 *	20000
121-14-2	2,4-dinitrotoluene	20 - 57	ug/kg	NSA	1600	5500	NSA
87-65-0	2,6-Dichlorophenol	8.2 - 19	ug/kg	NSA	18000 *	180000 *	NSA
606-20-2	2,6-dinitrotoluene	16 - 56	ug/kg	NSA	6100 *	62000 *	NSA
53-96-3	2-Acetylaminofluorene	9.1 - 19	ug/kg	NSA	130	450	NSA
91-58-7	2-chloronaphthalene	16 - 69	ug/kg	NSA	630000	8200000	NSA
95-57-8	2-chlorophenol	30 - 42	ug/kg	NSA	39000 *	510000 *	10
534-52-1	2-Methyl-4,6-dinitrophenol	38 - 46	ug/kg	NSA	490 *	4900 *	NSA
95-48-7	2-methylphenol	39 - 48	ug/kg	NSA	310000 *	3100000 *	NSA
91-59-8	2-Naphthylamine	9.8 - 24	ug/kg	NSA	270	960	NSA
88-74-4	2-nitroaniline	27 - 32	ug/kg	NSA	61000 *	600000 *	NSA
88-75-5	2-nitrophenol	38 - 61	ug/kg	NSA	2900	13000	7000
109-06-8	2-Picoline	6.5 - 18	ug/kg	NSA	NSA	NSA	NSA
34MP	3&4-methylphenol	49 - 71	ug/kg	NSA	31000 *	310000 *	NSA
91-94-1	3,3-dichlorobenzidine	42 - 76	ug/kg	NSA	1100	3800	NSA
119-93-7	3,3'-Dimethylbenzidine	22 - **46**	ug/kg	NSA	44	160	NSA
99-09-2	3-nitroaniline	15 - 38	ug/kg	NSA	610 *	6200 *	NSA
92-67-1	4-Aminobiphenyl	7.8 - 16	ug/kg	NSA	23	82	NSA
101-55-3	4-bromophenyl phenyl ether	20 - 25	ug/kg	NSA	NSA	NSA	NSA
59-50-7	4-chloro-3-methylphenol	44 - 63	ug/kg	NSA	610000 *	6200000 *	NSA
106-47-8	4-chloroaniline	15 - 31	ug/kg	NSA	2400	8600	NSA
7005-72-3	4-chlorophenyl phenyl ether	21 - 29	ug/kg	NSA	NSA	NSA	NSA
100-01-6	4-nitroaniline	23 - 34	ug/kg	NSA	24000	86000	NSA
100-02-7	4-nitrophenol	46 - 67	ug/kg	NSA	24000 *	110000	7000
56-57-5	4-Nitroquinoline 1-Oxide	29 - 45	ug/kg	NSA	NSA	NSA	NSA
99-55-8	5-Nitro-O-Toluidine	8.8 - 21	ug/kg	NSA	54000	190000	NSA
122-09-8	A,A-Dimethylphenethylamine	51 - 62	ug/kg	NSA	NSA	NSA	NSA
83-32-9	Acenaphthene	19 - 25	ug/kg	NSA	340000 *	3300000 *	20000
98-86-2	Acetophenone	18 - 31	ug/kg	NSA	780000	10000000	NSA
62-53-3	Aniline	9.6 - 19	ug/kg	NSA	43000 *	300000	NSA
140-57-8	Aramite	27 - 190	ug/kg	NSA	19000	69000	NSA
100-51-6	Benzyl alcohol	21 - 41	ug/kg	NSA	610000 *	6200000 *	NSA
85-68-7	Benzyl butyl phthalate	18 - 37	ug/kg	NSA	260000	910000	NSA
111-91-1	Bis(2-chloroethoxy) methane	18 - 32	ug/kg	NSA	18000 *	180000 *	NSA
111-44-4	Bis(2-chloroethyl) ether	17 - 25	ug/kg	NSA	210	1000	NSA
510-15-6	Chlorobenzilate	6.7 - 22	ug/kg	NSA	4400	16000	NSA
2303-16-4	Diallate	20 - 24	ug/kg	NSA	8000	28000	NSA
132-64-9	Dibenzofuran	17 - 23	ug/kg	NSA	7800 *	100000	NSA
84-66-2	Diethyl phthalate	16 - 21	ug/kg	NSA	4900000 *	49000000	100000
60-51-5	Dimethoate	11 - 13	ug/kg	NSA	1200 *	12000 *	NSA
131-11-3	Dimethyl phthalate	17 - 21	ug/kg	NSA	NSA	NSA	200000
84-74-2	Di-n-butyl phthalate	23 - 31	ug/kg	NSA	610000 *	6200000 *	200000
117-84-0	Di-n-octyl phthalate	16 - 42	ug/kg	NSA	610000 *	6200000 *	NSA
88-85-7	Dinoseb	14 - 16	ug/kg	NSA	6100 *	62000 *	NSA
122-39-4	Diphenylamine	17 - 36	ug/kg	NSA	150000 *	1500000 *	NSA
298-04-4	Disulfoton	12 - 14	ug/kg	NSA	240 *	2500 *	NSA
62-50-0	Ethyl Methanesulfonate	5.6 - 23	ug/kg	NSA	NSA	NSA	NSA
52-85-7	Famphur	100 - 110	ug/kg	NSA	NSA	NSA	NSA
86-73-7	Fluorene	17 - 21	ug/kg	NSA	230000 *	2200000 *	30000
87-68-3	Hexachloro-1,3-butadiene	17 - 33	ug/kg	NSA	6100 *	22000	NSA
118-74-1	Hexachlorobenzene	21 - 28	ug/kg	NSA	300	1100	2.5
77-47-4	Hexachlorocyclopentadiene	31 - 41	ug/kg	NSA	37000 *	370000 *	10000
67-72-1	Hexachloroethane	22 - 28	ug/kg	NSA	6100 *	62000 *	NSA
70-30-4	Hexachlorophene	7.3 - 16	ug/kg	NSA	1800 *	18000 *	NSA

Table 4-7
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Soil

CAS	**Compound**	**Range of MDLs**	**Units**	**Background**	**EPA RSL RES**	**EPA RSL IND**	**Eco SSL**
1888-71-7	Hexachloropropene	5 - 31	ug/kg	NSA	NSA	NSA	NSA
465-73-6	ISODRIN	11 - 25	ug/kg	NSA	NSA	NSA	NSA
78-59-1	Isophorone	22 - 38	ug/kg	NSA	510000	1800000	NSA
120-58-1	Isosafrole	4.8 - 37	ug/kg	NSA	NSA	NSA	NSA
143-50-0	Kepone	100 - **170**	ug/kg	NSA	49	170	NSA
91-80-5	Methapyrilene	32 - 41	ug/kg	NSA	NSA	NSA	NSA
66-27-3	Methyl Methanesulfonate	10 - 16	ug/kg	NSA	4900	17000	NSA
298-00-0	Methyl Parathion	18 - 20	ug/kg	NSA	1500 *	15000 *	NSA
98-95-3	Nitrobenzene	16 - 34	ug/kg	NSA	4800	24000	40000
55-18-5	N-Nitrosodiethylamine	8.8 - **25**	ug/kg	NSA	0.77	11	NSA
62-75-9	n-Nitrosodimethylamine	25 - **38**	ug/kg	NSA	2.3	34	NSA
924-16-3	N-Nitrosodi-N-Butylamine	18 - 26	ug/kg	NSA	87	400	NSA
621-64-7	N-nitrosodi-n-propylamine	22 - 32	ug/kg	NSA	69	250	NSA
86-30-6	N-nitrosodiphenylamine	18 - 30	ug/kg	NSA	99000	350000	20000
10595-95-6	N-Nitrosomethylethylamine	21 - **73**	ug/kg	NSA	22	78	NSA
59-89-2	N-Nitrosomorpholine	7.4 - 16	ug/kg	NSA	73	260	NSA
100-75-4	N-Nitrosopiperidine	16 - 45	ug/kg	NSA	52	180	NSA
930-55-2	N-Nitrosopyrrolidine	18 - 22	ug/kg	NSA	230	820	NSA
126-68-1	O,O,O-Triethyl Phosphorothioat	17 - 19	ug/kg	NSA	NSA	NSA	NSA
95-53-4	O-TOLUIDINE	10 - 20	ug/kg	NSA	NSA	NSA	NSA
60-11-7	P-(Dimethylamine)Azobenzene	12 - 14	ug/kg	NSA	110	370	NSA
56-38-2	Parathion	17 - 19	ug/kg	NSA	37000 *	370000 *	NSA
608-93-5	Pentachlorobenzene	6.8 - 33	ug/kg	NSA	4900 *	49000 *	NSA
82-68-8	Pentachloronitrobenzene	29 - 43	ug/kg	NSA	1900	6600	NSA
87-86-5	Pentachlorophenol	49 - 55	ug/kg	NSA	890	2700	2
62-44-2	PHENACETIN	8.5 - 22	ug/kg	NSA	220000	780000	NSA
108-95-2	Phenol	27 - 61	ug/kg	NSA	1800000 *	18000000	50
298-02-2	Phorate	19 - 22	ug/kg	NSA	1200 *	12000 *	NSA
106-50-3	P-Phenylenediamine	18 - 220	ug/kg	NSA	1200000 *	12000000	NSA
23950-58-5	Pronamide	2.4 - 23	ug/kg	NSA	460000 *	4600000 *	NSA
110-86-1	Pyridine	21 - 28	ug/kg	NSA	7800 *	100000 *	NSA
94-59-7	Safrole	8.2 - 28	ug/kg	NSA	520	7800	NSA
3689-24-5	Tetraethyl Dithiopyrophosphate	10 - 21	ug/kg	NSA	3100 *	31000 *	NSA
297-97-2	Thionazin	14 - 17	ug/kg	NSA	NSA	NSA	NSA
	Semivolatile Organic Compounds (PAH)						
91-57-6	2-methylnaphthalene	1.1 - 1.4	ug/kg	NSA	31000 *	410000	NSA
56-49-5	3-Methylcholanthrene	7.3 - **9.9**	ug/kg	NSA	5.2	78	NSA
57-97-6	7,12-Dimethylbenz[a]anthracene	7.3 - **9.9**	ug/kg	NSA	0.43	6.2	NSA
91-20-3	Naphthalene	0.44 - 0.59	ug/kg	NSA	3600	18000	100
	TPH- DRO/GRO						
TPH-GRO	TPH-GRO (C6-C10)	2.5 - 5.2	mg/kg	NSA	100 [1]	NSA	NSA

[1] = PR Environmental Quality Board value, not EPA RSL

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

Maxium MDLs > the EPA RSL Res are bolded.

Maxium MDLs > the EPA RSL Ind are shaded gray.

Maxium MDLs > the Eco SSL are in blue font

Table 4-8
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Sediment

CAS	Compound	Range of MDLs	Units	EPA RSL Res	EPA RSL Ind	EPA Eco
	Metals					
7440-36-0	Antimony	0.72 - 1.4	mg/kg	31 *	410 *	12
7440-28-0	Thallium	0.94 - **4.2**	mg/kg	0.78 *	10 *	NSA
	Pesticides					
309-00-2	Aldrin	0.38 - 2.1	ug/kg	290	1000	NSA
319-84-6	alpha-BHC	0.34 - 1.7	ug/kg	770	2700	NSA
319-85-7	Beta-BHC	0.62 - 2	ug/kg	2700	9600	NSA
319-86-8	delta-BHC	0.34 - 3.5	ug/kg	770	2700	NSA
959-98-8	Endosulfan I	0.38 - 2.5	ug/kg	370000 *	3700000 *	NSA
33213-65-9	Endosulfan II	0.62 - 2.5	ug/kg	370000 *	3700000 *	NSA
1031-07-8	Endosulfan sulfate	0.4 - 2.5	ug/kg	370000 *	3700000 *	NSA
72-20-8	Endrin	0.4 - 2.3	ug/kg	18000 *	180000 *	3.3
7421-93-4	Endrin aldehyde	0.44 - 2.2	ug/kg	18000 *	180000 *	NSA
53494-70-5	Endrin ketone	0.37 - 2.6	ug/kg	18000 *	180000 *	NSA
58-89-9	Gamma-BHC (Lindane)	0.46 - 1.9	ug/kg	5200	21000	3.3
76-44-8	Heptachlor	0.49 - 2.4	ug/kg	1100	3800	NSA
72-43-5	Methoxychlor	0.5 - 3.1	ug/kg	310000 *	3100000 *	NSA
8001-35-2	Toxaphene	18 - 45	ug/kg	4400	16000	NSA
	PCBs					
12674-11-2	Aroclor 1016	13 - 13	ug/kg	3900 *	37000 *	33
11104-28-2	Aroclor 1221	40 - 40	ug/kg	1400	5400	67
11141-16-5	Aroclor 1232	20 - 20	ug/kg	1400	5400	33
53469-21-9	Aroclor 1242	39 - 39	ug/kg	2200	7400	33
12672-29-6	Aroclor 1248	22 - 22	ug/kg	2200	7400	33
11097-69-1	Aroclor 1254	14 - 14	ug/kg	1100 *	7400	33
11096-82-5	Aroclor 1260	13 - 13	ug/kg	2200	7400	33
	Herbicides					
75-99-0	2,2-dichloropropionic acid	2.6 - 9.9	ug/kg	1800000 *	18000000 *	NSA
93-76-5	2,4,5-T	1 - 9.7	ug/kg	610000 *	6200000 *	NSA
93-72-1	2,4,5-TP (silvex)	1.2 - 9.6	ug/kg	490000 *	4900000 *	NSA
94-75-7	2,4-D	11 - 46	ug/kg	690000 *	7700000 *	NSA
94-82-6	2,4-DB	8.5 - 33	ug/kg	490000 *	4900000 *	NSA
1918-00-9	Dicamba	3 - 11	ug/kg	1800000 *	18000000 *	NSA
120-36-5	Dichlorprop	15 - 57	ug/kg	NSA	NSA	NSA
88-85-7	Dinoseb	9.1 - 35	ug/kg	61000 *	620000 *	NSA
94-74-6	MCPA (2-methyl-4-chlorophenoxyacetic acid)	950 - 3700	ug/kg	31000 *	310000 *	NSA
93-65-2	MCPP	770 - 3000	ug/kg	61000 *	620000 *	NSA
87-86-5	Pentachlorophenol	1.2 - 4.6	ug/kg	8900	27000	NSA
	Organosphosphorus Compounds					
60-51-5	Dimethoate	20 - 230	ug/kg	12000 *	120000 *	NSA
298-04-4	Disulfoton	39 - 460	ug/kg	2400 *	25000 *	NSA
52-85-7	Famphur	20 - 230	ug/kg	NSA	NSA	NSA
298-00-0	Methyl Parathion	20 - 230	ug/kg	15000 *	150000 *	NSA
126-68-1	O,O,O-Triethyl Phosphorothioat	20 - 230	ug/kg	NSA	NSA	NSA
56-38-2	Parathion	20 - 230	ug/kg	370000 *	3700000 *	NSA
298-02-2	Phorate	20 - 230	ug/kg	12000 *	120000 *	NSA
3689-24-5	Tetraethyl Dithiopyrophosphate	20 - 230	ug/kg	31000 *	310000 *	NSA
297-97-2	Thionazin	20 - 230	ug/kg	NSA	NSA	NSA
	Volatile Organic Compounds					
630-20-6	1,1,1,2-tetrachloroethane	61 - 130	ug/kg	19000	93000	NSA
71-55-6	1,1,1-trichloroethane	60 - 130	ug/kg	8700000	38000000	NSA
79-34-5	1,1,2,2-tetrachloroethane	46 - 100	ug/kg	5600	28000	NSA
79-00-5	1,1,2-trichloroethane	46 - 100	ug/kg	1600 *	6800 *	NSA
75-34-3	1,1-dichloroethane	110 - 240	ug/kg	33000	170000	NSA
75-35-4	1,1-dichloroethene	74 - 160	ug/kg	240000 *	1100000 *	NSA
96-18-4	1,2,3-trichloropropane	720 - **1500**	ug/kg	50	950	NSA

Table 4-8
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Sediment

CAS	Compound	Range of MDLs	Units	EPA RSL Res	EPA RSL Ind	EPA Eco
96-12-8	1,2-Dibromo-3-chloropropane	150 - **320**	ug/kg	54	690	NSA
106-93-4	1,2-dibromoethane	46 - 100	ug/kg	340	1700	NSA
107-06-2	1,2-dichloroethane	37 - 81	ug/kg	4300	22000	NSA
78-87-5	1,2-dichloropropane	65 - 140	ug/kg	9400	47000	NSA
123-91-1	1,4-dioxane	6000 - 13000	ug/kg	49000	170000	NSA
78-93-3	2-butanone	450 - 960	ug/kg	28000000 *	200000000	NSA
591-78-6	2-hexanone	270 - 590	ug/kg	210000 *	1400000 *	NSA
107-05-1	3-Chloropropene	160 - 340	ug/kg	1800 *	7500 *	NSA
108-10-1	4-methyl-2-pentanone	310 - 680	ug/kg	5300000	53000000	NSA
67-64-1	Acetone	650 - 1400	ug/kg	61000000 *	630000000	NSA
75-05-8	Acetonitrile	3400 - 7200	ug/kg	870000 *	3700000 *	NSA
107-02-8	Acrolein	680 - **1500**	ug/kg	150 *	650 *	NSA
107-13-1	Acrylonitrile	1500 - **3100**	ug/kg	2400	12000	NSA
71-43-2	Benzene	120 - 250	ug/kg	11000	54000	NSA
75-27-4	Bromodichloromethane	40 - 85	ug/kg	2700	14000	NSA
75-25-2	Bromoform	130 - 280	ug/kg	620000	2200000	NSA
74-83-9	Bromomethane	77 - 170	ug/kg	7300 *	32000 *	NSA
75-15-0	Carbon disulfide	46 - 99	ug/kg	820000	3700000	NSA
56-23-5	Carbon tetrachloride	40 - 85	ug/kg	6100	30000	NSA
108-90-7	Chlorobenzene	89 - 190	ug/kg	290000 *	1400000	NSA
75-00-3	Chloroethane	82 - 180	ug/kg	15000000	61000000	NSA
67-66-3	Chloroform	63 - 140	ug/kg	2900	15000	NSA
74-87-3	Chloromethane	83 - 180	ug/kg	120000 *	500000 *	NSA
126-99-8	Chloroprene	71 - **150**	ug/kg	94	470	NSA
10061-01-5	Cis-1,3-dichloropropene	79 - 170	ug/kg	17000	83000	NSA
124-48-1	Dibromochloromethane	33 - 72	ug/kg	6800	33000	NSA
74-95-3	Dibromomethane	37 - 80	ug/kg	25000 *	110000 *	NSA
75-71-8	Dichlorodifluoromethane	65 - 140	ug/kg	94000 *	400000 *	NSA
97-63-2	Ethyl Methacrylate	210 - 450	ug/kg	1500000	7500000	NSA
100-41-4	Ethylbenzene	77 - 160	ug/kg	54000	270000	NSA
74-88-4	Iodomethane	45 - 97	ug/kg	NSA	NSA	NSA
78-83-1	Isobutyl Alcohol	1900 - 4100	ug/kg	23000000	310000000	NSA
126-98-7	Methacrylonitrile	560 - 1200	ug/kg	3200 *	18000 *	NSA
80-62-6	Methyl Methacrylate	170 - 360	ug/kg	4800000	21000000	NSA
75-09-2	Methylene Chloride	75 - 160	ug/kg	110000	530000	NSA
76-01-7	Pentachloroethane	41 - 88	ug/kg	54000	190000	NSA
107-12-0	Propane Nitrile (Propionitrile)	3400 - 7300	ug/kg	NSA	NSA	NSA
100-42-5	Styrene	36 - 78	ug/kg	6300000	36000000	NSA
127-18-4	Tetrachloroethene	53 - 110	ug/kg	5500	26000	NSA
108-88-3	Toluene	67 - 140	ug/kg	5000000	45000000	NSA
156-60-5	trans-1,2-dichloroethene	88 - 190	ug/kg	150000 *	690000 *	NSA
10061-02-6	trans-1,3-dichloropropene	130 - 270	ug/kg	17000	83000	NSA
110-57-6	trans-1,4-dichloro-2-butene	130 - **290**	ug/kg	69	350	NSA
79-01-6	Trichloroethene	51 - 110	ug/kg	25000 *	100000 *	NSA
75-69-4	Trichlorofluoromethane	74 - 160	ug/kg	790000 *	3400000	NSA
108-05-4	Vinyl acetate	210 - 450	ug/kg	970000 *	4100000	NSA
75-01-4	Vinyl chloride	88 - 190	ug/kg	600	17000	NSA
1330-20-7	Xylenes, Total	41 - 88	ug/kg	630000	2700000	NSA
	Semivolatile Organic Compounds					
95-94-3	1,2,4,5-tetrachlorobenzene	1 - 54	ug/kg	18000 *	180000 *	NSA
120-82-1	1,2,4-trichlorobenzene	0.92 - 48	ug/kg	62000 *	270000 *	NSA
95-50-1	1,2-dichlorobenzene	0.66 - 34	ug/kg	1900000	9800000	NSA
541-73-1	1,3-dichlorobenzene	0.8 - 41	ug/kg	24000	120000	NSA
106-46-7	1,4-dichlorobenzene	0.62 - 32	ug/kg	24000	120000	NSA
130-15-4	1,4-Naphthoquinone	0.42 - 22	ug/kg	NSA	NSA	NSA
134-32-7	1-Naphthylamine	1.2 - 65	ug/kg	NSA	NSA	NSA

Table 4-8
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Sediment

CAS	Compound	Range of MDLs	Units	EPA RSL Res	EPA RSL Ind	EPA Eco
108-60-1	2,2-oxybis(1-chloropropane)	1.1 - 58	ug/kg	46000	220000	NSA
58-90-2	2,3,4,6-tetrachlorophenol	1.7 - 90	ug/kg	1800000 *	18000000 *	NSA
95-95-4	2,4,5-trichlorophenol	2.2 - 120	ug/kg	6100000 *	62000000 *	NSA
88-06-2	2,4,6-trichlorophenol	1.3 - 65	ug/kg	61000 *	620000 *	NSA
120-83-2	2,4-dichlorophenol	2.5 - 130	ug/kg	180000 *	1800000 *	NSA
105-67-9	2,4-dimethylphenol	3.8 - 200	ug/kg	1200000 *	12000000 *	NSA
51-28-5	2,4-dinitrophenol	2.3 - 120	ug/kg	120000 *	1200000 *	NSA
121-14-2	2,4-dinitrotoluene	1.7 - 90	ug/kg	16000	55000	NSA
87-65-0	2,6-Dichlorophenol	0.56 - 29	ug/kg	180000 *	1800000 *	NSA
606-20-2	2,6-dinitrotoluene	1.7 - 88	ug/kg	61000 *	620000 *	NSA
53-96-3	2-Acetylaminofluorene	0.57 - 30	ug/kg	1300	4500	NSA
91-58-7	2-chloronaphthalene	2.1 - 110	ug/kg	6300000	82000000	NSA
95-57-8	2-chlorophenol	1.3 - 66	ug/kg	390000 *	5100000 *	NSA
534-52-1	2-Methyl-4,6-dinitrophenol	1.3 - 67	ug/kg	4900 *	49000 *	NSA
95-48-7	2-methylphenol	1.5 - 76	ug/kg	3100000 *	31000000 *	NSA
91-59-8	2-Naphthylamine	0.71 - 37	ug/kg	2700	9600	NSA
88-74-4	2-nitroaniline	0.94 - 49	ug/kg	610000 *	6000000 *	NSA
88-75-5	2-nitrophenol	1.8 - 96	ug/kg	29000	130000	NSA
34MP	3&4-methylphenol	2.1 - 110	ug/kg	310000 *	3100000 *	NSA
91-94-1	3,3-dichlorobenzidine	1.4 - 74	ug/kg	11000	38000	NSA
119-93-7	3,3'-Dimethylbenzidine	0.75 - 39	ug/kg	440	1600	NSA
99-09-2	3-nitroaniline	1.2 - 60	ug/kg	6100 *	62000 *	NSA
92-67-1	4-Aminobiphenyl	0.48 - 25	ug/kg	230	820	NSA
101-55-3	4-bromophenyl phenyl ether	0.76 - 39	ug/kg	NSA	NSA	NSA
59-50-7	4-chloro-3-methylphenol	1.9 - 98	ug/kg	6100000 *	62000000 *	NSA
106-47-8	4-chloroaniline	0.92 - 48	ug/kg	24000	86000	NSA
7005-72-3	4-chlorophenyl phenyl ether	0.7 - 36	ug/kg	NSA	NSA	NSA
100-01-6	4-nitroaniline	1 - 54	ug/kg	240000	860000	NSA
100-02-7	4-nitrophenol	2 - 110	ug/kg	240000 *	1100000	NSA
56-57-5	4-Nitroquinoline 1-Oxide	1.4 - 71	ug/kg	NSA	NSA	NSA
99-55-8	5-Nitro-O-Toluidine	0.63 - 33	ug/kg	540000	1900000	NSA
122-09-8	A,A-Dimethylphenethylamine	1.7 - 91	ug/kg	NSA	NSA	NSA
83-32-9	Acenaphthene	0.76 - 40	ug/kg	3400000 *	33000000 *	330
98-86-2	Acetophenone	0.94 - 49	ug/kg	7800000	100000000	NSA
62-53-3	Aniline	0.59 - 31	ug/kg	430000 *	3000000	NSA
120-12-7	Anthracene	0.58 - 30	ug/kg	17000000 *	170000000	330
100-51-6	Benzyl alcohol	1.2 - 64	ug/kg	6100000 *	62000000 *	NSA
85-68-7	Benzyl butyl phthalate	1.1 - 59	ug/kg	2600000	9100000	NSA
111-91-1	Bis(2-chloroethoxy) methane	0.96 - 50	ug/kg	180000 *	1800000 *	NSA
111-44-4	Bis(2-chloroethyl) ether	0.74 - 39	ug/kg	2100	10000	NSA
117-81-7	Bis(2-ethylhexyl) phthalate	1.9 - 99	ug/kg	350000	1200000	182
510-15-6	Chlorobenzilate	0.66 - 34	ug/kg	44000	160000	NSA
2303-16-4	Diallate	0.72 - 38	ug/kg	80000	280000	NSA
132-64-9	Dibenzofuran	0.69 - 36	ug/kg	78000 *	1000000	NSA
84-66-2	Diethyl phthalate	0.64 - 33	ug/kg	49000000 *	490000000	NSA
60-51-5	Dimethoate	0.38 - 20	ug/kg	12000 *	120000 *	NSA
131-11-3	Dimethyl phthalate	0.64 - 33	ug/kg	NSA	NSA	NSA
84-74-2	Di-n-butyl phthalate	0.95 - 49	ug/kg	6100000 *	62000000 *	NSA
117-84-0	Di-n-octyl phthalate	1.3 - 66	ug/kg	6100000 *	62000000 *	NSA
88-85-7	Dinoseb	0.48 - 25	ug/kg	61000 *	620000 *	NSA
298-04-4	Disulfoton	0.42 - 22	ug/kg	2400 *	25000 *	NSA
86-73-7	Fluorene	0.6 - 31	ug/kg	2300000 *	22000000 *	330
87-68-3	Hexachloro-1,3-butadiene	0.98 - 51	ug/kg	61000 *	220000	NSA
118-74-1	Hexachlorobenzene	0.86 - 45	ug/kg	3000	11000	NSA
77-47-4	Hexachlorocyclopentadiene	1.1 - 56	ug/kg	370000 *	3700000 *	NSA
67-72-1	Hexachloroethane	0.74 - 39	ug/kg	61000 *	620000 *	NSA

Table 4-8

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Sediment

CAS	Compound	Range of MDLs	Units	EPA RSL Res	EPA RSL Ind	EPA Eco
70-30-4	Hexachlorophene	0.25 - 13	ug/kg	18000 *	180000 *	NSA
1888-71-7	Hexachloropropene	0.94 - 49	ug/kg	NSA	NSA	NSA
465-73-6	ISODRIN	0.75 - 39	ug/kg	NSA	NSA	NSA
78-59-1	Isophorone	0.74 - 38	ug/kg	5100000	18000000	NSA
143-50-0	Kepone	3.6 - 190	ug/kg	490	1700	NSA
98-95-3	Nitrobenzene	1 - 54	ug/kg	48000	240000	NSA
55-18-5	N-Nitrosodiethylamine	0.76 - **40**	ug/kg	7.7	110	NSA
62-75-9	n-Nitrosodimethylamine	0.86 - **45**	ug/kg	23	340	NSA
924-16-3	N-Nitrosodi-N-Butylamine	0.62 - 32	ug/kg	870	4000	NSA
621-64-7	N-nitrosodi-n-propylamine	0.96 - 50	ug/kg	690	2500	NSA
86-30-6	N-nitrosodiphenylamine	0.61 - 32	ug/kg	990000	3500000	NSA
10595-95-6	N-Nitrosomethylethylamine	2.2 - 110	ug/kg	220	780	NSA
59-89-2	N-Nitrosomorpholine	0.49 - 26	ug/kg	730	2600	NSA
100-75-4	N-Nitrosopiperidine	0.53 - 28	ug/kg	520	1800	NSA
930-55-2	N-Nitrosopyrrolidine	0.63 - 33	ug/kg	2300	8200	NSA
126-68-1	O,O,O-Triethyl Phosphorothioat	0.57 - 30	ug/kg	NSA	NSA	NSA
95-53-4	O-TOLUIDINE	0.6 - 31	ug/kg	NSA	NSA	NSA
60-11-7	P-(Dimethylamine)Azobenzene	0.43 - 23	ug/kg	1100	3700	NSA
56-38-2	Parathion	0.56 - 29	ug/kg	370000 *	3700000 *	NSA
608-93-5	Pentachlorobenzene	0.99 - 51	ug/kg	49000 *	490000 *	NSA
82-68-8	Pentachloronitrobenzene	1.3 - 67	ug/kg	19000	66000	NSA
87-86-5	Pentachlorophenol	1.7 - 87	ug/kg	8900	27000	NSA
62-44-2	PHENACETIN	0.67 - 35	ug/kg	2200000	7800000	NSA
108-95-2	Phenol	1.8 - 96	ug/kg	18000000 *	180000000	NSA
298-02-2	Phorate	0.65 - 34	ug/kg	12000 *	120000 *	NSA
106-50-3	P-Phenylenediamine	0.6 - 31	ug/kg	12000000 *	120000000	NSA
23950-58-5	Pronamide	0.68 - 35	ug/kg	4600000 *	46000000 *	NSA
110-86-1	Pyridine	0.85 - 44	ug/kg	78000 *	1000000 *	NSA
3689-24-5	Tetraethyl Dithiopyrophosphate	0.65 - 34	ug/kg	31000 *	310000 *	NSA
297-97-2	Thionazin	0.53 - 27	ug/kg	NSA	NSA	NSA
	Semivolatile Organic Compounds (PAH)					
91-57-6	2-methylnaphthalene	1.4 - 2.3	ug/kg	310000 *	4100000	330
56-49-5	3-Methylcholanthrene	9.8 - 16	ug/kg	52	780	NSA
57-97-6	7,12-Dimethylbenz[a]anthracene	9.8 - **16**	ug/kg	4.3	62	NSA
208-96-8	Acenaphthylene	0.5 - 0.79	ug/kg	36000	180000	330
56-55-3	Benzo[a]anthracene	0.3 - 0.48	ug/kg	1500	21000	330
91-20-3	Naphthalene	0.59 - 0.93	ug/kg	36000	180000	330
	TPH- DRO/GRO					
TPH-GRO	TPH-GRO (C6-C10)	6.2 - 6.2	mg/kg	NSA	100[1]	NSA

[1] = PR Environmental Quality Board value, not EPA RSL

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil multipied by 10 for Sediment, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil multipied by 10 for Sediment, June 2011

EPA Eco = EPA Region 4 ecological screening values for sediment: USEPA, 2001

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA Eco are in blue font.

Table 4-9
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Groundwater and Pore Water

CAS	Compound	Range of MDLs	Units	MCL	RSL Tapwater
Metals and Cyanide					
7440-36-0	Antimony	1.3 - 5.7	ug/l	6	1.5 *
7440-31-5	Tin	1.1 - 4.2	ug/l	NSA	2200 *
57-12-5	Cyanide	0.0028 - 0.0028	mg/l	200	0.73 *
Organochlorine Pesticides					
72-54-8	4,4-DDD	0.0024 - 0.023	ug/l	NSA	0.28
72-55-9	4,4-DDE	0.0013 - 0.0065	ug/l	NSA	0.2
50-29-3	4,4-DDT	0.0035 - 0.018	ug/l	NSA	0.2
309-00-2	Aldrin	0.0017 - 0.013	ug/l	NSA	0.004
319-84-6	alpha-BHC	0.001 - 0.005	ug/l	NSA	0.011
5103-71-9	alpha-Chlordane	0.002 - 0.0098	ug/l	2	0.19
319-85-7	Beta-BHC	0.0036 - 0.018	ug/l	NSA	0.037
319-86-8	delta-BHC	0.0031 - 0.018	ug/l	NSA	0.011
60-57-1	Dieldrin	0.0014 - 0.0069	ug/l	NSA	0.0042
959-98-8	Endosulfan I	0.0018 - 0.0089	ug/l	NSA	22 *
33213-65-9	Endosulfan II	0.0029 - 0.017	ug/l	NSA	22 *
1031-07-8	Endosulfan sulfate	0.0026 - 0.013	ug/l	NSA	22 *
72-20-8	Endrin	0.003 - 0.0091	ug/l	2	1.1 *
7421-93-4	Endrin aldehyde	0.003 - 0.019	ug/l	2	1.1 *
53494-70-5	Endrin ketone	0.0026 - 0.013	ug/l	2	1.1 *
58-89-9	Gamma-BHC (Lindane)	0.0011 - 0.0059	ug/l	0.2	0.061
5566-34-7	Gamma-chlordane	0.0017 - 0.012	ug/l	2	0.19
76-44-8	Heptachlor	0.002 - 0.012	ug/l	0.4	0.015
1024-57-3	Heptachlor epoxide	0.0015 - 0.0078	ug/l	0.2	0.0074
72-43-5	Methoxychlor	0.0068 - 0.034	ug/l	40	18 *
8001-35-2	Toxaphene	0.094 - 1.1	ug/l	3	0.061
PCBs					
12674-11-2	Aroclor 1016	0.094 - 0.47	ug/l	NSA	0.26 *
11104-28-2	Aroclor 1221	0.29 - 0.77	ug/l	NSA	0.0068
11141-16-5	Aroclor 1232	0.21 - 0.52	ug/l	NSA	0.0068
53469-21-9	Aroclor 1242	0.089 - 0.22	ug/l	NSA	0.034
12672-29-6	Aroclor 1248	0.15 - 0.64	ug/l	NSA	0.034
11097-69-1	Aroclor 1254	0.11 - 0.28	ug/l	NSA	0.034
11096-82-5	Aroclor 1260	0.12 - 0.36	ug/l	NSA	0.034
Herbicides					
75-99-0	2,2-dichloropropionic acid	0.028 - 0.071	ug/l	200	110 *
93-76-5	2,4,5-T	0.02 - 0.099	ug/l	NSA	37 *
93-72-1	2,4,5-TP (silvex)	0.026 - 0.088	ug/l	50	29 *
94-75-7	2,4-D	0.16 - 0.47	ug/l	70	37 *
94-82-6	2,4-DB	0.15 - 0.43	ug/l	NSA	29 *
1918-00-9	Dicamba	0.03 - 0.076	ug/l	NSA	110 *
120-36-5	Dichlorprop	0.13 - 0.48	ug/l	NSA	NSA
88-85-7	Dinoseb	0.071 - 0.24	ug/l	7	3.7 *
94-74-6	MCPA (2-methyl-4-chlorophenoxyacetic acid)	9.6 - 24	ug/l	NSA	1.8 *
93-65-2	MCPP	6.8 - 29	ug/l	NSA	3.7 *
87-86-5	Pentachlorophenol	0.0075 - 0.026	ug/l	1	0.17
Volatile Organic Compounds					
630-20-6	1,1,1,2-tetrachloroethane	0.12 - 0.25	ug/l	NSA	0.52
71-55-6	1,1,1-trichloroethane	0.24 - 0.48	ug/l	200	910 *
79-34-5	1,1,2,2-tetrachloroethane	0.13 - 0.8	ug/l	NSA	0.067
75-34-3	1,1-dichloroethane	0.16 - 0.48	ug/l	NSA	2.4
96-18-4	1,2,3-trichloropropane	0.49 - 2.6	ug/l	NSA	0.00072
96-12-8	1,2-Dibromo-3-chloropropane	0.8 - **2.6**	ug/l	0.2	0.00032
106-93-4	1,2-dibromoethane	0.17 - **0.52**	ug/l	0.05	0.0065
78-87-5	1,2-dichloropropane	0.18 - 0.35	ug/l	5	0.39
123-91-1	1,4-dioxane	43 - 94	ug/l	NSA	0.67

Table 4-9
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Groundwater and Pore Water

CAS	Compound	Range of MDLs	Units	MCL	RSL Tapwater
78-93-3	2-butanone	1.6 - 4.6	ug/l	NSA	710 *
591-78-6	2-hexanone	0.94 - 3.4	ug/l	NSA	4.7 *
107-05-1	3-Chloropropene	0.38 - 2.9	ug/l	NSA	0.21 *
108-10-1	4-methyl-2-pentanone	0.86 - 2.7	ug/l	NSA	200 *
75-05-8	Acetonitrile	18 - 58	ug/l	NSA	13 *
107-02-8	Acrolein	4.1 - 44	ug/l	NSA	0.0042 *
107-13-1	Acrylonitrile	1 - 4	ug/l	NSA	0.045
75-27-4	Bromodichloromethane	0.14 - 0.28	ug/l	80	0.12
75-25-2	Bromoform	0.18 - 0.54	ug/l	80	8.5
74-83-9	Bromomethane	0.22 - 0.63	ug/l	NSA	0.87 *
56-23-5	Carbon tetrachloride	0.18 - 0.35	ug/l	5	0.44
108-90-7	Chlorobenzene	0.14 - 0.39	ug/l	100	9.1 *
75-00-3	Chloroethane	0.22 - 0.67	ug/l	NSA	2100 *
126-99-8	Chloroprene	0.16 - 0.93	ug/l	NSA	0.016
10061-01-5	Cis-1,3-dichloropropene	0.13 - 0.36	ug/l	NSA	0.43
124-48-1	Dibromochloromethane	0.12 - 0.32	ug/l	80	0.15
74-95-3	Dibromomethane	0.18 - 0.46	ug/l	NSA	0.82 *
75-71-8	Dichlorodifluoromethane	0.31 - 1.8	ug/l	NSA	20 *
97-63-2	Ethyl Methacrylate	0.38 - 1.9	ug/l	NSA	53 *
74-88-4	Iodomethane	0.13 - 0.49	ug/l	NSA	NSA
78-83-1	Isobutyl Alcohol	12 - 37	ug/l	NSA	1100 *
126-98-7	Methacrylonitrile	0.97 - 3.8	ug/l	NSA	0.1 *
80-62-6	Methyl Methacrylate	0.7 - 3.4	ug/l	NSA	140 *
75-09-2	Methylene Chloride	0.16 - 0.32	ug/l	5	4.8
76-01-7	Pentachloroethane	0.22 - 1.8	ug/l	NSA	0.75
107-12-0	Propane Nitrile (Propionitrile)	6.8 - 24	ug/l	NSA	NSA
100-42-5	Styrene	0.11 - 0.58	ug/l	100	160 *
108-88-3	Toluene	0.15 - 0.31	ug/l	1000	230 *
10061-02-6	trans-1,3-dichloropropene	0.11 - 0.3	ug/l	NSA	0.43
110-57-6	trans-1,4-dichloro-2-butene	0.72 - 3	ug/l	NSA	0.0012
75-69-4	Trichlorofluoromethane	0.25 - 0.54	ug/l	NSA	130 *
108-05-4	Vinyl acetate	1.3 - 3.2	ug/l	NSA	41 *
Semivolatile Organic Compounds					
95-94-3	1,2,4,5-tetrachlorobenzene	0.25 - 2	ug/l	NSA	1.1 *
120-82-1	1,2,4-trichlorobenzene	0.12 - 0.37	ug/l	70	0.41 *
99-35-4	1,3,5-Trinitrobenzene	0.26 - 2.5	ug/l	NSA	110 *
541-73-1	1,3-dichlorobenzene	0.15 - 0.43	ug/l	75	0.43
99-65-0	1,3-Dinitrobenzene	0.37 - 0.8	ug/l	NSA	0.37 *
130-15-4	1,4-Naphthoquinone	0.37 - 0.88	ug/l	NSA	NSA
134-32-7	1-Naphthylamine	0.42 - 1.4	ug/l	NSA	NSA
108-60-1	2,2-oxybis(1-chloropropane)	0.45 - 0.78	ug/l	NSA	0.32
58-90-2	2,3,4,6-tetrachlorophenol	0.94 - 1.6	ug/l	NSA	110 *
95-95-4	2,4,5-trichlorophenol	1.1 - 2	ug/l	NSA	370 *
88-06-2	2,4,6-trichlorophenol	1 - 1.6	ug/l	NSA	3.7 *
120-83-2	2,4-dichlorophenol	1.2 - 1.9	ug/l	NSA	11 *
105-67-9	2,4-dimethylphenol	1.5 - 2	ug/l	NSA	73 *
51-28-5	2,4-dinitrophenol	0.89 - 19	ug/l	NSA	7.3 *
121-14-2	2,4-dinitrotoluene	0.43 - 0.91	ug/l	NSA	0.22
87-65-0	2,6-Dichlorophenol	0.29 - 1.5	ug/l	NSA	11 *
606-20-2	2,6-dinitrotoluene	0.46 - 0.6	ug/l	NSA	3.7 *
53-96-3	2-Acetylaminofluorene	0.24 - 1.6	ug/l	NSA	0.018
91-58-7	2-chloronaphthalene	0.2 - 1	ug/l	NSA	290 *
95-57-8	2-chlorophenol	0.87 - 1.5	ug/l	NSA	18 *
534-52-1	2-Methyl-4,6-dinitrophenol	0.72 - 2.2	ug/l	NSA	0.29 *
95-48-7	2-methylphenol	1 - 1.4	ug/l	NSA	180 *
91-59-8	2-Naphthylamine	0.23 - 1.5	ug/l	NSA	0.037

Table 4-9
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Groundwater and Pore Water

CAS	Compound	Range of MDLs	Units	MCL	RSL Tapwater
88-74-4	2-nitroaniline	0.45 - 1.3	ug/l	NSA	37 *
88-75-5	2-nitrophenol	1.5 - 1.9	ug/l	NSA	0.31
109-06-8	2-Picoline	0.2 - 1.3	ug/l	NSA	NSA
34MP	3&4-methylphenol	0.93 - 1.5	ug/l	NSA	18 *
91-94-1	3,3-dichlorobenzidine	0.36 - 4.6	ug/l	NSA	0.15
119-93-7	3,3'-Dimethylbenzidine	0.37 - 2.9	ug/l	NSA	0.0061
99-09-2	3-nitroaniline	0.32 - 1.4	ug/l	NSA	0.37 *
92-67-1	4-Aminobiphenyl	0.35 - 1.1	ug/l	NSA	0.0032
101-55-3	4-bromophenyl phenyl ether	0.3 - 0.41	ug/l	NSA	NSA
59-50-7	4-chloro-3-methylphenol	1.2 - 2.3	ug/l	NSA	370 *
106-47-8	4-chloroaniline	0.33 - 0.6	ug/l	NSA	0.34
7005-72-3	4-chlorophenyl phenyl ether	0.29 - 0.45	ug/l	NSA	NSA
100-01-6	4-nitroaniline	0.45 - 1.9	ug/l	NSA	3.4
100-02-7	4-nitrophenol	0.84 - 5.9	ug/l	NSA	4.2
56-57-5	4-Nitroquinoline 1-Oxide	0.43 - 1.4	ug/l	NSA	NSA
99-55-8	5-Nitro-O-Toluidine	0.22 - 1.6	ug/l	NSA	7.5
122-09-8	A,A-Dimethylphenethylamine	0.49 - 3.3	ug/l	NSA	NSA
83-32-9	Acenaphthene	0.25 - 0.38	ug/l	NSA	220 *
98-86-2	Acetophenone	0.36 - 0.47	ug/l	NSA	370 *
62-53-3	Aniline	0.34 - 0.5	ug/l	NSA	12
120-12-7	Anthracene	0.29 - 0.42	ug/l	NSA	1100 *
140-57-8	Aramite	0.91 - 14	ug/l	NSA	2.7
100-51-6	Benzyl alcohol	0.33 - 0.39	ug/l	NSA	370 *
85-68-7	Benzyl butyl phthalate	0.42 - 0.64	ug/l	NSA	35
111-91-1	Bis(2-chloroethoxy) methane	0.32 - 0.69	ug/l	NSA	11 *
111-44-4	Bis(2-chloroethyl) ether	0.49 - 0.67	ug/l	NSA	0.012
510-15-6	Chlorobenzilate	0.26 - 0.73	ug/l	NSA	0.61
2303-16-4	Diallate	0.44 - 18	ug/l	NSA	1.1
132-64-9	Dibenzofuran	0.23 - 0.49	ug/l	NSA	3.7 *
84-66-2	Diethyl phthalate	0.33 - 0.41	ug/l	NSA	2900 *
60-51-5	Dimethoate	0.37 - 0.68	ug/l	NSA	0.73 *
131-11-3	Dimethyl phthalate	0.28 - 0.36	ug/l	NSA	NSA
84-74-2	Di-n-butyl phthalate	0.4 - 0.63	ug/l	NSA	370 *
117-84-0	Di-n-octyl phthalate	0.31 - 0.6	ug/l	NSA	370 *
88-85-7	Dinoseb	0.36 - 0.93	ug/l	7	3.7 *
122-39-4	Diphenylamine	0.46 - 2.9	ug/l	NSA	91 *
298-04-4	Disulfoton	0.31 - 0.67	ug/l	NSA	0.15 *
62-50-0	Ethyl Methanesulfonate	0.23 - 1.2	ug/l	NSA	NSA
52-85-7	Famphur	3 - 9.3	ug/l	NSA	NSA
206-44-0	Fluoranthene	0.25 - 0.4	ug/l	NSA	150 *
86-73-7	Fluorene	0.36 - 0.47	ug/l	NSA	150 *
87-68-3	Hexachloro-1,3-butadiene	0.13 - 0.38	ug/l	NSA	0.86
118-74-1	Hexachlorobenzene	0.31 - 0.57	ug/l	1	0.042
77-47-4	Hexachlorocyclopentadiene	0.1 - 4.5	ug/l	50	22 *
67-72-1	Hexachloroethane	0.16 - 0.3	ug/l	NSA	3.7 *
70-30-4	Hexachlorophene	0.22 - 1.6	ug/l	NSA	1.1 *
1888-71-7	Hexachloropropene	0.3 - 1.8	ug/l	NSA	NSA
465-73-6	ISODRIN	0.3 - 1.4	ug/l	NSA	0.029
78-59-1	Isophorone	0.49 - 0.69	ug/l	NSA	NSA
120-58-1	Isosafrole	0.3 - 1.9	ug/l	NSA	71
143-50-0	Kepone	3.1 - 5	ug/l	NSA	NSA
91-80-5	Methapyrilene	0.52 - 1.9	ug/l	NSA	0.0067
66-27-3	Methyl Methanesulfonate	0.29 - 1	ug/l	NSA	NSA
298-00-0	Methyl Parathion	0.39 - 1.1	ug/l	NSA	0.68
98-95-3	Nitrobenzene	0.42 - 0.71	ug/l	NSA	0.12
55-18-5	N-Nitrosodiethylamine	0.22 - 1.2	ug/l	NSA	0.00014

Table 4-9

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Groundwater and Pore Water

CAS	Compound	Range of MDLs	Units	MCL	RSL Tapwater
62-75-9	n-Nitrosodimethylamine	0.36 - 0.73	ug/l	NSA	0.00042
924-16-3	N-Nitrosodi-N-Butylamine	0.46 - 3.5	ug/l	NSA	0.0024
621-64-7	N-nitrosodi-n-propylamine	0.38 - 0.49	ug/l	NSA	0.0096
86-30-6	N-nitrosodiphenylamine	0.41 - 0.61	ug/l	NSA	14
10595-95-6	N-Nitrosomethylethylamine	0.74 - 1	ug/l	NSA	0.0031
59-89-2	N-Nitrosomorpholine	0.27 - 0.99	ug/l	NSA	0.01
100-75-4	N-Nitrosopiperidine	0.36 - 0.98	ug/l	NSA	0.0072
930-55-2	N-Nitrosopyrrolidine	0.49 - 1.5	ug/l	NSA	0.032
126-68-1	O,O,O-Triethyl Phosphorothioat	0.36 - 1.1	ug/l	NSA	NSA
95-53-4	O-TOLUIDINE	0.23 - 1.7	ug/l	NSA	NSA
60-11-7	P-(Dimethylamine)Azobenzene	0.26 - 2.2	ug/l	NSA	0.015
56-38-2	Parathion	0.35 - 1.2	ug/l	NSA	22 *
608-93-5	Pentachlorobenzene	0.21 - 1.8	ug/l	NSA	2.9 *
82-68-8	Pentachloronitrobenzene	0.49 - 3.9	ug/l	NSA	0.26
87-86-5	Pentachlorophenol	0.93 - **2**	ug/l	1	0.17
62-44-2	PHENACETIN	0.22 - 2.4	ug/l	NSA	31
108-95-2	Phenol	0.5 - 1.5	ug/l	NSA	1100 *
298-02-2	Phorate	0.53 - 0.8	ug/l	NSA	0.73 *
106-50-3	P-Phenylenediamine	0.15 - 5	ug/l	NSA	690 *
23950-58-5	Pronamide	0.05 - 1	ug/l	NSA	270 *
129-00-0	Pyrene	0.27 - 0.48	ug/l	NSA	110 *
110-86-1	Pyridine	0.21 - 0.67	ug/l	NSA	3.7 *
94-59-7	Safrole	0.32 - 1.3	ug/l	NSA	0.098
3689-24-5	Tetraethyl Dithiopyrophosphate	0.23 - 1.6	ug/l	NSA	1.8 *
297-97-2	Thionazin	0.29 - 1	ug/l	NSA	NSA
	Semivolatile Organic Compounds (PAH)				
91-57-6	2-methylnaphthalene	0.023 - 0.028	ug/l	NSA	15 *
56-49-5	3-Methylcholanthrene	0.2 - 0.23	ug/l	NSA	0.00098
57-97-6	7,12-Dimethylbenz[a]anthracene	0.2 - 0.23	ug/l	NSA	0.000086
208-96-8	Acenaphthylene	0.007 - 0.018	ug/l	NSA	0.14
56-55-3	Benzo[a]anthracene	0.0068 - 0.034	ug/l	NSA	0.029
50-32-8	Benzo[a]pyrene	0.0049 - 0.036	ug/l	0.2	0.0029
205-99-2	Benzo[b]fluoranthene	0.017 - 0.038	ug/l	NSA	0.029
191-24-2	Benzo[g,h,i]perylene	0.01 - 0.019	ug/l	NSA	110 *
207-08-9	Benzo[k]fluoranthene	0.016 - 0.019	ug/l	NSA	0.29
218-01-9	Chrysene	0.017 - 0.026	ug/l	NSA	2.9
53-70-3	Dibenz[a,h]anthracene	0.016 - 0.026	ug/l	NSA	0.0029
193-39-5	Indeno[1,2,3-c,d]pyrene	0.011 - 0.014	ug/l	NSA	0.029
85-01-8	Phenanthrene	0.016 - 0.022	ug/l	NSA	1100 *
	TPH- DRO/GRO				
TPH-DRO	TPH-DRO (C10-C28)	0.039 0.041	mg/l	NSA	NSA
TPH-GRO	TPH-GRO (C6-C10)	0.011 0.011	mg/l	NSA	NSA
	General Chemistry				
74-84-0	Ethane	0.011 - 0.011	ug/l	NSA	NSA
74-85-1	Ethene	0.02 - 0.02	ug/l	NSA	NSA
TOC	Total organic carbon	0.31 - 0.31	mg/l	NSA	NSA

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are bolded.

Table 4-10

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Water

CAS	Compound	Range of MDLs	Units	EPA RSL	EPA Eco
	Metals				
7440-36-0	Antimony	5 - 5	ug/l	15 *	160.0
7440-43-9	Cadmium	1.3 - 1.3	ug/l	18 *	0.66
7440-28-0	Thallium	9.8 - **9.8**	ug/l	0.37 *	4
7440-31-5	Tin	2.6 - 2.6	ug/l	22000 *	NSA
	Organochlorine Pesticides				
72-54-8	4,4-DDD	0.0024 - 0.0027	ug/l	2.8	0.0064
50-29-3	4,4-DDT	0.0049 - 0.0055	ug/l	2	0.001
309-00-2	Aldrin	0.0033 - 0.0037	ug/l	0.04	0.3
319-84-6	alpha-BHC	0.0026 - 0.0029	ug/l	0.11	500.0
5103-71-9	alpha-Chlordane	0.0044 - 0.0048	ug/l	1.9	NSA
319-85-7	Beta-BHC	0.0062 - 0.0069	ug/l	0.37	5000.0
319-86-8	delta-BHC	0.0031 - 0.0034	ug/l	0.11	NSA
60-57-1	Dieldrin	0.0017 - 0.0019	ug/l	0.042	0.0019
959-98-8	Endosulfan I	0.0021 - 0.0023	ug/l	220 *	0.056
33213-65-9	Endosulfan II	0.0032 - 0.0036	ug/l	220 *	0.056
1031-07-8	Endosulfan sulfate	0.0046 - 0.0051	ug/l	220 *	NSA
72-20-8	Endrin	0.003 - 0.0033	ug/l	11 *	0.0023
7421-93-4	Endrin aldehyde	0.0064 - 0.0072	ug/l	11 *	NSA
53494-70-5	Endrin ketone	0.0035 - 0.0039	ug/l	11 *	NSA
58-89-9	Gamma-BHC (Lindane)	0.0017 - 0.0019	ug/l	0.61	0.08
5566-34-7	Gamma-chlordane	0.0017 - 0.0019	ug/l	1.9	NSA
76-44-8	Heptachlor	0.0026 - 0.0028	ug/l	0.15	0.0038
1024-57-3	Heptachlor epoxide	0.0015 - 0.0016	ug/l	0.074	0.0038
72-43-5	Methoxychlor	0.0068 - 0.0075	ug/l	180 *	0.03
8001-35-2	Toxaphene	0.094 - 0.1	ug/l	0.61	0.0002
	PCBs				
12674-11-2	Aroclor 1016	0.19 - 0.22	ug/l	2.6 *	0.014
11104-28-2	Aroclor 1221	0.31 - **0.36**	ug/l	0.068	0.014
11141-16-5	Aroclor 1232	0.21 - **0.24**	ug/l	0.068	0.014
53469-21-9	Aroclor 1242	0.089 - 0.1	ug/l	0.34	0.014
12672-29-6	Aroclor 1248	0.25 - 0.3	ug/l	0.34	0.014
11097-69-1	Aroclor 1254	0.11 - 0.13	ug/l	0.34	0.014
11096-82-5	Aroclor 1260	0.14 - 0.17	ug/l	0.34	0.014
	Herbicides				
93-76-5	2,4,5-T	0.034 - 0.037	ug/l	370 *	NSA
93-72-1	2,4,5-TP (silvex)	0.035 - 0.039	ug/l	290 *	NSA
94-75-7	2,4-D	0.34 - 0.38	ug/l	370 *	NSA
	Volatile Organic Compounds				
630-20-6	1,1,1,2-tetrachloroethane	0.19 - 0.19	ug/l	5.2	NSA
71-55-6	1,1,1-trichloroethane	0.3 - 0.3	ug/l	9100 *	528
79-34-5	1,1,2,2-tetrachloroethane	0.8 - **0.8**	ug/l	0.67	240.0
79-00-5	1,1,2-trichloroethane	0.49 - **0.49**	ug/l	0.42 *	940.0
75-34-3	1,1-dichloroethane	0.2 - 0.2	ug/l	24	NSA
75-35-4	1,1-dichloroethene	0.28 - 0.28	ug/l	340 *	303
96-18-4	1,2,3-trichloropropane	1.1 - **1.1**	ug/l	0.0072	NSA
96-12-8	1,2-Dibromo-3-chloropropane	0.8 - **0.8**	ug/l	0.0032	NSA
106-93-4	1,2-dibromoethane	0.45 - **0.45**	ug/l	0.065	NSA
107-06-2	1,2-dichloroethane	0.29 - 0.29	ug/l	1.5	2000.0
540-59-0	1,2-dichloroethene	0.27 - 0.27	ug/l	330 *	NSA
78-87-5	1,2-dichloropropane	0.24 - 0.24	ug/l	3.9	525
123-91-1	1,4-dioxane	47 - **47**	ug/l	6.7	NSA
78-93-3	2-butanone	2.7 - 2.7	ug/l	7100 *	NSA
591-78-6	2-hexanone	0.94 - 0.94	ug/l	47 *	NSA
107-05-1	3-Chloropropene	1.3 - 1.3	ug/l	2.1 *	NSA

Table 4-10
Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Water

CAS	**Compound**	**Range of MDLs**	**Units**	**EPA RSL**	**EPA Eco**
108-10-1	4-methyl-2-pentanone	1.4 - 1.4	ug/l	2000 *	NSA
67-64-1	Acetone	2.9 - 2.9	ug/l	22000 *	NSA
75-05-8	Acetonitrile	24 - 24	ug/l	130 *	NSA
107-02-8	Acrolein	44 - **44**	ug/l	0.042 *	NSA
107-13-1	Acrylonitrile	4 - **4**	ug/l	0.45	NSA
71-43-2	Benzene	0.19 - 0.19	ug/l	4.1	53
75-27-4	Bromodichloromethane	0.15 - 0.15	ug/l	1.2	NSA
75-25-2	Bromoform	0.34 - 0.34	ug/l	85	293
74-83-9	Bromomethane	0.38 - 0.38	ug/l	8.7 *	110.0
75-15-0	Carbon disulfide	0.14 - 0.14	ug/l	1000 *	NSA
56-23-5	Carbon tetrachloride	0.19 - 0.19	ug/l	4.4	352
108-90-7	Chlorobenzene	0.19 - 0.19	ug/l	91 *	195
75-00-3	Chloroethane	0.67 - 0.67	ug/l	21000 *	NSA
67-66-3	Chloroform	0.25 - 0.25	ug/l	1.9	289
74-87-3	Chloromethane	0.3 - 0.3	ug/l	190 *	5500.0
126-99-8	Chloroprene	0.36 - **0.36**	ug/l	0.16	NSA
10061-01-5	Cis-1,3-dichloropropene	0.13 - 0.13	ug/l	4.3	24.4
124-48-1	Dibromochloromethane	0.28 - 0.28	ug/l	1.5	NSA
74-95-3	Dibromomethane	0.42 - 0.42	ug/l	8.2 *	NSA
75-71-8	Dichlorodifluoromethane	1 - 1	ug/l	200 *	NSA
97-63-2	Ethyl Methacrylate	0.96 - 0.96	ug/l	530 *	NSA
100-41-4	Ethylbenzene	0.21 - 0.21	ug/l	15	453
74-88-4	Iodomethane	0.2 - 0.2	ug/l	NSA	NSA
78-83-1	Isobutyl Alcohol	19 - 19	ug/l	11000 *	NSA
126-98-7	Methacrylonitrile	1.8 - **1.8**	ug/l	1 *	NSA
80-62-6	Methyl Methacrylate	3.4 - 3.4	ug/l	1400 *	NSA
75-09-2	Methylene Chloride	0.21 - 0.21	ug/l	48	1930.0
76-01-7	Pentachloroethane	0.75 - 0.75	ug/l	7.5	NSA
107-12-0	Propane Nitrile (Propionitrile)	11 - 11	ug/l	NSA	NSA
100-42-5	Styrene	0.2 - 0.2	ug/l	1600 *	NSA
127-18-4	Tetrachloroethene	0.28 - 0.28	ug/l	1.1	84
108-88-3	Toluene	0.21 - 0.21	ug/l	2300 *	175
156-60-5	trans-1,2-dichloroethene	0.32 - 0.32	ug/l	110 *	1350.0
10061-02-6	trans-1,3-dichloropropene	0.17 - 0.17	ug/l	4.3	24.4
110-57-6	trans-1,4-dichloro-2-butene	0.72 - **0.72**	ug/l	0.012	NSA
79-01-6	Trichloroethene	0.26 - 0.26	ug/l	20	NSA
75-69-4	Trichlorofluoromethane	0.26 - 0.26	ug/l	1300 *	NSA
108-05-4	Vinyl acetate	1.3 - 1.3	ug/l	410 *	NSA
75-01-4	Vinyl chloride	0.22 - **0.22**	ug/l	0.16	NSA
1330-20-7	Xylenes, Total	0.2 - 0.2	ug/l	200 *	NSA
	Semivolatile Organic Compounds				
95-94-3	1,2,4,5-tetrachlorobenzene	0.71 - 0.77	ug/l	11 *	50.0
120-82-1	1,2,4-trichlorobenzene	0.34 - 0.37	ug/l	4.1 *	44.9
95-50-1	1,2-dichlorobenzene	0.21 - 0.23	ug/l	370 *	15.8
541-73-1	1,3-dichlorobenzene	0.16 - 0.17	ug/l	4.3	50.2
106-46-7	1,4-dichlorobenzene	0.18 - 0.2	ug/l	4.3	11.2
134-32-7	1-Naphthylamine	0.61 - 0.67	ug/l	NSA	NSA
108-60-1	2,2-oxybis(1-chloropropane)	0.74 - 0.8	ug/l	3.2	NSA
58-90-2	2,3,4,6-tetrachlorophenol	1.1 - 1.2	ug/l	1100 *	NSA
95-95-4	2,4,5-trichlorophenol	1.9 - 2.1	ug/l	3700 *	NSA
88-06-2	2,4,6-trichlorophenol	1.3 - 1.4	ug/l	37 *	3.2
120-83-2	2,4-dichlorophenol	1.6 - 1.7	ug/l	110 *	36.5
105-67-9	2,4-dimethylphenol	1.6 - 1.8	ug/l	730 *	21.2
51-28-5	2,4-dinitrophenol	0.89 - 0.97	ug/l	73 *	6.2
121-14-2	2,4-dinitrotoluene	0.86 - 0.93	ug/l	2.2	310.0

Table 4-10

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Water

CAS	Compound	Range of MDLs	Units	EPA RSL	EPA Eco
87-65-0	2,6-Dichlorophenol	0.46 - 0.5	ug/l	110 *	NSA
606-20-2	2,6-dinitrotoluene	0.56 - 0.61	ug/l	37 *	NSA
53-96-3	2-Acetylaminofluorene	0.57 - **0.62**	ug/l	0.18	NSA
91-58-7	2-chloronaphthalene	0.98 - 1.1	ug/l	2900 *	NSA
95-57-8	2-chlorophenol	0.95 - 1	ug/l	180 *	43.8
534-52-1	2-Methyl-4,6-dinitrophenol	0.72 - 0.78	ug/l	2.9 *	2.3
95-48-7	2-methylphenol	1.4 - 1.5	ug/l	1800 *	NSA
91-59-8	2-Naphthylamine	0.23 - 0.25	ug/l	0.37	NSA
88-74-4	2-nitroaniline	0.66 - 0.72	ug/l	370 *	NSA
88-75-5	2-nitrophenol	1.8 - 2	ug/l	3.1	3500.0
109-06-8	2-Picoline	0.28 - 0.3	ug/l	NSA	NSA
34MP	3&4-methylphenol	1.3 - 1.4	ug/l	180 *	NSA
91-94-1	3,3-dichlorobenzidine	1.2 - 1.3	ug/l	1.5	NSA
119-93-7	3,3'-Dimethylbenzidine	1.5 - **1.6**	ug/l	0.061	NSA
99-09-2	3-nitroaniline	1.3 - 1.4	ug/l	3.7 *	NSA
92-67-1	4-Aminobiphenyl	0.58 - **0.63**	ug/l	0.032	NSA
101-55-3	4-bromophenyl phenyl ether	0.3 - 0.33	ug/l	NSA	12.2
59-50-7	4-chloro-3-methylphenol	1.2 - 1.3	ug/l	3700 *	0.3
106-47-8	4-chloroaniline	0.4 - 0.43	ug/l	3.4	NSA
7005-72-3	4-chlorophenyl phenyl ether	0.43 - 0.47	ug/l	NSA	NSA
100-01-6	4-nitroaniline	0.72 - 0.78	ug/l	34	NSA
100-02-7	4-nitrophenol	0.84 - 0.92	ug/l	42	82.8
56-57-5	4-Nitroquinoline 1-Oxide	0.7 - 0.76	ug/l	NSA	NSA
99-55-8	5-Nitro-O-Toluidine	0.47 - 0.51	ug/l	7.50E+01	NSA
122-09-8	A,A-Dimethylphenethylamine	1.2 - 1.3	ug/l	NSA	NSA
83-32-9	Acenaphthene	0.35 - 0.38	ug/l	2200 *	17
98-86-2	Acetophenone	0.37 - 0.41	ug/l	3700 *	NSA
62-53-3	Aniline	0.34 - 0.37	ug/l	120	NSA
120-12-7	Anthracene	0.4 - 0.43	ug/l	11000 *	NSA
140-57-8	Aramite	0.91 - 0.99	ug/l	27	NSA
100-51-6	Benzyl alcohol	0.37 - 0.4	ug/l	3700 *	NSA
85-68-7	Benzyl butyl phthalate	0.59 - 0.64	ug/l	350	22
111-91-1	Bis(2-chloroethoxy) methane	0.65 - 0.71	ug/l	110 *	NSA
111-44-4	Bis(2-chloroethyl) ether	0.53 - **0.58**	ug/l	0.12	2380.0
510-15-6	Chlorobenzilate	0.32 - 0.35	ug/l	6.1	NSA
2303-16-4	Diallate	0.44 - 0.48	ug/l	29	NSA
132-64-9	Dibenzofuran	0.34 - 0.37	ug/l	37 *	NSA
84-66-2	Diethyl phthalate	0.39 - 0.42	ug/l	29000 *	521
60-51-5	Dimethoate	0.37 - 0.41	ug/l	7.3 *	NSA
131-11-3	Dimethyl phthalate	0.33 - 0.36	ug/l	NSA	330.0
84-74-2	Di-n-butyl phthalate	0.59 - 0.64	ug/l	3700 *	9.4
117-84-0	Di-n-octyl phthalate	0.57 - 0.62	ug/l	3700 *	NSA
88-85-7	Dinoseb	0.36 - 0.39	ug/l	37 *	NSA
298-04-4	Disulfoton	0.31 - 0.34	ug/l	1.5 *	NSA
52-85-7	Famphur	3 - 3.2	ug/l	NSA	NSA
206-44-0	Fluoranthene	0.25 - 0.27	ug/l	1500 *	39.8
86-73-7	Fluorene	0.45 - 0.49	ug/l	1500 *	NSA
87-68-3	Hexachloro-1,3-butadiene	0.18 - 0.19	ug/l	8.6	0.93
118-74-1	Hexachlorobenzene	0.54 - **0.58**	ug/l	0.42	NSA
77-47-4	Hexachlorocyclopentadiene	0.41 - 0.44	ug/l	220 *	0.07
67-72-1	Hexachloroethane	0.28 - 0.31	ug/l	37 *	9.8
70-30-4	Hexachlorophene	0.32 - 0.35	ug/l	11 *	NSA
1888-71-7	Hexachloropropene	0.66 - 0.72	ug/l	NSA	NSA
465-73-6	ISODRIN	0.34 - 0.37	ug/l	NSA	NSA
78-59-1	Isophorone	0.59 - 0.64	ug/l	710	1170.0

Table 4-10

Method Detection Limits of Compounds Never Detected Compared to Screening Levels - Surface Water

CAS	Compound	Range of MDLs	Units	EPA RSL	EPA Eco
143-50-0	Kepone	3.1 - **3.4**	ug/l	0.067	NSA
66-27-3	Methyl Methanesulfonate	0.29 - 0.32	ug/l	6.8	NSA
98-95-3	Nitrobenzene	0.42 - 0.46	ug/l	1.2	270.0
55-18-5	N-Nitrosodiethylamine	0.51 - **0.55**	ug/l	0.0014	NSA
62-75-9	n-Nitrosodimethylamine	0.46 - **0.5**	ug/l	0.0042	NSA
924-16-3	N-Nitrosodi-N-Butylamine	0.46 - **0.5**	ug/l	0.024	NSA
621-64-7	N-nitrosodi-n-propylamine	0.47 - **0.51**	ug/l	0.096	NSA
86-30-6	N-nitrosodiphenylamine	0.52 - 0.56	ug/l	140	58.5
10595-95-6	N-Nitrosomethylethylamine	0.77 - **0.83**	ug/l	0.031	NSA
59-89-2	N-Nitrosomorpholine	0.33 - **0.36**	ug/l	0.1	NSA
100-75-4	N-Nitrosopiperidine	0.56 - **0.61**	ug/l	0.072	NSA
930-55-2	N-Nitrosopyrrolidine	0.54 - **0.58**	ug/l	0.32	NSA
126-68-1	O,O,O-Triethyl Phosphorothioat	0.36 - 0.39	ug/l	NSA	NSA
95-53-4	O-TOLUIDINE	0.28 - 0.3	ug/l	NSA	NSA
60-11-7	P-(Dimethylamine)Azobenzene	0.28 - **0.31**	ug/l	0.15	NSA
56-38-2	Parathion	0.35 - 0.38	ug/l	220 *	NSA
608-93-5	Pentachlorobenzene	0.69 - 0.75	ug/l	29 *	NSA
82-68-8	Pentachloronitrobenzene	1 - 1.1	ug/l	2.6	NSA
87-86-5	Pentachlorophenol	1.9 - **2.1**	ug/l	1.7	13
62-44-2	PHENACETIN	0.6 - 0.65	ug/l	310	NSA
108-95-2	Phenol	0.5 - 0.54	ug/l	11000 *	256
298-02-2	Phorate	0.53 - 0.57	ug/l	7.3 *	NSA
106-50-3	P-Phenylenediamine	0.52 - 0.57	ug/l	6900 *	NSA
23950-58-5	Pronamide	0.34 - 0.37	ug/l	2700 *	NSA
129-00-0	Pyrene	0.34 - 0.36	ug/l	1100 *	NSA
110-86-1	Pyridine	0.64 - 0.69	ug/l	37 *	NSA
3689-24-5	Tetraethyl Dithiopyrophosphate	0.42 - 0.45	ug/l	18 *	NSA
297-97-2	Thionazin	0.35 - 0.38	ug/l	NSA	NSA
	Semivolatile Organic Compounds (PAH)				
91-57-6	2-methylnaphthalene	0.025 - 0.027	ug/l	150 *	NSA
56-49-5	3-Methylcholanthrene	0.2 - **0.22**	ug/l	0.0098	NSA
57-97-6	7,12-Dimethylbenz[a]anthracene	0.2 - **0.22**	ug/l	0.00086	NSA
208-96-8	Acenaphthylene	0.0095 - 0.01	ug/l	1.4	NSA
56-55-3	Benzo[a]anthracene	0.0068 - 0.0074	ug/l	0.29	NSA
50-32-8	Benzo[a]pyrene	0.017 - 0.018	ug/l	0.029	NSA
205-99-2	Benzo[b]fluoranthene	0.036 - 0.039	ug/l	0.29	NSA
191-24-2	Benzo[g,h,i]perylene	0.018 - 0.019	ug/l	1100 *	NSA
207-08-9	Benzo[k]fluoranthene	0.016 - 0.017	ug/l	2.9	NSA
218-01-9	Chrysene	0.017 - 0.018	ug/l	29	NSA
53-70-3	Dibenz[a,h]anthracene	0.016 - 0.018	ug/l	0.029	NSA
193-39-5	Indeno[1,2,3-c,d]pyrene	0.011 - 0.012	ug/l	0.29	NSA
91-20-3	Naphthalene	0.026 - 0.028	ug/l	1.4	62
85-01-8	Phenanthrene	0.021 - 0.023	ug/l	11000 *	NSA
	TPH- DRO/GRO				
TPH-DRO	TPH-DRO (C10-C28)	0.039 - 0.041	mg/l	NSA	NSA
TPH-GRO	TPH-GRO (C6-C10)	0.033 - 0.033	mg/l	NSA	NSA

EPA RSL = EPA Tapwater Regional Screening Level * 10 for Surface Water, June 2011

EPA Eco = EPA Region 4 ecological screening values for freshwater SW, 2001.

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

Detected concentrations exceeding the EPA RSL are bold.

Detected concentrations exceeding the EPA Eco are in blue font.

5 NATURE AND EXTENT OF CONTAMINATION

The results of chemical sampling and analysis performed at the sites are presented in this section. These results include summaries of the analytical data from the RFI activities completed from October 2006 through September 2011. Summary tables with the analytical results are referenced as the results are discussed in the following subsections. A summary of the RFI field activities and details on sampling methodology are presented in Section 3.0. Human health and ecological risk assessments are presented in Appendices D and E and are summarized in Section 7.0.

Filtered and unfiltered data are available for aqueous samples collected at each Site. Unfiltered aqueous samples are likely to contain particulate matter from the surrounding material (soil or sediment particles). Metals may be adsorbed to the particulate matter causing the reported concentrations of these inorganics in unfiltered aqueous samples to be higher than the concentrations reported in associated filtered samples. Because the filtered aqueous samples do not contain particulate matter, the data generated from them are more representative of the actual dissolved concentrations of inorganics that are present in groundwater or surface water. Therefore, data for filtered samples (or "dissolved" metals) are discussed in more detail in this nature and extent evaluation than data for unfiltered samples ("total" metals). However, it should be noted that data for total metals will be used in the HHRA.

5.1 SITE 1, SWMU 1: OLD HAZARDOUS WASTE CONTAINERS

Site 1 is associated with a 600 sq ft, concrete-floored building (Building 539) that stored various chemicals (e.g. acids, bases, solvents, and pesticides) from 1968 to 1977. Surface soil, subsurface soil, and groundwater samples were collected from Site 1. Groundwater samples were collected as part of the NWBA RFI; and the groundwater underlying this site was fully evaluated in that RFI. Tables 5-1 through 5-3 summarize the concentrations of compounds detected in the samples and Figure 3-1 shows the sample locations.

5.1.1 Surface Soil

Sample locations were selected during the field inspection. Three of the locations (borings 2, 3, and 4) were chosen based on visual observation of drains coming from the building and were located in the grass immediately downgradient of the drains. The other location (boring 1) was placed to capture an upgradient, or background, location for the site, and was located in a packed earth/gravelly area between the building and the road. Soil samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, and herbicides. Acetone, aroclor 1260, and numerous SVOCs (PAHs) and pesticides were detected in at least one surface soil sample (Table 5-1). Ten SVOCs and four pesticides were found at concentrations greater than the selected criteria.

Elevated concentrations of SVOCs were found primarily at two of the sample locations, boring 3 and boring 4. Concentrations of nine SVOCs in these samples were greater than the ecological screening levels; no SVOCs at the other two locations were found at concentrations above ecological screening levels (Table 5-1, Figure 5-1). Residential screening levels were exceeded by detected concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene at borings 3 and 4, and the concentration of benzo(a)pyrene detected in boring 1 also exceeded the residential screening level. However, industrial screening levels were only exceeded by the maximum concentration of benzo(a)pyrene (421 ug/kg) found at boring 4 (Table 5-1, Figure 5-1).

Pesticides, specifically DDD, DDE, and DDT were detected at concentrations above ecological screening levels (2.5 ug/kg for all three compounds) in all four samples, and dieldrin was also detected at a concentration above the ecological screening level (0.5 ug/kg) in sample S-01-08-01-0-2. All of the detected concentrations were greater than background pesticide concentrations. None of the pesticides were found at concentrations greater than human health screening levels (Table 5-1, Figure 5-1). The highest concentrations of pesticides were found at boring 1. It should be noted that this boring was located in a packed earth/gravelly area between the building and the road and upgradient of building drains.

5.1.2 Subsurface Soil

Subsurface soil samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, and herbicides. VOCs, SVOCs, organochlorine pesticides, and one herbicide (pentachlorphenol) were detected in at least one of the subsurface soil samples (Table 5-2). Concentrations of benzo(a)pyrene (73.4 ug/kg) and dibenz(a,h)anthracene (18.3 ug/kg) detected at boring 3 were greater than residential screening levels (15 ug/kg for each compound). None of the detected compounds were found at concentrations above industrial screening levels.

Pentachlorophenol at boring 2 and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene at boring 3 were detected at concentrations above protection of groundwater SSLs. However, herbicides and SVOCs were not detected in groundwater samples from MW-11A and MW-11B, indicating that groundwater at Site 1 has not been impacted by these compounds.

5.1.3 Groundwater

Groundwater samples were collected from two wells downgradient of Site 1 as part of the NWBA RFI (MW-11A and 11B). The first round of samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals and subsequent rounds were analyzed for VOCs and TPH (in August 2010 only).

VOCs and metals were detected in the groundwater samples (Table 5-3 and Figure 5-2). Six VOCs were detected at least once at concentrations greater than the tap water screening levels (range of detected concentrations is in parentheses): 1,1,2-trichloroethane (0.51-1.3 ug/L), 1,2-dichloroethane (0.31 and 0.36 ug/L), chloroform (0.38-0.75 ug/L), tetrachloroethene (PCE) (6.7-11.5 ug/L), TCE (163-240 ug/L), and vinyl chloride 0.45-0.83 ug/L). Concentrations of PCE and TCE were also above their MCLs.

Two of the groundwater samples were analyzed for metals, and dissolved arsenic (6 ug/L), chromium (1.3 ug/L), and cobalt (2.5 ug/L) were detected in one sample each at concentrations greater than the tap water screening levels. Total chromium (0.8 ug/L) was detected once at a concentration above the tap water screening level. None of the detected concentrations were above MCLs.

Data from wells MW-11A and MW-11B were evaluated as part of the NWBA RFI and HHRA. They are located approximately 200 meters downgradient of the suspected source area for the TCE plume identified in the NWBA RFI. They are located within the portion of the plume with notably elevated concentrations of TCE and PCE. While elevated concentrations of VOCs and a few metals were identified in these wells, Site 1 was not identified as a potential source area for groundwater contamination. As noted in Section 5.1.2, some PAHs and one herbicide were found in subsurface soil at concentrations above protection of groundwater soil screening levels. However, no herbicides or SVOCs were detected in the groundwater samples from MW-11A and MW-11B, and overall groundwater contamination from PAHs, herbicides, and metals were not identified in the NWBA RFI.

The NWBA RFI included an evaluation of the potential for contaminated groundwater to adversely impact other media, such as surface water and air. No impacts to surface water from the groundwater plume were found. Potential concerns for the commercial worker and off-post resident exposure to groundwater were identified in the HHRA completed for the NWBA RFI. For the commercial worker, there are potential concerns for inhalation of indoor air from vapor intrusion. However, there are currently no buildings within the NWBA that are occupied on a regular basis. Potential concerns for off-post resident exposure to groundwater as a tap water source were also identified. The primary contributor to groundwater concerns (via all exposure routes) is TCE originating from an unidentified source south of Site 1. These concerns are being addressed in a CMS prepared specifically for the NWBA.

5.1.4 Site 1 Nature and Extent Summary

SVOCs (specifically PAHs) were found at elevated concentrations, primarily in two surface soil samples: S-01-08-03-0-2 and S-01-08-04-0-2. These compounds had elevated concentrations with respect to residential human health screening levels, ecological screening levels, and protection of groundwater SSLs. There was only one instance where a compound was found at a concentration above the industrial screening level, benzo(a)pyrene in surface soil at boring 4. This elevated concentration is bounded vertically, as benzo(a)pyrene was not detected in the subsurface soil sample from that location, and is bounded to the south by the building and to the east by boring 3. The location is not bounded to the north or west. The potential for risks to human and ecological receptors from concentrations of PAHs above screening levels is fully evaluated in the HHRA and the Baseline Ecologicial Risk Assessment (BERA).

Concentrations of pesticides were elevated in surface soil when compared to ecological screening levels, but not with respect to human health screening levels. The highest concentrations of pesticides were found at boring 1, which was located in a packed earth/gravelly area between the building and the road and upgradient of building drains. Therefore boring 1 does not represent quality ecological habitat, and it likely reflects impacts from non-site-related areas. The potential for risks to ecological receptors from concentrations of pesticides is fully evaluated in the BERA.

VOCs were the primary compounds found at elevated concentrations in groundwater; PCE and TCE exceeded screening levels to the greatest extent. Groundwater underlying Site 1 was fully evaluated in the NWBA RFI and associated HHRA. Site 1 was not identified as a potential source area for groundwater contamination, although it is within the portion of the plume where notably elevated concentrations of TCE and PCE were found. Concerns regarding the potential risks to receptors from exposure to contaminated groundwater are being addressed in a CMS prepared specifically for the NWBA.

5.2 SITE 2, SWMU 3: PESTICIDES AND CHEMICALS BURIAL TRENCH

Site 2 is located on the western side of Fort Buchanan, immediately south of the CPR facility (Figure 1-2). The site consists primarily of open, maintained fields and wooded areas along PR-28. As discussed in Section 3.2, this area was first identified as a SWMU because it was suspected that a disposal trench for pesticides was located in the area. No evidence of a disposal trench or other disposal activities has been found at the Site, despite numerous investigations. A summary of the past investigations completed at Site 2 is presented in the following subsection.

5.2.1 Site 2 Previous Investigations

SWMU 3 was first identified during the Army Installation Assessment as a suspected hazardous materials disposal site (McMaster 1984). The disposal site was believed to be a trench 6 ft deep, 30 ft wide, and 100 ft long that was reportedly used to dispose of one ton of dry pesticides in 1977, construction debris, and trees. The pesticides were suspected to be chlordane, DDE, and heptachlor. The trench was suspected to be along the perimeter road on the northwest corner of Fort Buchanan. SWMU 3 is located just south of the CPR facility and the locations where TCE was first detected in groundwater. Therefore, the SWMU was considered a potential source area for the TCE contamination found at the CPR facility, and a review of historic activities and documents relating to the site was conducted in an effort to locate the suspected trench.

In 1980, the PRASA installed a potable water supply main across the installation near SWMU 3. The main is 66 inches in diameter, buried 10 ft bgs, and is supported by packed gravel underlayment. In 1983 the USATHAMA advanced and sampled soil from 17 shallow borings and one deep boring in the vicinity of SWMU 3. No firm evidence for the burial of pesticides was found during either of these activities. Subsequently, geophysical surveys using ground conductivity (quadrature, in-phase) and magnetic (total magnetic field, magnetic gradient) techniques were conducted. A copy of the 1984 USATHAMA report is included in Appendix F and Figure 3-2 shows the area included in the investigation.

In 1990, the PREQB completed a RFA of Fort Buchanan. On the basis of this RFA, the USEPA determined there was potential for risk at SWMU 3. Consequently, in 1992-93, the USACE-WES collected fifty-two soil samples from eight test pits (Figure 3-2, Llopis 1992 and Llopis 1993). No evidence of large-scale pesticide disposal or a burial trench was found. Low concentrations of DDT (to a maximum 3.28 ug/g) were found in composite samples from a depth of 4 ft on the northern end of one of the test pits. In July 1995 the USEPA indicated their acceptance of the findings presented in the 1993 WES report, including the recommendation of no further action (NFA) at the site, via a letter to the Deputy Installation Commander. A copy of the 1993 WES report, the USATHAMA report, and the USEPA acceptance letter are included in Appendix F. In response to the RFA, and in support of the Army Base Realignment and Closure Program, an Environmental Baseline Survey Report was published in 1997 (Woodward-Clyde 1997). This document is also included in Appendix F.

Despite USEPA acceptance of the findings of the 1993 WES report, it was recommended that the Fort Buchanan RFI Work Plan incorporate an investigation of the TCE contamination of the water table aquifer and a deeper semi-confined aquifer that is known to be present on the adjacent property to the north occupied by CPR. Thus, a RFI specifically for the groundwater of the NWBA was planned and executed (EA 2012). The NWBA RFI included groundwater data generated from wells located throughout the NWBA and off-post. Six of the NWBA monitoring wells were installed in the vicinity of the suspected burial trench and are included in this Site Wide RFI.

The Site Wide RFI addresses Site 2 with respect to the pesticides and chemicals burial trench; this RFI does not address the TCE plume. Therefore, only samples located in the vicinity of the suspected burial trench are included with Site 2 in this RFI (Figure 3-2).

5.2.2 Subsurface Soil

A series of soil borings were drilled and sampled during installation of six monitoring wells. A total of eight samples were collected and were analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, metals, sulfide, and total petroleum hydrocarbons. The results of the soil samples are summarized in Table 5-4 and Figure 5-3.

No SVOCs, pesticides, PCBs, or herbicides were detected above residential RSLs in the soil samples, and neither PCE nor TCE were detected in any of the soil samples. One sample from boring 4 (4-8 ft) had a concentration of ethylbenzene (18,600 ug/kg) that was greater than the residential RSL of 5,400 ug/kg but less than the industrial RSL of 27,000 ug/kg. This sample also had detected concentrations of TPH-DRO (136 mg/kg) and TPH-GRO (515 mg/kg) that were greater than the PREQB-recommended screening criteria of 100 mg/kg. No organic compounds were found at concentrations above industrial screening levels (Table 5-4).

Four inorganic analytes had concentrations above the residential and industrial RSLs: arsenic, chromium, and cobalt. Each of the shallow subsurface soil samples, taken between 4 and 8 ft bgs, had concentrations of arsenic that were greater than the residential and industrial RSLs (0.39 and 1.6 mg/kg respectively). Concentrations of arsenic in these samples ranged from 34.1 mg/kg to 61.8 mg/kg. Arsenic was not detected in any of the deep samples (>20 ft bgs) except the sample collected from boring 4, where a concentration of 4.7 mg/kg was found.

Vanadium was also detected at concentrations greater than the residential RSL of 39 mg/kg in all of the shallow subsurface soil samples and the deep sample at boring 4. None of the detected concentrations were greater than the industrial RSL of 520 mg/kg.

The industrial RSL for cobalt (30 mg/kg) was exceeded by the concentration detected in one sample (boring 3, 4-8 ft, 37.7 mg/kg), while the residential RSL (2.3 mg/kg) was also exceeded by the cobalt concentrations detected in both samples from boring 4 (concentrations of 21.1 and 9 mg/kg). The industrial and residential RSLs for chromium (0.29 and 5.6 mg/kg respectively) were exceeded by all detected concentrations.

Concentrations of three VOCs and three SVOCs detected in the shallow sample from boring 4 were greater than the USEPA protection of groundwater SSLs: ethylbenzene, isobutyl alcohol, total xylenes, 2-methylnaphthalene, benzo(a)anthracene, and naphthalene. Of these compounds, ethylbenzene, total xylenes, and naphthalene were detected in groundwater at Site 2, and maximum concentrations of ethylbenzene and naphthalene (found in a sample from MW-4B) were greater than tap water RSLs. Two subsequent samples were collected from this well and analyzed for VOCs; concentrations of ethylbenzene were below the tap water RSL.

Arsenic, cadmium, chromium, cobalt, copper, mercury, and vanadium were detected at concentrations above the USEPA protection of groundwater SSLs. Of these metals, only chromium and mercury were detected in groundwater at Site 2. All detected concentrations of mercury were below the tap water RSL, while the maximum detected concentration of total chromium was greater than the tap water RSL, but below the MCL.

Background data are available for surface soil (Section 3.1.15) and while these data are not directly comparable to subsurface soil, they can be used to generally characterize whether or not the onsite concentrations are similar to background concentrations. Each of the four metals with concentrations greater than residential or industrial screening levels (arsenic, chromium, cobalt, vanadium) also had some concentrations that were greater than the 95% UPL of background data (Figure 5-3). As a frame of reference for the magnitude of background exceedances, only the maximum concentration of cobalt (37.7 mg/kg) was more than twice its background UPL (16.6 mg/kg).

5.2.3 Groundwater

Groundwater samples were collected from six wells at Site 2 as part of the NWBA RFI: MW-01, MW-02, MW-03A, MW-03B, MW-04A, and MW-04B. The first round of samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals and subsequent rounds were analyzed for VOCs and TPH (in August 2010 only). The results of these sampling events are summarized in Table 5-5 and Figure 5-4.

No pesticides, PCBs, herbicides, or TPH were detected in any of the groundwater samples, and neither PCE nor TCE was detected. Two VOCs, benzene and ethylbenzene were found in early samples from well cluster MW-4 at concentrations above the tap water screening levels of 0.41 and 1.5 ug/L respectively. The elevated concentrations of benzene ranged from 0.49-0.93 ug/L and the one elevated concentration of ethylbenzene was 3.9 ug/L. Samples collected in later phases did not report elevated concentrations of these VOCs. Naphthalene was found at an elevated concentration (1.51 ug/L) in one sample; the tap water RSL for this compound is 0.14 ug/L.

Barium is the only metal detected in the dissolved phase, and its one detected concentration was below the tap water RSL. Total chromium was detected in one sample at 19.8 ug/L, which is above the tap water RSL of 0.043 ug/L but below the MCL of 100 ug/L.

Data from the Site 2 wells were evaluated in the NWBA RFI and HHRA. They are located approximately 450 meters west, and cross-gradient of the suspected source area for the TCE plume identified in the NWBA RFI. They are located outside the identified plume extent. Few elevated concentrations of chemicals were identified in these wells, and Site 2 was not identified as a potential source area for groundwater contamination. In fact, TCE has been identified as the primary groundwater contaminant, and neither it nor any of its daughter products were detected in the groundwater samples from Site 2. As noted in Section 5.2.2, some metals, VOCs, and SVOCs were found in subsurface soil at concentrations above protection of groundwater soil screening levels. However, the groundwater data generated for these specific wells, and for the aquifer as a whole, do not indicate that these compounds are associated with a contaminant plume.

The NWBA RFI included an evaluation of the potential for contaminated groundwater to adversely impact other media, such as surface water and air. No impacts to surface water from the groundwater plume were found. Potential concerns for the commercial worker and off-post resident exposure to groundwater were identified in the HHRA completed for the NWBA RFI. The primary contributor to groundwater concerns (via all exposure routes) is TCE originating from an unidentified source east of Site 2, and Site 2 is not contributing to the potential risks. These concerns are being addressed in a CMS prepared specifically for the NWBA.

5.2.4 Site 2 Nature and Extent Summary

Extensive investigation had been completed at Site 2 prior to initiation of the Site Wide RFI. The previous investigations included the advancement of 18 soil borings, collection of 52 soil samples from eight test pits, and the completion of a geophysical survey. Despite these efforts, no evidence of a disposal area was found, and in 1995 the USEPA concurred with a recommendation for NFA at the site (Appendix F). When elevated concentrations of TCE were found in groundwater under the CPR facility, immediately north of the Site, additional investigation was completed as part of the NWBA RFI in an effort to determine whether or not Site 2 was a source for the TCE. This produced the groundwater and subsurface soil data evaluated in the current Site Wide RFI. Site 2 was not identified as a source of TCE for the groundwater plume, and the current data (including the results of the HHRA and BERA summarized in Section 7) indicate that organic compounds are not a concern in soil or groundwater at Site 2, with the possible exception of elevated concentrations of TPH found in sample SB-03-06-04-(4-8). The elevated TPH concentrations are bounded vertically as TPH was not detected in the subsurface soil sample from this location; they are bounded to the north by PR-28, and to the west by boring 3. The concentrations are not bounded to the south or east, although it should be noted that the finding of TPH in surface soil immediately south of a refinery and on the edge of a road at a sharp turn where vehicle accidents are, at least anecdotally, relatively common, suggests that their source may not be limited to historic onsite activities. Furthermore, TPH was not detected in groundwater samples, indicating that migration through the soil column into groundwater is not occurring.

Some metals were found at concentrations above residential and industrial human health screening levels and the 95% UPL of background. Elevated concentrations of metals are not bounded within Site 2, although they are consistent with concentrations found at sites around the former DPW area (to the immediate northeast). As noted in the Nature and Extent discussions for Sites 3, 9, and 11, particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

5.3 SITE 3, SWMU 4: SPENT SOLVENTS STORAGE AREA

Site 3 consists of an asphalt covered area on the southwest portion of the Building 556 yard where several 55-gallon drums containing spent solvents were stored. Nine subsurface soil and six groundwater samples (including duplicates) were collected from Site 3 (Figure 3-1). Tables 5-6 and 5-7 and Figures 5-5 and 5-6 present a summary of the sample results.

5.3.1 Subsurface Soil

Because the site is covered with asphalt, surface soil is not present. Soil samples were collected by drilling through the asphalt and collecting soil from 1-2 ft bgs and 2-4 ft bgs at four locations. Subsurface soil samples were analyzed for VOCs, SVOCs, organochlorine and organophosphorus pesticides, herbicides, total petroleum hydrocarbons, and metals. VOCs, herbicides, organochlorine pesticides, metals, and TPH-DRO were detected in at least one sample. SVOCs and TPH-GRO were not detected in any of the samples. No organic compounds were detected at concentrations above residential or industrial screening levels.

Eight metals were detected at concentrations above residential screening levels: aluminum, arsenic, chromium, cobalt, iron, manganese, thallium, and vanadium. Almost all of the detected concentrations of these metals were greater than the residential screening levels. Six metals were detected at concentrations above industrial screening levels: arsenic, chromium, cobalt, iron, manganese, and thallium. Concentrations of arsenic and chromium found at all locations were elevated while concentrations of cobalt, manganese, and thallium were only elevated at boring 1, and iron was elevated in the 2-4 ft deep samples collected at borings 1, 2, and 3 (Table 5-6).

Antimony, arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, silver, thallium, vanadium, DDD, alpha-chlordane, dieldrin, gamma-chlordane, heptachlor, and pentachlorophenol were detected at concentrations above the USEPA protection of groundwater SSLs. Of these compounds, chromium, iron, and manganese were detected in groundwater at Site 3, and only the maximum detected concentration of total chromium was greater than the tap water RSL, but below the MCL.

When considered with respect the 95% UPL of background data numerous metals had concentrations greater than background. The six metals with concentrations above industrial screening levels were all detected at concentrations above background (Figure 5-5). As a frame of reference for the magnitude of background exceedances, the maximum concentrations of arsenic, chromium, and iron, and the two highest concentrations of manganese and thallium, were more than 2 times higher than their background UPLs.

5.3.2 Groundwater

MW-5A and MW-5B were installed along the perimeter road just northwest of Site 3 (Figure 5-6) as part of the NWBA RFI. The first round of samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals and subsequent rounds were analyzed for VOCs and TPH (in August 2010 only). VOCs, SVOCs, and total concentrations of metals were detected in the samples.

TCE was detected in all three samples from MW-5A, and all concentrations were greater than the tap water screening level of 2.0 ug/L. The maximum concentration (5.5 ug/L) was greater than the MCL of 5 ug/L. Chloroform was detected in one sample from MW-5A, and the concentration (0.31 ug/L) was greater than the screening level of 0.19 ug/L. A subsequent sample was non-detect for chloroform. No other compounds were detected at concentrations above screening levels in MW-5A.

VOCs were not detected in MW-05B; however, the SVOCs 1,4-dichlorobenzene and naphthalene were detected in one sample (07-JA-09-DP) at concentrations greater than the screening levels of 0.43 ug/L and 0.14 ug/L respectively. Total chromium was detected in the same sample (07-JA-09-DP, 10.5 ug/L) at a concentration above its tap water screening level (0.043 ug/L) but below its MCL (100 ug/L). These analytes were not detected in the parent sample associated with this field duplicate.

Data from wells MW-5A and MW-5B were evaluated as part of the NWBA RFI and HHRA. They are located approximately 300 meters west, and cross-gradient, of the suspected source area for the TCE plume identified in the NWBA RFI. They are located at the very edge of the delineated extent of the plume. While elevated concentrations of two VOCs, two SVOCs, and one inorganic were identified in these wells, Site 3 was not identified as a potential source area for groundwater contamination. As noted in Section 5.3.2, some metals, pesticides, and one herbicide were found in subsurface soil at concentrations above protection of groundwater SSLs. However, no herbicides or pesticides were detected in the groundwater samples from MW-5A and MW-5B, and overall groundwater contamination from pesticides, herbicides, and metals was not identified in the NWBA RFI.

The NWBA RFI included an evaluation of the potential for contaminated groundwater to adversely impact other media, such as surface water and air. No impacts to surface water from the groundwater plume were found. Potential concerns for the commercial worker and off-post resident exposure to groundwater were identified in the HHRA completed for the NWBA RFI. The primary contributor to groundwater concerns (via all exposure routes) is TCE originating from an unidentified source east of Site 3. These concerns are being addressed in a CMS prepared specifically for the NWBA.

5.3.3 Site 3 Nature and Extent Summary

Organic compounds were not detected at concentrations above residential or industrial screening levels in subsurface soil from Site 3. Metals, however, were found at concentrations greater than both screening levels and greater than the 95% UPL of background data. In particular, some concentrations of arsenic, chromium, iron, manganese, and thallium were found to be more than twice the UPL of background data, and sample S-03-08-02-2-4 had some of the highest concentrations. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved area. To the immediate west is the boundary road and PR-28, to the south/southeast is Site 11 (and Site 2 is farther south), and other buildings were located to the north and east. It should be noted that demolition of the buildings within the former DPW area is expected, as the current future land use for the area is a solar panel bank. As noted in the Nature and Extent discussions for Sites 2, 9, and 11, particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

TCE is the primary compound found at elevated concentrations in groundwater. Groundwater underlying Site 3 was fully evaluated in the NWBA RFI and associated HHRA. Site 3 was not identified as a potential source area for groundwater contamination, and it is located just within the western edge of the plume. Concerns regarding the potential risks to receptors from exposure to contaminated groundwater are being addressed in a CMS prepared specifically for the NWBA.

5.4 SITE 4, SWMU 5: PCB TRANSFORMER STORAGE AREA #1

Site 4 consists of an area where PCB transformers were stored on asphalt immediately north of the former DPW building (Figure 3-1). Surface soil and groundwater samples were collected from Site 4. Groundwater samples were collected as part of the NWBA RFI; and the groundwater underlying this site was fully evaluated in that RFI. Tables 5-8 and 5-9 and Figure 5-7 summarize the concentrations of compounds detected in the samples and Figure 3-1 shows the sample locations.

5.4.1 Surface Soil

Six surface soil samples were collected and analyzed for PCBs; no PCBs were detected in any of the samples (Table 5-8).

5.4.2 Groundwater

Two monitoring wells installed for the NWBA RFI are located in the vicinity of the Site (Figure 5-7), and the data from these wells are included in this RFI. Six ground water samples were collected during three rounds of sampling. Samples collected during the first round were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals. Samples collected during the second and third rounds were analyzed for VOCs only.

Organic compounds were not detected in any samples from MW-10A and MW-10B (Table 5-9). Dissolved and total concentrations of chromium were greater than the tap water RSL but less than the MCL. Dissolved concentrations of chromium were 2 and 5.1 ug/L; total concentrations were 4.7 ug/L and 1.5 ug/L. The tap water screening level for chromium is 0.043 ug/L and the MCL is 100 ug/L.

Data from the Site 4 wells were evaluated in the NWBA RFI and HHRA. They are located approximately 150 meters west, and cross-gradient of the suspected source area for the TCE plume identified in the NWBA RFI. VOCs were not detected in any of the groundwater samples, and this site is located outside the identified plume extent. Metals were detected in the groundwater samples; however, the groundwater data generated for the aquifer as a whole do not indicate that metals are associated with a contaminant plume.

5.4.3 Site 4 Nature and Extent Summary

PCBs were the anticipated site related COPCs based on site history. PCBs were not detected in soil or groundwater samples; this suggests that storage of PCB transformers at the site did not result in environmental contamination. In addition, the data indicate that Site 4 is not contributing to groundwater contamination in the NWBA.

5.5 SITE 5, SWMU 6: PCB TRANSFORMERS STORAGE AREA #2

Site 5 consists of a 100 sq ft facility south of the DPW building that was used in the early 1980s to store transformers. The facility has a concrete floor, is now occupied by a metal structure, and is surrounded by an asphalt work area. Four soil samples were collected from two borings at the site. Because the site is covered with concrete, surface soil is not present. Soil samples were collected by drilling through the concrete and collecting soil from 1-2 ft bgs and 2-4 ft bgs. Samples were analyzed for PCBs. No PCBs were detected in any samples (Table 5-10). Figure 3-1 shows the sample locations.

5.6 SITE 6: PESTICIDE STORAGE AREA

Site 6 consists of a pesticide and herbicide mixing area located on a 5-by-5 ft concrete slab north of Building 138 (Figure 3-3). Four surface soil (including one duplicate) and three subsurface soil samples were collected around the concrete slab. Three sediment samples were collected from the drainage ditch leading away from the slab. On 2 December 2008, the site was sampled for pesticides and herbicides. However, the organophosphorous pesticides fraction was mistakenly submitted to a laboratory not outlined in the QAPP. Consequently, the organophosphorous pesticides fraction was resampled on 4 February 2009 and submitted to the laboratory outlined in the QAPP.

Tables 5-11, 5-12, and 5-13 present the concentrations of analytes detected in surface soil, subsurface soil, and sediment samples respectively, and Figure 5-8 summarizes exceedances of screening levels.

5.6.1 Surface Soil

Four pesticides and one herbicide were detected at least once in the surface soil samples. No compounds were detected at concentrations above human health screening levels. Pentachlorophenol, an herbicide and insecticide that is used for preserving wood, was detected in three of the four samples at concentrations above the ecological screening level of 2 ug/kg (Table 5-11). Detected concentrations ranged from 2-5.6 ug/kg. DDE was detected in one sample, and the concentration (9.8 ug/kg) was greater than the ecological screening level of 2.5 ug/kg and the background comparison value of 3.37 ug/kg. No other compounds were detected at concentrations above screening levels.

5.6.2 Subsurface Soil

Two pesticides and one herbicide were detected at least once in the subsurface soil samples. No compounds were detected at concentrations above human health screening levels (Table 5-12). Alpha- and gamma-chlordane were detected at boring 3, and the detected concentrations, 16.8 ug/kg and 18.2 ug/kg respectively, were greater than the protection of groundwater SSL of 13 ug/kg. Pentachlorophenol was detected at borings 1 and 2 and the concentrations (14 and 8.5 ug/kg respectively) were greater than the protection of groundwater SSL of 1.7 ug/kg.

Groundwater data were not generated for Site 6 because it was not identified as a media of concern during the RFI planning process. Therefore the potential for impacts to groundwater from the detected concentrations of alpha-chlordane, gamma-chlordane, and pentachlorophenol is uncertain. However, these organic compounds were detected in surface and subsurface soil at Sites 1 and 3, which overlay the NWBA, at concentrations above the protection of groundwater SSLs. Detected concentrations of alpha-chlordane ranged from 2.4 ug/kg to 221 ug/kg; detected concentrations of gamma-chlordane ranged from 2.8 ug/kg to 244 ug/kg, and detected concentrations of pentachlorophenol ranged from 3.7 ug/kg to 57.8 ug/kg. Alpha-chlordane, gamma-chlordane, and pentachlorophenol were not detected in the groundwater samples collected from Sites 1 and 3, nor were they detected in any of the other groundwater samples collected for the NWBA RFI. This suggests that the concentrations of these organics found at Site 6 are highly unlikely to result in impacts to groundwater.

5.6.3 Sediment

A drainage ditch is present at Site 6 that collects water during rain events. This ditch is intermittently wet and therefore is not expected to provide habitat for aquatic organisms. Three samples were collected from this drainage ditch and were analyzed for organochlorine pesticides, organophosphorus pesticides, and herbicides. Four pesticides were detected in the sediment samples (Table 5-13), and none of the detected concentrations were above human health screening levels.

The one detected concentration of DDE (6.9 ug/kg) was greater than the ecological screening level of 3.3 ug/kg, and all detected concentrations of alpha-chlordane (16.5 and 69 ug/kg) and gamma-chlordane (10.4 and 40.5 ug/kg) were greater than the ecological screening levels of 1.7 ug/kg. It is important to note that surface water flow at Site 6 is to the southeast. Therefore, sample location 3 is upgradient of the building, location 2 is adjacent to the building, and location 1 is downgradient of the building (Figure 5-8). The highest concentrations of pesticides were found at location 3, upgradient of the building, while no analytes were detected in the most downgradient location. This suggests that the pesticides are not originating from the Site.

5.6.4 Site 6 Nature and Extent Summary

One herbicide and a few pesticides were detected in soil and sediment at Site 6. None of the detected concentrations were above human health screening levels, but concentrations of pentachlorophenol and DDE found in surface soil and concentrations of DDE, alpha-chlordane, and gamma-chlordane in sediment were greater than ecological screening levels. The pesticides found in sediment do not appear to be originating from the Site, as the highest concentrations were found upgradient of the building. The pentachlorophenol found in surface soil is bounded to the west by the building and to the north and east by the samples collected in the drainage ditch.

Pentachlorophenol, alpha-chlordane, and gamma-chlordane were detected in subsurface soil at concentrations above the protection of groundwater SSLs. Groundwater data are not available for Site 6; however, higher concentrations of these analytes were detected at Sites 1 and 3, and none of them were detected in groundwater samples from those Sites. This suggests that the concentrations of these organics found at Site 6 are highly unlikely to result in impacts to groundwater.

5.7 SITE 7: BUILDING 541

Building 541 historically housed a hazardous material storage area, with a 55-gallon drum containment system located immediately north of the building. A secondary containment system consisted of a concrete berm with an open PVC pipe extending to the north. The area around the containment system is grass, relatively flat, and has no visible staining on the ground surface. One surface soil and two subsurface soil samples were collected from one location at the Site. In addition, two groundwater samples were collected from a well installed as part of the NWBA RFI and one groundwater sample was collected from a temporary point installed as part of the Site Wide RFI.

Tables 5-14, 5-15, and 5-16 present the concentrations of analytes detected in surface soil, subsurface soil, and groundwater samples respectively, and Figures 5-9 and 5-10 summarize exceedances of screening levels .

5.7.1 Surface Soil

One surface soil sample was collected adjacent to and downgradient of the PVC overflow pipe.

The sample was analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals. Acetone, two SVOCs, four pesticides, TPH-DRO, and numerous metals were detected in the sample. None of the organic compounds were found at concentrations greater than human health screening levels. The concentrations of the four pesticides (DDD, DDE, DDT, and dieldrin) were greater than ecological screening levels and background comparison values.

Aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium were detected at concentrations above residential screening levels. Concentrations of arsenic (43.8 mg/kg) and chromium (102 mg/kg) were also above industrial screening levels. The concentration of arsenic detected onsite was equal to the background UPL and the concentration of chromium was one and a half times greater than the background UPL.

Aluminum, arsenic, chromium, copper, iron, manganese, selenium, vanadium, and zinc were detected at concentrations above ecological screening levels. Of these metals, concentrations of chromium (102 mg/kg), selenium (1.7 mg/kg), and vanadium (163 mg/kg) were also above their background UPLs (69.8, 1, and 145 mg/kg, respectively). As a frame of reference for the magnitude of background exceedances, all of the onsite concentrations were less than twice the background UPL.

5.7.2 Subsurface Soil

One subsurface soil sample and a field duplicate were collected from the boring located adjacent to and downgradient of the PVC overflow pipe from 2-4 ft bgs. The samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals. No pesticides, PCBs, SVOCs, or herbicides were detected in the samples (Table 5-15). Two VOCs (1,1-dichloroethene and acetone) and TPH-DRO were detected, and none of the detected concentrations were greater than human health or ecological screening levels.

Aluminum, arsenic, chromium, cobalt, iron, manganese, mercury, and vanadium were detected at concentrations above the residential screening levels. Concentrations of arsenic (7.2 and 7.9 mg/kg) and chromium (13.7 and 15.7 mg/kg) were also above industrial screening levels, but were below their background comparison values (Figure 5-9).

Arsenic, chromium, cobalt, iron, manganese, mercury, and selenium were found at concentrations above protection of groundwater SSLs. Of these metals, arsenic and cobalt were detected in groundwater at Site 7. All detected concentrations of both metals were above tap water RSLs. Concentrations of arsenic were below its MCL and a MCL is not available for cobalt.

5.7.3 Groundwater

Groundwater samples were collected from two wells at Site 7 as part of the NWBA RFI, MW-19A and MW-19B. The first round of samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals and subsequent rounds were analyzed for VOCs. MW-19B was installed in a confined, deep aquifer and may not be representative of the shallow water table; MW-19A was installed in a shallower aquifer, and has a total depth of 36 ft. To help characterize any groundwater impacts in this area, an examination of MW-19A analytical results may be relevant. Data for MW-19B are presented in Table 5-16 for informational purposes, but may not be representative of the shallow water table.

A temporary well point was installed as part of the Site Wide RFI field effort, and the sample collected from this well was analyzed for VOCs, pesticides, PCBs, and herbicides. The groundwater results for Site 7 are summarized in Table 5-16 and Figure 5-10. Acetone was the only organic compound detected; it was detected in sample G-07-09-01, and the concentration (16 ug/L) was well below the tap water screening level of 2,200 ug/L.

Total and dissolved cobalt were detected in G-03-08-MW19A at concentrations of 5.4 and 2.3 ug/L respectively, which are greater than the screening level of 1.1 ug/L. This is the only metal detected at a concentration above screening levels from MW-19A, which best represents the shallow aquifer (and thus is the better indicator of site-related impacts).

Total and dissolved cobalt and arsenic were detected at concentrations above screening levels in MW-19B, although data from this well characterizes the deep aquifer rather than the shallow aquifer, and may not represent site-specific impacts.

Data from the Site 7 monitoring wells (MW-19A and MW-19B) were evaluated in the NWBA RFI and HHRA. They are located approximately 350 meters southeast, and upgradient of the suspected source area for the TCE plume identified in the NWBA RFI. Site 7 is located outside the identified plume extent and Site 7 was not identified as a potential source area for groundwater contamination. In fact, TCE has been identified as the primary groundwater contaminant, and neither it nor any of its daughter products were detected in the groundwater samples from Site 7. As noted in Section 5.7.2, some metals were found in subsurface soil at concentrations above protection of groundwater soil screening levels. However, the groundwater data generated for these specific wells, and for the aquifer as a whole, do not indicate that metals contamination is a concern for the groundwater of the NWBA.

5.7.4 Site 7 Nature and Extent Summary

Organic compounds were not detected in any media at concentrations above human health screening levels. Pesticides were found in surface soil at concentrations above ecological screening levels. No other organic compounds were found at concentrations above ecological screening levels.

Concentrations of arsenic and chromium in surface and subsurface soil were greater than industrial screening levels; however the concentrations were less than or similar to background. Similarly, concentrations of nine metals in surface soil were greater than ecological screening levels, but only three of the metals had concentrations that were slightly greater than background.

Data for shallow groundwater at Site 7 suggest that notable contamination is not present. In addition, groundwater underlying Site 7 was fully evaluated in the NWBA RFI and associated HHRA. Site 7 was not identified as a potential source area for groundwater contamination, and the site is located outside and upgradient of the plume and suspected source area.

5.8 SITE 8: BUILDING S-563

Building S-563 (Figure 3-1) was used as an automobile body shop and a hobby shop, and is currently a workout room for the National Guard. Discarded car parts have been observed in storm drains immediately to the west of the building, and the building itself discharges into concrete storm water junction boxes located on the east side of the building. Building S-563 is surrounded by an asphalt parking lot.

Two soil borings were installed through the asphalt at the end of each of two storm water sumps (Figure 3-1). Four subsurface soil samples were collected from the two locations, and one groundwater sample was collected from a well located at the site (MW-23) that was installed as part of the NWBA RFI (EA 2012).

Tables 5-17 and 5-18 present the concentrations of analytes detected in the soil and groundwater samples collected at Site 8, and Figures 5-11 and 5-12 display sample locations and concentrations exceeding screening levels.

5.8.1 Subsurface Soil

Subsurface soil samples were analyzed for VOCs, SVOCs, TPH, and metals. VOCs, metals, and TPH-DRO were detected in at least one of the samples. All of the VOCs were found at concentrations below residential and industrial screening levels (Table 5-17).

All detected concentrations of aluminum (16,700-31,800 mg/kg), iron (19,600-49,400 mg/kg), manganese (191-2,050 mg/kg), vanadium (70.2-139 mg/kg), and three of the detected concentrations of cobalt (8.8-17.4 mg/kg) and thallium (0.23-0.65 mg/kg) were above residential screening levels but were less than industrial screening levels.

All detected concentrations of arsenic (11.9-33.7 mg/kg), chromium (42.3-66.3 mg/kg) and the maximum concentration of cobalt (56.6 mg/kg) were greater than both residential and industrial screening levels. Of these three metals, only the maximum concentration of cobalt was greater than the 95% UPLs of background data; all detected concentrations of arsenic and chromium are below background (Figure 5-11).

Arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, and thallium were found at concentrations above the protection of groundwater SSLs (Table 5-17). Of these metals, chromium, cobalt, iron, and manganese were detected in groundwater at Site 8. Total and dissolved concentrations of chromium, cobalt, and manganese were above tap water RSLs. Concentrations of chromium were below its MCL and MCLs are not available for cobalt or iron.

Field observations during the sampling activities included a light to moderate petroleum odor during the installation of Boring 1 (20 parts per million [ppm] registered on the photoionization detector [PID]). TPH were not detected in samples from this boring. On 28 January 2009, while collecting the deep sample from Boring 2, a moderate petroleum odor was detected (maximum PID reading was 200 ppm). TPH-DRO was detected at 129 mg/kg in the shallow sample (1-2 ft bgs) from Boring 2, and at a concentration of 87.4 mg/kg in the deep sample (4-6 ft bgs). The PREQB recommended criteria for TPH is 100 mg/kg.

During the 22 October 2008 sampling effort it appeared that the sumps contained overflow from the sanitary sewer system, as the sumps were observed filling while the shower was running inside the building. However, a follow-up site visit by Fort Buchanan DPW personnel on 19 June 2009 concluded that there was no connection between the sumps and the shower drains, after several gallons of water were flushed down the drains. Army Reserve personnel confirmed that the interior plumbing had been re-done and that such a connection does not exist.

5.8.2 Groundwater

Two groundwater samples were collected from monitoring well MW-23, which was installed as part of the NWBA RFI. This well is located along the north side of Building S-563, is 33 ft deep, and has been sampled twice. In May 2008, MW-23 was sampled for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals. In January 2009 the well was sampled for VOCs only.

No organic compounds were detected in any samples from MW-23.

Dissolved concentrations of chromium (1.1 ug/L), cobalt (2.8 ug/L), manganese (321 ug/L), and vanadium (1.6 ug/L) were detected at concentrations greater than the tap water screening levels.

Total concentrations of these metals were also greater than the tap water screening levels (Table 5-18 and Figure 5-12).

Data from the Site 8 monitoring well were evaluated in the NWBA RFI and HHRA. The well is located approximately 150 meters south, and upgradient, of the suspected source area for the TCE plume identified in the NWBA RFI. Site 8 is located outside the identified plume extent. Few elevated concentrations of chemicals were identified in this well, and Site 8 was not identified as a potential source area for groundwater contamination. In fact, TCE has been identified as the primary groundwater contaminant, and neither it nor any of its daughter products were detected in the groundwater samples from Site 8. As noted in Section 5.7.2, some metals were found in subsurface soil at concentrations above protection of groundwater soil screening levels. However, the groundwater data generated for this specific well, and for the aquifer as a whole, do not indicate that metals contamination is a concern for the groundwater of the NWBA.

5.8.3 Site 8 Nature and Extent Summary

Organic compounds were not found at elevated concentrations in either soil or groundwater, with the exception of TPH-DRO detected at 129 mg/kg in one soil sample. Arsenic, chromium, and cobalt were found in soil at concentrations greater than both residential and industrial screening levels, although only the maximum concentration of cobalt was greater than background. Elevated concentrations of chromium and cobalt were also observed in the groundwater samples, but were not found to be associated with broader groundwater contamination of the NWBA aquifer (EA 2012).

5.9 SITE 9: USED OIL STAGING AREA

Site 9 consists of a former used oil staging area south of Building T-552 (DPW yard, Figure 3-1). During an inspection conducted as part of the EBS (Woodward-Clyde 1997), eight 55-gallon drums of used oil were observed. The ground surface is covered with gravel. Seven subsurface soil samples (including one duplicate) were collected from three locations at Site 9. Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, TPH, and metals. Table 5-19 presents the concentrations of analytes detected in the samples, and Figure 5-13 displays sample locations and concentrations exceeding screening levels.

VOCs, metals, and TPH-DRO were detected in at least one of the samples. None of the detected concentrations of VOCs or TPH-DRO were greater than residential or industrial screening levels.

All concentrations of aluminum (14,600-23,400 mg/kg), four concentrations of cobalt (2.5-24 mg/kg), three concentrations of iron (37,900-61,900 mg/kg), three concentrations of manganese (592-2,110 mg/kg), and all concentrations of vanadium (140-232 mg/kg) were found to be greater than the residential screening levels but less than the industrial screening levels.

All concentrations of arsenic (35.7-239 mg/kg) and chromium (35.4-184 mg/kg), the two highest concentrations of cobalt (104 and 32.7 mg/kg), the four highest concentrations of iron (76,000-127,000 mg/kg), and the maximum concentration of manganese (7,150 mg/kg) were found to be greater than the residential and industrial screening levels (Table 5-19). Of these elevated concentrations, most were also greater than background UPLs (Figure 5-13).

Arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, and vanadium were detected at concentrations above protection of groundwater SSLs. Groundwater data were not generated specifically for Site 9, although numerous wells were installed in the vicinity of the former DPW area as part of the NWBA RFI (Figure 1-1). Groundwater was fully evaluated in the NWBA RFI, and broad metals contamination was not identified, nor was Site 9 considered a potential source area for any kind of groundwater contamination.

5.9.1 Site 9 Nature and Extent Summary

Organic compounds were not detected at concentrations above residential or industrial screening levels in subsurface soil from Site 9. Metals, however, were found consistently at concentrations greater than both screening levels and greater than the 95% UPL of background data. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved/gravel area (Figure 3-1). As noted in the Nature and Extent discussions for Sites 2, 3, and 11, particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

5.10 SITE 10: 65TH ARMY RESERVE COMMAND REFUELING AREA

Site 10 consists of an area where a spill occurred in May 1995. Stained soil was removed and the area was later covered with a 3-6 ft thick concrete pad. The pad is surrounded by a gravel and packed earth yard (Figure 3-1). Surface soil, subsurface soil, and groundwater samples were collected at three locations around the pad. The groundwater samples were collected from a monitoring well installed as part of the NWBA RFI that is downgradient of the pad (MW-20). Tables 5-20 through 5-22 present the concentrations of compounds detected in the samples and Figure 5-14 displays sample locations and concentrations exceeding screening levels.

5.10.1 Surface Soil

Three surface soil samples were collected and analyzed for VOCs and TPH (Table 5-20). Acetone and TPH-DRO were detected, but none of the concentrations were greater than screening levels.

5.10.2 Subsurface Soil

Three subsurface soil samples were collected and analyzed for VOCs and TPH (Table 5-21). Acetone and carbon disulfide were detected, but none of the concentrations were greater than screening levels.

5.10.3 Groundwater

Two groundwater samples were collected from monitoring well MW-20 as part of the NWBA RFI (EA 2012). In May 2008, MW-20 was sampled for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals. In January 2009 the well was sampled for VOCs.

TCE was detected in both samples, although the concentrations were below the tap water screening level of 2 ug/L. No other organic compounds were detected in the samples (Table 5-22). Total and dissolved concentrations of arsenic, chromium, and manganese were greater than tap water screening levels.

Data MW-20 were fully evaluated in the NWBA RFI and HHRA. This well is located approximately 100 meters east of the suspected source area for the TCE plume identified in the NWBA RFI, and is on the very edge of the identified plume extent. Site 10 was not identified as a potential source area for groundwater contamination. Three metals were detected at elevated concentrations in groundwater at this well, but were not found to be associated with broader groundwater contamination of the NWBA aquifer (EA 2012).

5.10.4 Site 10 Nature and Extent Summary

Organic compounds were not detected at concentrations above residential or industrial screening levels in any media at Site 10. This Site is located on the eastern edge of the identified plume extent, and was not identified as a source area. Three metals were detected at elevated concentrations in groundwater, but were not found to be associated with broader groundwater contamination of the NWBA aquifer (EA 2012).

5.11 SITE 11: HEAVY EQUIPMENT STORAGE AREA

Site 11 consists of an asphalt-covered area southwest of the former DPW building (T-552) that was used as a heavy equipment storage area. Evidence of the release petroleum products from the equipment was observed during the EBS (Woodward-Clyde 1997). Because the site is covered with asphalt, surface soil is not present. Soil samples were collected by drilling through the asphalt and collecting soil from 2-4 ft bgs at four locations. Samples were analyzed for VOCs, PCBs, TPH, and metals. Table 5-23 presents the concentrations of compounds detected in the samples, and Figure 5-15 presents the sample locations and chemical concentrations exceeding screening levels.

No organic compounds were detected at concentrations above screening levels.

All concentrations of aluminum (20,600-25,300 mg/kg), cobalt (4.3-23.7 mg/kg), iron (44,500-70,000), and vanadium (131-241 mg/kg) and three concentrations of manganese (200-220 mg/kg) were greater than the residential screening levels but less than the industrial screening levels.

All concentrations of arsenic (41-119 mg/kg) and chromium (57-140 mg/kg), and the maximum concentration of manganese (3,040 mg/kg) were greater than both the residential and industrial screening levels. Of these elevated concentrations, most were also greater than background UPLs (Figure 5-15).

Arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, and vanadium were detected at concentrations above protection of groundwater SSLs. Groundwater data were not generated specifically for Site 11, although numerous wells were installed in the vicinity of the former DPW area as part of the NWBA RFI (Figure 1-1). Groundwater was fully evaluated in the NWBA RFI, and broad metals contamination was not identified, nor was Site 11 considered a potential source area for any kind of groundwater contamination.

5.11.1 Site 11 Nature and Extent Summary

Organic compounds were not detected at concentrations above residential or industrial screening levels in subsurface soil from Site 11. Metals, however, were found consistently at concentrations greater than both screening levels and greater than the 95% UPL of background data. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved/gravel area (Figure 3-1). As noted in the Nature and Extent discussions for Sites 2, 3, and 9, particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

5.12 SITE 12: OLD LANDFILL

Site 12 consists of an upland area and an adjacent steep, rocky, ravine with a creek at the bottom. The headwaters of the creek are groundwater discharge points present at the southern end of the ravine. The creek runs north/northwest through the ravine and enters a pipe that flows under the school soccer field at the extreme north end. The ravine was used as a waste disposal area where the disposal method consisted of pushing material over the edge of the ravine, although some historic documents suggest that some disposal occurred in upland areas around the edge of the ravine. A previous investigation was conducted at Site 12 (Section 3.12.2), which indicated that elevated concentrations of arsenic were present in groundwater, soil, and sediment. Four monitoring wells were installed on the upland portion of the site as part of this investigation. Only three of these wells could be located for sampling in support of this Site Wide RFI.

Surface soil, sediment, surface water, groundwater, and sediment pore water samples were collected at Site 12. Tables 5-24 through 5-27 present the concentrations of compounds detected in the samples, Figure 3-6 shows the sample locations, and Figures 5-16, 5-17, and 5-18 summarize chemical concentrations exceeding screening levels.

5.12.1 Surface Soil

Four surface soil locations were sampled from the upland portion of Site 12, and data were generated for SVOCs, pesticides, PCBs, herbicides, TPH, and metals. SVOCs (PAHs), DDE, DDT, metals, and TPH-DRO were detected in the samples. All detected concentrations of organic compounds were below screening levels, except for one detection of DDT (3.7 ug/kg), which was greater than the ecological screening level of 2.5 ug/kg (Table 5-24).

All concentrations of arsenic (6.9-7.9 mg/kg) and chromium (19.6-27.2 mg/kg) are greater than both residential and industrial screening levels. All concentrations of aluminum (16,400-19,100 mg/kg), cobalt (6.8-9.4 mg/kg), iron (19,300-23,400 mg/kg), manganese (231-406 mg/kg), and vanadium (41.9-113 mg/kg) are greater than residential screening levels but are less than industrial screening levels.

Concentrations of aluminum, chromium, iron, manganese, vanadium, and the maximum concentration of zinc are greater than ecological screening levels.

When considered with respect to the 95% UPL of background data, the concentrations of all metals that exceeded screening levels were found to be below background UPLs, indicating that the concentrations onsite are consistent with concentrations found in background (Figure 5-16).

5.12.2 Sediment

Six sediment locations were sampled at Site 12. The samples were collected as far upstream and downstream as possible, such that the most downstream sample was collected just outside the pipe the creek enters at the northern end of the site. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals. SVOCs (PAHs), pesticides, TPH-DRO, and metals were detected in the samples (Table 5-25).

None of the detected concentrations of organic compounds were greater than residential human health screening levels, although maximum concentrations of fluoranthene (414 ug/kg) and pyrene (344 ug/kg) were greater than the ecological screening value of 330 ug/kg. In addition, DDD, DDE, DDT, dieldrin, and gamma-chlordane were detected at concentrations greater than ecological screening values. Most of these pesticides were detected in sample SD-12-07-04, and were not detected in the associated field duplicate (Figure 5-17). Some pesticides with elevated concentrations were also detected at location 5, but no pesticides were detected in the most downstream sample (SD-12-07-06).

All concentrations of chromium (15.2-24.5 mg/kg) were greater than the residential screening level of 2.9 mg/kg but less than the industrial and ecological screening levels. All detected concentrations of arsenic (16.4-35.8 mg/kg) were greater than the industrial screening level (16 mg/kg) and the ecological screening level (7.24 mg/kg). Concentrations of copper found at locations 1, 3, and 4 (in the duplicate sample only) and the maximum concentration of mercury (0.14 mg/kg location 1) were greater than the ecological screening levels (Table 5-25).

5.12.3 Surface Water

Six surface water samples were collected in conjunction with the sediment samples. Data were generated for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals. Bis(2-ethylhexyl)phthalate and DDE are the only organic compounds detected, and they were only found at location 1, which is the most upstream location. Concentrations of these organics were below human health screening levels; the concentration of bis(2-ethylhexyl)phthalate exceeded the ecological screening level (Table 5-26).

Total and dissolved arsenic were detected at concentrations above the tap water RSLs and below ecological screening levels. Dissolved mercury and silver, and total copper, lead, mercury, and selenium were found at concentrations above ecological screening levels and below tap water RSLs.

5.12.4 Groundwater

Groundwater samples were collected from three pre-existing monitoring wells located in the upland portion of Site 12. These samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals. In addition, sediment pore water samples were collected from three locations at the base of the ravine. These data were generated to characterize groundwater immediately downgradient of landfill. Installation of groundwater monitoring wells immediately downgradient of the landfill was not feasible due to the heavy vegetation at the Site and the fact that the area is protected habitat for the endangered species *Epicrates inornatus* (the Puerto Rican boa). Therefore, it was agreed among the Army and the USEPA that sediment pore water samples would be collected at the base of the landfill and used to represent groundwater conditions (EA 2011c, Appendix G).

Carbon disulfide, chloroform, and bis(2-ethylhexyl)phthalate were the only organic compounds detected in the samples. Concentrations of carbon disulfide were below screening levels. Chloroform was detected in two samples from the upgradient monitoring wells, and both concentrations (5.3 and 0.46 ug/L) were greater than the tap water screening level of 0.19 ug/L but below the MCL of 80 ug/L. Bis(2-ethylhexyl)phthalate was detected in the field duplicate of the sediment pore water samples at 7.5 ug/L, which is greater than the tap water screening level (4.8 ug/L) and the MCL (6 ug/L). Bis(2-ethylhexyl)phthalate was not detected in the parent sample collected from this same location. This SVOC is a common laboratory contaminant and is associated with plastics; although the data were not B-qualified, because the elevated concentration was not repeated in the parent sample, there is uncertainty regarding its site relatedness.

Numerous metals were detected in the samples at dissolved and total concentrations above tap water RSLs, and a few concentrations were above MCLs (Table 5-27). Arsenic, chromium, cobalt, iron, manganese, and thallium were detected at dissolved concentrations greater than tap water RSLs, and most of the detections were in the sediment pore water samples. All of the detected concentrations of dissolved arsenic (10.3-36.7 ug/L) were greater than the MCL (10 ug/L). No other metals were found at dissolved concentrations above MCLs (Table 5-27). Total concentrations of arsenic (8.9-68.9 ug/L) were also higher than the MCL, as was the maximum total concentration of chromium (206 ug/L), which was found in one of the upgradient monitoring wells (MW-2), and the maximum total concentration of thallium (2.7 ug/L) in one of the sediment pore water samples (Figure 5-18).

5.12.5 Site 12 Nature and Extent Summary

Numerous metals were found in soil at concentrations above human health and ecological screening levels; however, all metals concentrations were below background UPLs. In sediment, arsenic, pesticides, and two PAHs were found at elevated concentrations, although the horizontal extent of elevated pesticides and PAHs was limited. Metals were also found at elevated concentrations in surface water, arsenic most notably for human health and mercury, copper, and lead for ecological receptors. As with the other media at the site, groundwater was characterized by elevated metals concentrations, particularly concentrations of arsenic, which were consistently above the MCL.

5.13 SITE 13: POTENTIAL HAZARDOUS MATERIAL BURIAL SITE

Site 13 is a wooded area south of old building S-18 (which no longer exists) that was potentially used for the disposal of various materials (Figure 1-3). Observations made during earlier investigations (see Section 3.13) described the Site as a low area filled with trash, empty paint cans, fluorescent lamps, and construction debris. Surface soil samples were collected from seven locations and subsurface soil and groundwater were collected from one location. Tables 5-28 through 5-30 present the concentrations of compounds detected in the samples and Figure 5-19 presents the sample locations and chemical concentrations exceeding screening levels.

5.13.1 Surface Soil

Seven surface soil locations were sampled at Site 13, and data were generated for VOCs, SVOCs, metals, pesticides, herbicides, PCBs, and TPH (Table 5-28).

Organic compounds were detected in the samples, although none of the concentrations were above residential human health screening levels. Pentachlorophenol was detected in six samples, and all concentrations were greater than the ecological screening level of 2 ug/kg. DDT was detected at location 1 (S-13-08-01-0-2), and DDD, DDE, DDT, and dieldrin were detected in location 7 (S-13-08-07-0-2) at concentrations greater than ecological screening levels (Figure 5-19). TPH-DRO was detected in five samples, and the concentration found in sample S-13-08-07-0-2 (136 mg/kg) was greater than the PREQB-recommended criteria of 100 mg/kg.

All concentrations of aluminum (13,800-22,100 mg/kg), cobalt (4.6-18.4 mg/kg), and iron (14,600-27,300 mg/kg), six concentrations of manganese (262-1,230 mg/kg), four concentrations of vanadium (44.5 and 86.5 mg/kg), and two concentrations of thallium (0.36 and 0.99 mg/kg) were greater than residential screening levels but were below industrial screening levels. The maximum concentration of lead (562 mg/kg) was also greater than the residential screening level but below the industrial screening level.

All concentrations of arsenic (2.4-14.6 mg/kg) and chromium (9-33.1 mg/kg) were greater than residential and industrial screening levels. Aluminum, arsenic, chromium, copper, iron, lead, manganese, selenium, vanadium, and zinc were all detected at concentrations above ecological screening levels.

When considered with respect to the 95% UPL of background data, the concentrations of all metals that exceeded industrial screening levels and/or ecological screening levels were found to be below background UPLs with the following exceptions. The concentrations of lead found in samples S-13-08-06-0-2 and S-13-08-07-0-2 (562 and 158 mg/kg respectively) were greater than the background UPL of 125 mg/kg. The maximum concentration of manganese found in sample S-13-08-02-0-2 (1,230 mg/kg) was greater than the background UPL of 1,184 mg/kg. Six of the seven concentrations of selenium were greater than the background UPL of 1 mg/kg (Figure 5-19).

5.13.2 Subsurface Soil

One subsurface soil sample and a field duplicate were collected from Boring 7 at 2-4 ft bgs (Table 5-29). The samples were analyzed for VOCs, SVOCs, metals, pesticides, herbicides, PCBs, and TPH. Two organic compounds, benzo(a)pyrene and benzo(b)fluoranthene were detected at concentrations above the residential screening levels in the sample, but were not detected in the duplicate sample. Similarly, the concentration of TPH-DRO detected in the sample (196 mg/kg) was greater than the PREQB-recommended criteria of 100 mg/kg, but the concentration detected in the duplicate sample (37.7 mg/kg) was much lower. No other organic compounds were detected at concentrations above residential screening levels, and none were found at concentrations above industrial screening levels (Table 5-29).

Both concentrations of aluminum (14,000 and 22,300 mg/kg), cobalt (12.3 and 14.4 mg/kg), iron (22,400 and 28,600 mg/kg), manganese (696 and 809 mg/kg), and vanadium (53.2 and 90.1 mg/kg) were greater than the residential screening levels but were less than the industrial screening levels. Both concentrations of arsenic (14.2 and 18.9 mg/kg) and chromium (22.4 and 36.5 mg/kg) were greater than residential and industrial screening levels. Of the metals with concentrations above residential and industrial screening levels, all concentrations were below the 95% UPLs of background data.

Antimony, arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, DDE, DDT, pentachlorophenol, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected at concentrations above the protection of groundwater SSLs (Table 5-29). Groundwater was collected at Site 13 and none of these organic compounds were detected in the groundwater sample. The groundwater was not analyzed for metals; therefore the potential for them to adversely impact groundwater is uncertain. However; of these metals, only mercury (0.54 and 0.11 mg/kg) and selenium (2.7 and 1.1 mg/kg) were found at concentrations greater than background (0.32 mg/kg for mercury and 1 mg/kg for selenium). Subsurface soil data generated from monitoring well boring locations as part of the NWBA RFI (EA 2012) had concentrations of selenium up to 4.7 mg/kg and no detections in associated groundwater. These borings also reported concentrations of mercury up to 0.38 mg/kg with a detection in associated groundwater of 1.4 ug/L, which is below the tap water RSL of 3.7 ug/L and below the MCL of 2 ug/L. For these reasons it is unlikely that the concentrations of compounds found in subsurface soil would be adversely impacting groundwater at Site 13.

5.13.3 Groundwater

One grab groundwater sample was obtained at Site 13. Due to the nature of the soil (stiff clay) a limited volume of groundwater was available. Based on the results from the soil samples and site history, the groundwater sample (G-13-09-07) was analyzed for VOCs, SVOCs, herbicides, pesticides, and PCBs. No compounds were detected in the sample (Table 5-30).

5.13.4 Site 13 Nature and Extent Summary

Numerous metals were found in surface and subsurface soil at concentrations above human health and ecological screening levels. Of the metals with concentrations above residential and industrial screening levels, all concentrations were below the 95% UPLs of background data. Of the metals with concentrations above ecological screening levels, all but lead, selenium, and the maximum concentration of manganese were below the 95% UPLs of background data. Metals were also found at concentrations above protection of groundwater SSLs, and because metals data for groundwater are not available there is uncertainty regarding the potential for adverse impacts to groundwater from subsurface soil metals concentrations. However, only mercury and selenium were present in subsurface soil at concentrations above both the protection of groundwater SSLs and background. Based on data available from the NWBA RFI (EA 2012), the concentrations of these metals are not expected to result in adverse impacts to groundwater.

Pentachlorophenol was found in six surface soil samples at concentrations well above the ecological screening level, and pesticides were found in sample S-13-08-07-0-2 (boring 7) at concentrations well above the ecological screening levels. In addition, boring 7 also had elevated concentrations of TPH-DRO in surface and subsurface soil samples. Pesticides, PAHs, and pentachlorophenol were detected in subsurface soil at concentrations above protection of groundwater SSLs. However, no organic compounds were detected in the groundwater sample, indicating that groundwater has not been adversely affected by concentrations in subsurface soil.

5.14 SITE 15: BUILDING S-159

Site 15 consists of an area behind Building S-159 that contained approximately twenty 55-gallon drums of used oil, solvents, and coolant (Figure 3-3). Staining was observed beneath the drum locations, and leakage was found to flow west across asphalt into a grassy area, down a small hill, and into the storm water system. The building currently has a used oil storage system in the form of a 1,000 gallon AST with secondary containment (Woodward-Clyde 1997). In addition, since completion of the field work at Site 15 in support of this Site Wide RFI (October 2008), the area of investigation has been significantly reworked. In January 2009 the area was excavated for the installation of a drainpipe. Supporting information that is available regarding the excavation is provided in Appendix K. As a result of this recent work at Site 15, the findings described below may no longer be representative of the Site.

Surface soil and subsurface soil samples were collected from two locations within a drainage swale at Site 15. Tables 5-31 and 5-32 present the concentrations of compounds detected in the samples and Figure 5-20 presents the sample locations and chemical concentrations exceeding screening levels.

5.14.1 Surface Soil

Two surface soil samples were collected and analyzed for TPH and metals. TPH-DRO was detected in the upgradient sample at a concentration of 223 mg/kg, which is higher than the PREQB-recommended criteria of 100 mg/kg. The downgradient sample reported a concentration of TPH-DRO of only 19.9 mg/kg.

Concentrations of aluminum (25,700 and 24,600 mg/kg), cobalt (17.4 and 6.3 mg/kg), iron (41,300 and 31,100 mg/kg), manganese (917 and 480 mg/kg), and vanadium (162 and 89.6 mg/kg) in both samples were greater than residential screening levels but were less than industrial screening levels.

Concentrations of arsenic (6 and 20.5 mg/kg) and chromium (48.3 and 44.1 mg/kg) in both samples and the maximum concentration of thallium (1.1 mg/kg) were greater than residential and industrial screening levels. The concentrations of each of these metals were below the 95% UPL of background data.

Concentrations of aluminum, arsenic, beryllium, chromium, copper, iron manganese, nickel, selenium, thallium, vanadium, and zinc were greater than ecological screening levels. Concentrations of these metals were below the 95% UPL of background data with the following exceptions: the maximum concentrations of beryllium, copper, nickel, vanadium, and zinc, all of which were detected in the upgradient sample (Figure 5-20).

5.14.2 Subsurface Soil

Two subsurface soil samples were collected and analyzed for TPH and metals. TPH-DRO was detected in one sample at a concentration below the PREQB-recommended criteria of 100 mg/kg (detected concentration of 45.1 mg/kg).

Concentrations of aluminum (27,500 and 19,000 mg/kg), cobalt (9.3 and 3.8 mg/kg), iron (45,800 and 32,900 mg/kg), thallium (0.8 and 0.25 mg/kg), and vanadium (139 and 80.2 mg/kg) in both samples and the maximum concentration of manganese (917 mg/kg) were greater than residential screening levels but were less than industrial screening levels.

Concentrations of arsenic (45.2 and 18 mg/kg) and chromium (89.3 and 36.8 mg/kg) in both samples were greater than residential and industrial screening levels. The maximum detected concentrations of both metals were slightly above the 95% UPLs of background data and were detected in the upgradient sample. Concentrations in the downgradient sample were below background (Figure 5-20).

Antimony, arsenic, chromium, cobalt, copper, iron, manganese, mercury, selenium, and thallium were detected at concentrations above the protection of groundwater screening levels (Table 5-32). Of these metals, all were found at concentrations below background except antimony (2.7 and 1.3 mg/kg), arsenic (45.2 and 18 mg/kg), chromium (89.3 and 36.8 mg/kg), and selenium (2 and 1.6 mg/kg). Subsurface soil data generated from monitoring well boring locations as part of the NWBA RFI (EA 2012) had concentrations of antimony, arsenic, and selenium that were higher than those detected at Site 15, and the groundwater samples collected from those borings were non-detect for each of these metals. Chromium was also detected in monitoring well boring locations at concentrations higher than what was found at Site 15 (up to 152 mg/kg). The two borings with the highest concentrations of chromium had associated groundwater samples with total concentrations of chromium that were above the tap water screening criteria but below the MCL. These groundwater samples were non-detect for dissolved chromium. There were other wells with concentrations of chromium up to 95.1 mg/kg in the subsurface soil that had no detected concentrations of chromium in groundwater. For these reasons it is unlikely that the concentrations of compounds found in subsurface soil would be adversely impacting groundwater at Site 15.

5.14.3 Site 15 Nature and Extent Summary

Since completion of the field work at Site 15, the area of investigation has been significantly reworked. As a result of this recent work, the findings described herein may no longer be representative of the Site. Numerous metals were found in surface and subsurface soil at concentrations above screening levels. Most metals were present at concentrations below background, including all concentrations detected in the most downgradient sample. Some metals that were found at concentrations above industrial screening levels and/or ecological screening levels in the upgradient sample (closest to the source area) were also above background (Figure 5-20). Because concentrations found in the downgradient surface and subsurface soil samples were below background, the horizontal extent is limited. Similarly, only arsenic and chromium exceeded screening levels in the upgradient subsurface soil sample; therefore the vertical extent of the other inorganic exceedances has been determined.

Four metals were present in subsurface soil at concentrations above both the protection of groundwater SSLs and background. Based on data available from the NWBA RFI (EA 2012), the concentrations of these metals are not expected to result in adverse impacts to groundwater.

TPH-DRO was detected at an elevated concentration in the upgradient surface soil sample, but concentrations found in the downgradient surface soil sample and in the subsurface soil samples were below criteria. Therefore the horizontal and vertical extent of TPH is limited.

Table 5-1
Site 1
Summary of Analytes Detected in Surface Soil

Sample Location:						Boring 1	Boring 2	Boring 3	Boring 4
Sample Name:						S-01-08-01-0-2	S-01-08-02-0-2	S-01-08-03-0-2	S-01-08-04-0-2
Parent Sample:									
Date Sampled:						10/23/2008	10/23/2008	10/23/2008	10/23/2008
Depth:						0-2 ft	0-2 ft	0-2 ft	0-2 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**				
Group:Pesticides									
4,4-DDD	0.51	2000	7200	2.5	ug/kg	52.6	0.26 U	14.9	50
4,4-DDE	3.37	1400	5100	2.5	ug/kg	970	9.7	31	98
4,4-DDT	2.65	1700	7000	2.5	ug/kg	302	6.2	55	517
alpha-Chlordane	0.64	1600	6500	NSA	ug/kg	2.5	0.48 U	8.2	12.1
Dieldrin	NSA	30	110	0.5	ug/kg	3.3	0.31 U	0.32 U	1.5 U
Gamma-chlordane	NSA	1600	6500	NSA	ug/kg	4.8	0.35 U	11.7	11.5
Group:PCBs									
Aroclor 1260	NSA	220	740	NSA	ug/kg	65.5	91.1	8.3 U	8 U
Group: VOCs									
Acetone	NSA	6100000 *	63000000	NSA	ug/kg	1.4 U	5.1 J	14.3	6 J
Group: SVOCs									
Acenaphthylene	NSA	3600	18000	100	ug/kg	0.37 U	0.41 U	0.42 U	8.41
Anthracene	NSA	1700000 *	17000000	100	ug/kg	16 U	18 U	18 U	25 J
Benzo[a]anthracene	NSA	150	2100	100	ug/kg	52.1	9.53	149	**277**
Benzo[a]pyrene	NSA	15	210	100	ug/kg	**53.6**	0.6 U	**196**	**421**
Benzo[b]fluoranthene	NSA	150	2100	100	ug/kg	95.7	1.5 U	**192**	**430**
Benzo[g,h,i]perylene	NSA	170000 *	1700000 *	100	ug/kg	23.4	0.68 U	142	285
Benzo[k]fluoranthene	NSA	1500	21000	100	ug/kg	58.2	0.68 U	150	381
Chrysene	NSA	15000	210000	100	ug/kg	47.8	0.45 U	152	366
Dibenz[a,h]anthracene	NSA	15	210	100	ug/kg	0.47 U	0.52 U	**16.6**	**93**
Fluoranthene	NSA	230000 *	2200000 *	100	ug/kg	37.2	18 U	180	269
Indeno[1,2,3-c,d]pyrene	NSA	150	2100	100	ug/kg	19.8	0.63 U	126	**258**
Phenanthrene	NSA	1700000 *	17000000	100	ug/kg	12.8	0.43 U	54.9	50.4
Pyrene	NSA	170000 *	1700000 *	100	ug/kg	38.5	18 U	192	304

Table 5-1
Site 1
Summary of Analytes Detected in Surface Soil

Notes:

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, and herbicides
Analytes not listed on the table were not detected in any samples
Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL Res are bolded.
Detected concentrations exceeding the EPA RSL Ind are shaded gray.
Detected concentrations exceeding the Eco SSL are in blue font

Table 5-2

Site 1

Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 1	Boring 2	Boring 3	Boring 4
					Sample Name:	S-01-08-01-2-4	S-01-08-02-2-4	S-01-08-03-2-4	S-01-08-04-2-4
					Parent Sample:				
					Date Sampled:	10/23/2008	10/23/2008	10/23/2008	10/23/2008
					Depth:	2-4 ft	2-4 ft	2-4 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**				
Group:Pesticides									
4,4-DDD	0.51	2000	7200	66	ug/kg	1.8	0.27 U	4.3	0.27 U
4,4-DDE	3.37	1400	5100	46	ug/kg	27.3 J	0.42 U	3.8	0.41 U
4,4-DDT	2.65	1700	7000	67	ug/kg	9.1 J	0.39 U	8.7	0.38 U
alpha-Chlordane	0.64	1600	6500	13	ug/kg	0.49 U	0.51 U	2.5	0.51 U
Gamma-chlordane	NSA	1600	6500	13	ug/kg	0.35 U	0.37 U	3	0.37 U
Group: Herbicides									
Pentachlorophenol	NSA	890	2700	1.7	ug/kg	1.1 U	3.7	1.1 U	1.1 U
Group: VOCs									
1,1-dichloroethene	NSA	24000 *	1100000 *	120	ug/kg	0.61 J	0.55 U	0.48 U	0.44 U
Acetone	NSA	6100000 *	630000000	4500	ug/kg	28.5	2.3 U	134	1.8 U
Carbon disulfide	NSA	82000	3700000	310	ug/kg	1.1 J	0.53 U	0.46 U	0.42 U
Group: SVOCs									
Benzo[a]anthracene	NSA	150	2100	10	ug/kg	0.25 U	0.26 U	68.2	0.27 U
Benzo[a]pyrene	NSA	15	210	3.5	ug/kg	0.61 U	0.63 U	**73.4**	0.64 U
Benzo[b]fluoranthene	NSA	150	2100	35	ug/kg	1.5 U	1.6 U	96.5	1.6 U
Benzo[g,h,i]perylene	NSA	170000 *	17000000 *	120000	ug/kg	0.69 U	0.72 U	53.2	0.73 U
Benzo[k]fluoranthene	NSA	1500	21000	350	ug/kg	0.69 UJ	0.71 U	88.3	0.72 U
Chrysene	NSA	15000	210000	1100	ug/kg	0.46 U	0.47 U	64.1	0.48 U
Dibenz[a,h]anthracene	NSA	15	210	11	ug/kg	0.53 U	0.55 U	**18.3**	0.56 U
Fluoranthene	NSA	230000 *	22000000 *	160000	ug/kg	19 U	19 U	93.1	20 U
Indeno[1,2,3-c,d]pyrene	NSA	150	2100	120	ug/kg	0.64 U	0.66 U	48.4	0.67 U
Phenanthrene	NSA	1700000 *	170000000	360000	ug/kg	0.44 U	0.45 U	31.3	0.46 U
Pyrene	NSA	170000 *	17000000 *	120000	ug/kg	18 U	19 U	89.5	19 U

Table 5-2
Site 1
Summary of Analytes Detected in Subsurface Soil

Notes:

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, and herbicides

Analytes not listed on the table were not detected in any samples

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-3
Site 1
Summary of Analytes Detected in Groundwater

Sample Location:				G-03-MW-11A	G-03-MW-11A	G-03-MW-11A	G-03-MW-11A	G-03-MW-11A
Sample Name:				G-03-07-MW-11A	G-03-08-MW-11A	G-03-08-MW-11A	G-03-09-MW-11A	G-03-10-MW-11A
Parent Sample:								
Date Sampled:				6/12/2007	1/9/2008	5/14/2008	1/6/2009 & 1/7/2009	8/18/2010
Analyte	**EPA MCL**	**EPA RSL**	**Units**					
Group: Metals (Dissolved)								
Arsenic	10	0.045	ug/l	4.5 U	--	--	--	--
Barium	2000	730 *	ug/l	32.9 J	--	--	--	--
Chromium	100	0.043	ug/l	1.3 J	--	--	--	--
Cobalt	NSA	1.1 *	ug/l	2.5 J	--	--	--	--
Mercury	2	0.37	ug/l	0.093 J	--	--	--	--
Nickel	NSA	73 *	ug/l	7.4 J	--	--	--	--
Silver	NSA	18 *	ug/l	2.8 J	--	--	--	--
Vanadium	NSA	18 *	ug/l	2.6 J	--	--	--	--
Zinc	NSA	1100 *	ug/l	7.9 J	--	--	--	--
Group: Metals (Total)								
Barium	2000	730 *	ug/l	33.6 J	--	--	--	--
Chromium	100	0.043	ug/l	0.8 U	--	--	--	--
Mercury	2	NSA	ug/l	0.16 J	--	--	--	--
Nickel	NSA	73 *	ug/l	8 J	--	--	--	--
Zinc	NSA	1100 *	ug/l	13.7 J	--	--	--	--
Group: VOCs								
1,1,2-trichloroethane	5	0.042 *	ug/l	0.73 J	0.69 J	0.17 U	0.81 J	0.51 J
1,1-dichloroethene	7	34 *	ug/l	0.41 J	0.28 U	0.29 U	0.38 J	0.4 U
1,2-dichloroethane	5	0.15	ug/l	0.31 J	0.29 U	0.35 U	0.36 J	0.33 U
1,2-dichloroethene	NSA	33 *	ug/l	18.1	20.7	17.7	--	21.7
Chloroform	80	0.19	ug/l	0.56 J	0.62 J	0.62 J	0.75 J	0.4 J
Chloromethane	NSA	19 *	ug/l	0.3 U	0.3 U	0.29 U	0.5 J	0.29 U
Cis-1,2-dichloroethene	70	7.3 *	ug/l	--	--	16.8	21	21
Tetrachloroethene	5	0.11	ug/l	11.1	10.5	10.2	9.8	7
trans-1,2-dichloroethene	100	11 *	ug/l	0.76 J	0.79 J	0.87 J	0.87 J	0.69 J
Trichloroethene	5	2	ug/l	175	187	171	163	174
Vinyl chloride	2	0.016	ug/l	0.22 U	0.22 U	0.21 U	0.45 J	0.44 U
Group: General Chemistry								
Sulfate	NSA	NSA	mg/l	--	--	--	37.6	--
Nitrogen as nitrate + nitrite	NSA	NSA	mg/l	--	--	--	0.19	--
Methane	NSA	NSA	ug/l	--	--	--	13.8	--

Table 5-3
Site 1
Summary of Analytes Detected in Groundwater

			Sample Location:	G-03-MW-11A	G-03-MW-11B	G-03-MW-11B	G-03-MW-11B	G-03-MW-11B
			Sample Name:	10-AUG-18-DP2	G-03-07-MW-11B	G-03-08-MW-11B	G-03-08-MW-11B	G-03-09-MW-11B
			Parent Sample:	G-03-10-MW-11A				
			Date Sampled:	8/18/2010	6/12/2007	1/9/2008	5/14/2008	1/6/2009
Analyte	**EPA MCL**	**EPA RSL**	**Units**					
Group: Metals (Dissolved)								
Arsenic	10	0.045	ug/l	--	6 J	--	--	--
Barium	2000	730 *	ug/l	--	38.2 J	--	--	--
Chromium	100	0.043	ug/l	--	0.8 U	--	--	--
Cobalt	NSA	1.1 *	ug/l	--	1.8 U	--	--	--
Mercury	2	0.37	ug/l	--	0.08 J	--	--	--
Nickel	NSA	73 *	ug/l	--	2.8 U	--	--	--
Silver	NSA	18 *	ug/l	--	1 U	--	--	--
Vanadium	NSA	18 *	ug/l	--	1.8 U	--	--	--
Zinc	NSA	1100 *	ug/l	--	9.8 J	--	--	--
Group: Metals (Total)								
Barium	2000	730 *	ug/l	--	36.4 J	--	--	--
Chromium	100	0.043	ug/l	--	0.8 J	--	--	--
Mercury	2	NSA	ug/l	--	0.051 J	--	--	--
Nickel	NSA	73 *	ug/l	--	2.8 U	--	--	--
Zinc	NSA	1100 *	ug/l	--	3.4 U	--	--	--
Group: VOCs								
1,1,2-trichloroethane	5	0.042 *	ug/l	0.52 J	1.3	1.2	1.3	1 J
1,1-dichloroethene	7	34 *	ug/l	0.4 U	0.72 J	0.63 J	0.29 U	0.58 U
1,2-dichloroethane	5	0.15	ug/l	0.33 U	0.29 U	0.29 U	0.35 U	0.7 U
1,2-dichloroethene	NSA	33 *	ug/l	20.7	17.4	16.7	17.8	--
Chloroform	80	0.19	ug/l	0.38 J	0.25 U	0.25 U	0.16 U	0.32 U
Chloromethane	NSA	19 *	ug/l	0.29 U	0.3 U	0.3 U	0.29 U	0.58 U
Cis-1,2-dichloroethene	70	7.3 *	ug/l	20	--	--	16.6	14
Tetrachloroethene	5	0.11	ug/l	7.5	11.5	8.3	9.8	6.7
trans-1,2-dichloroethene	100	11 *	ug/l	0.67 J	1.1	0.93 J	1.1	0.77 J
Trichloroethene	5	2	ug/l	179	186	207	229	240
Vinyl chloride	2	0.016	ug/l	0.44 U	0.83 J	0.62 J	0.71 J	0.41 U
Group: General Chemistry								
Sulfate	NSA	NSA	mg/l	--	--	--	--	--
Nitrogen as nitrate + nitrite	NSA	NSA	mg/l	--	--	--	--	--
Methane	NSA	NSA	ug/l	--	--	--	--	--

Table 5-3
Site 1
Summary of Analytes Detected in Groundwater

Notes:
Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, General Chemistry, and metals
Analytes not listed on the table were not detected in any samples
EPA MCL = EPA Maximum Contaminant Level, June 2011
EPA RSL = EPA Tapwater Regional Screening Level, June 2011
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
-- = Not Analyzed
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL are shaded gray.
Detected concentrations exceeding the EPA MCL are in blue font

Table 5-4
Site 2
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 1	Boring 2	Boring 2
Sample Name:						SB-03-06-01-(4-8)	SB-03-06-01-(20-24)	SB-03-06-02-(4-8)	SB-03-06-02-(26-28)
Date Sampled:						12/1/2006	12/1/2006	12/6/2006	12/6/2006
Depth Interval:						4-8 ft	20-24 ft	4-8 ft	26-28 ft
Analyte Name	**Background**	**EPA RSL RES**	**EPA RSL IND**	**EPA SSL**	**Units**				
Group: Metals									
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**37.2**	0.67 U	**45.4**	0.64 U
Cadmium	0.858	7 *	80 *	1.4	mg/kg	1.8	0.17 U	0.88 U	0.17 U
Chromium	69.8	0.29	5.6	2.1	mg/kg	**72.4 J**	**12.5 J**	**89.3 J**	**14.9 J**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	0.14 U	0.15 U	0.75 U	0.14 U
Copper	83.65	310 *	4100 *	51	mg/kg	29.4	20.4	46.9 J	11 J
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.014 U	0.014 U	0.015 U	0.014 U
Lead	27.52	400 *	800 *	NSA	mg/kg	5.9 J	0.53 U	2.7 U	0.51 U
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.38 J	0.0097 U	0.22	0.01 U
Nickel	23.01	150 *	2000 *	48	mg/kg	5.7 J	5.3 J	3.3 U	0.61 U
Selenium	1	39 *	510 *	0.95	mg/kg	4.4	0.93 U	4.7 U	0.89 U
Vanadium	145.4	39 *	520 *	180	mg/kg	**186 J**	30.8 J	**202 J**	23.4 J
Zinc	81.04	2300 *	31000	680	mg/kg	24.1 J	22 J	35	16.4
Group:Pesticides									
4,4-DDE	3.37	1400	5100	46	ug/kg	0.38 U	0.4 U	0.42 U	0.4 U
Group: VOCs									
Acetone	NSA	6100000 *	63000000	4500	ug/kg	UR	UR	12.5	1.9 U
Benzene	NSA	1100	5400	0.21	ug/kg	0.37 U	0.31 U	0.39 U	0.32 U
Ethylbenzene	NSA	5400	27000	1.7	ug/kg	0.35 U	0.3 U	0.37 U	0.3 U
Isobutyl Alcohol	NSA	2300000	31000000	2300	ug/kg	UR	UR	UR	UR
Xylenes, Total	NSA	63000	270000	200	ug/kg	0.38 U	0.32 U	0.4 U	0.33 U
Group: SVOCs									
2-methylnaphthalene	NSA	31000 *	410000	750	ug/kg	1.1 U	1.2 U	1.2 U	1.2 U
Acenaphthene	NSA	340000 *	3300000 *	22000	ug/kg	20 U	21 U	22 U	21 U
Anthracene	NSA	1700000 *	17000000	360000	ug/kg	15 U	16 U	17 U	16 U
Benzo[a]anthracene	NSA	150	2100	10	ug/kg	0.24 U	0.25 U	0.27 U	0.25 U
Bis(2-ethylhexyl) phthalate	NSA	35000	120000	1100	ug/kg	50 U	52 U	55 U	52 U
Chrysene	NSA	15000	210000	1100	ug/kg	0.43 U	0.45 U	0.48 U	0.45 U
Dibenzofuran	NSA	7800 *	100000	680	ug/kg	18 U	19 U	20 U	19 U
Fluoranthene	NSA	230000 *	2200000 *	160000	ug/kg	14 U	14 U	15 U	14 U
Fluorene	NSA	230000 *	2200000 *	27000	ug/kg	16 U	16 U	17 U	16 U
Naphthalene	NSA	3600	18000	0.47	ug/kg	0.46 U	0.49 U	0.51 U	0.49 U

Table 5-4
Site 2
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 1	Boring 2	Boring 2
Sample Name:						SB-03-06-01-(4-8)	SB-03-06-01-(20-24)	SB-03-06-02-(4-8)	SB-03-06-02-(26-28)
Date Sampled:						12/1/2006	12/1/2006	12/6/2006	12/6/2006
Depth Interval:						4-8 ft	20-24 ft	4-8 ft	26-28 ft
Analyte Name	**Background**	**EPA RSL RES**	**EPA RSL IND**	**EPA SSL**	**Units**				
Phenanthrene	NSA	1700000 *	17000000	360000	ug/kg	0.41 U	0.43 U	0.46 U	0.43 U
Pyrene	NSA	170000 *	1700000 *	120000	ug/kg	13 U	14 U	15 U	14 U
Group: Total Petroleum Hydrocarbons									
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	2.5 U	2.7 U	2.8 U	16.5
TPH-GRO (C6-C10)	NSA	100 [1]	NSA	NSA	mg/kg	2.7 U	2.8 U	3.5 U	3.1 U
Group: General Chemistry									
Sulfide	NSA	NSA	NSA	NSA	mg/kg	4.6 UB	2.4 B	5.1	4.9 UB

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, herbicides, and total petroleum hydrocarbons.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-4

Site 2

Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 3	Boring 3	Boring 4	Boring 4
					Sample Name:	SB-03-06-03-(4-8)	SB-03-06-03-(20-22)	SB-03-06-04-(4-8)	SB-03-06-04-(37-36)
					Date Sampled:	10/20/2006	10/20/2006	11/13/2006	11/13/2006
					Depth Interval:	4-8 ft	20-22 ft	4-8 ft	37-36 ft
Analyte Name	**Background**	**EPA RSL RES**	**EPA RSL IND**	**EPA SSL**	**Units**				
Group: Metals									
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**61.8**	12 U	**34.1 J**	**4.7 J**
Cadmium	0.858	7 *	80 *	1.4	mg/kg	1.3	3.2 U	0.19 UJ	0.17 UJ
Chromium	69.8	0.29	5.6	2.1	mg/kg	**109**	**24.5**	**49.7 J**	**13.2 J**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**37.7**	2.7 U	**21.1 J**	**9 J**
Copper	83.65	310 *	4100 *	51	mg/kg	54.4	5.5 U	44.4	53.1
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.066 B	0.013 U	0.015 U	0.015 U
Lead	27.52	400 *	800 *	NSA	mg/kg	9.3	9.8 U	9.1 J	4.5 J
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.1	0.064	0.16	0.046
Nickel	23.01	150 *	2000 *	48	mg/kg	39.8	12 U	12	6.7
Selenium	1	39 *	510 *	0.95	mg/kg	1.9 U	17 U	0.99 UJ	0.93 UJ
Vanadium	145.4	39 *	520 *	180	mg/kg	**168**	3 U	**96.9 J**	**40.3 J**
Zinc	81.04	2300 *	31000	680	mg/kg	70.6	88.7	41.5 J	51.3 J
Group:Pesticides									
4,4-DDE	3.37	1400	5100	46	ug/kg	0.43 U	0.39 U	2.8	0.43 U
Group: VOCs									
Acetone	NSA	6100000 *	63000000	4500	ug/kg	3.2 U	2.8 U	UR	2.5 U
Benzene	NSA	1100	5400	0.21	ug/kg	0.53 U	0.48 U	1040	0.42 U
Ethylbenzene	NSA	5400	27000	1.7	ug/kg	0.5 U	0.45 U	**18600**	0.39 U
Isobutyl Alcohol	NSA	2300000	31000000	2300	ug/kg	UR	UR	65100	UR
Xylenes, Total	NSA	63000	270000	200	ug/kg	0.54 U	0.49 U	1380	0.43 U
Group: SVOCs									
2-methylnaphthalene	NSA	31000 *	410000	750	ug/kg	1.2 U	1.1 U	1630	1.2 U
Acenaphthene	NSA	340000 *	3300000 *	22000	ug/kg	22 U	20 U	53.4 J	22 U
Anthracene	NSA	1700000 *	17000000	360000	ug/kg	16 U	15 U	39.2 J	17 U
Benzo[a]anthracene	NSA	150	2100	10	ug/kg	0.26 U	0.24 U	29.1	0.26 U
Bis(2-ethylhexyl) phthalate	NSA	35000	120000	1100	ug/kg	72.3 J	71.9 J	70.9 J	55 U
Chrysene	NSA	15000	210000	1100	ug/kg	0.48 U	0.44 U	19.1 J	0.48 U
Dibenzofuran	NSA	7800 *	100000	680	ug/kg	20 U	18 U	30.4 J	20 U
Fluoranthene	NSA	230000 *	2200000 *	160000	ug/kg	15 U	14 U	90.9	15 U
Fluorene	NSA	230000 *	2200000 *	27000	ug/kg	17 U	16 U	145	17 U
Naphthalene	NSA	3600	18000	0.47	ug/kg	0.51 U	0.47 U	1510	0.51 U

Table 5-4
Site 2
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 3	Boring 3	Boring 4	Boring 4
					Sample Name:	SB-03-06-03-(4-8)	SB-03-06-03-(20-22)	SB-03-06-04-(4-8)	SB-03-06-04-(37-36)
					Date Sampled:	10/20/2006	10/20/2006	11/13/2006	11/13/2006
					Depth Interval:	4-8 ft	20-22 ft	4-8 ft	37-36 ft
Analyte Name	**Background**	**EPA RSL RES**	**EPA RSL IND**	**EPA SSL**	**Units**				
Phenanthrene	NSA	1700000 *	17000000	360000	ug/kg	0.45 U	0.42 U	83.3 J	0.46 U
Pyrene	NSA	170000 *	1700000 *	120000	ug/kg	15 U	13 U	73.6 J	15 U
Group: Total Petroleum Hydrocarbons									
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	2.8 U	2.5 U	**136**	2.8 U
TPH-GRO (C6-C10)	NSA	100 [1]	NSA	NSA	mg/kg	3.4 U	2.7 U	**515**	3.3 U
Group: General Chemistry									
Sulfide	NSA	NSA	NSA	NSA	mg/kg	3.8 B	2.3 B	8	5

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, herbicides, and total petroleum hydrocarbons.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-5
Site 2
Summary of Analytes Detected in Groundwater

			Sample Location:	G-03-MW-01	G-03-MW-01	G-03-MW-01	G-03-MW-02	G-03-MW-02	G-03-MW-02
			Sample Name:	G-03-07-MW-01	G-03-07-MW-01	G-03-10-MW-01	G-03-07-MW-02	G-03-07-MW-02	07-JN-13-DP-3
			Parent Sample:						G-03-07-MW-02
			Date Sampled:	1/10/2007	6/12/2007	8/17/2010	1/10/2007	6/13/2007	6/13/2007
Analyte	**EPA MCL**	**EPA RSL**	**Units**						
Group: Metals (Dissolved)									
Barium	2000	730 *	ug/l	2.3 U	--	--	2.3 U	--	--
Group: Metals (Total)									
Aluminum	NSA	3700 *	ug/l	--	--	--	--	--	--
Barium	2000	730 *	ug/l	2.3 U	--	--	2.3 U	--	--
Calcium	NSA	NSA	ug/l	--	--	--	--	--	--
Chromium	100	0.043	ug/l	0.8 U	--	--	0.8 U	--	--
Iron	NSA	2600 *	ug/l	--	--	--	--	--	--
Magnesium	NSA	NSA	ug/l	--	--	--	--	--	--
Manganese	NSA	88 *	ug/l	--	--	--	--	--	--
Mercury	2	3.7 *	ug/l	1.4	--	--	0.037 U	--	--
Sodium	NSA	NSA	ug/l	--	--	--	--	--	--
Group: VOCs									
Benzene	5	0.41	ug/l	0.21 U	0.19 U	0.23 U	0.21 U	0.19 U	0.19 U
Ethylbenzene	700	1.5	ug/l	0.2 U	0.21 U	0.27 U	0.2 U	0.21 U	0.21 U
Xylenes, Total	10000	20 *	ug/l	0.31 U	0.2 U	0.25 U	0.31 U	0.2 U	0.2 U
Group: SVOCs									
1,2-dichlorobenzene	600	37 *	ug/l	UR	--	--	UR	--	--
Bis(2-ethylhexyl) phthalate	6	4.8	ug/l	0.66 U	--	--	2.9	--	--
Naphthalene	NSA	0.14	ug/l	0.026 U	--	--	0.026 U	--	--

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals

Analytes not listed on the table were not detected in any samples

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-5
Site 2
Summary of Analytes Detected in Groundwater

			Sample Location:	G-03-MW-03A	G-03-MW-03A	G-03-MW-03A	G-03-MW-03B	G-03-MW-03B	G-03-MW-04A
			Sample Name:	G-03-07-MW-03A	G-03-07-MW-03A	G-03-10-MW-03A	G-03-07-MW-03B	G-03-07-MW-03B	G-03-07-MW-04A
			Parent Sample:						
			Date Sampled:	1/9/2007	6/12/2007	8/17/2010	1/9/2007	6/12/2007	1/9/2007
Analyte	**EPA MCL**	**EPA RSL**	**Units**						
Group: Metals (Dissolved)									
Barium	2000	730 *	ug/l	2.3 U	--	--	324	--	2.3 U
Group: Metals (Total)									
Aluminum	NSA	3700 *	ug/l	235	--	--	23 U	--	3400
Barium	2000	730 *	ug/l	2.3 U	--	--	313	--	2.3 U
Calcium	NSA	NSA	ug/l	171000	--	--	105000	--	136000
Chromium	100	0.043	ug/l	19.8	--	--	0.8 U	--	0.8 U
Iron	NSA	2600 *	ug/l	326	--	--	681	--	3450
Magnesium	NSA	NSA	ug/l	12100	--	--	24100	--	10000
Manganese	NSA	88 *	ug/l	28.6	--	--	53.9	--	92.2
Mercury	2	3.7 *	ug/l	0.75	--	--	0.037 U	--	0.33
Sodium	NSA	NSA	ug/l	25400	--	--	27900	--	26400
Group: VOCs									
Benzene	5	0.41	ug/l	0.21 U	0.19 U	0.23 U	0.21 U	0.19 U	0.53 J
Ethylbenzene	700	1.5	ug/l	0.2 U	0.21 U	0.27 U	0.2 U	0.21 U	0.2 U
Xylenes, Total	10000	20 *	ug/l	0.31 U	0.2 U	0.25 U	0.31 U	0.2 U	0.31 U
Group: SVOCs									
1,2-dichlorobenzene	600	37 *	ug/l	0.22 U	--	--	0.21 U	--	0.81 J
Bis(2-ethylhexyl) phthalate	6	4.8	ug/l	0.7 U	--	--	0.66 U	--	0.68 U
Naphthalene	NSA	0.14	ug/l	0.027 U	--	--	0.026 U	--	0.026 U

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals

Analytes not listed on the table were not detected in any samples

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-5
Site 2
Summary of Analytes Detected in Groundwater

			Sample Location:	G-03-MW-04A	G-03-MW-04A	G-03-MW-04B	G-03-MW-04B	G-03-MW-04B
			Sample Name:	G-03-07-MW-04A	G-03-10-MW-04A	G-03-07-MW-04B	G-03-07-MW-04B	G-03-10-MW-04B
			Parent Sample:					
			Date Sampled:	6/12/2007	8/18/2010	1/9/2007	6/12/2007	8/18/2010
Analyte	**EPA MCL**	**EPA RSL**	**Units**					
Group: Metals (Dissolved)								
Barium	2000	730 *	ug/l	--	--	450	--	--
Group: Metals (Total)								
Aluminum	NSA	3700 *	ug/l	--	--	23 U	--	--
Barium	2000	730 *	ug/l	--	--	442	--	--
Calcium	NSA	NSA	ug/l	--	--	104000	--	--
Chromium	100	0.043	ug/l	--	--	0.8 U	--	--
Iron	NSA	2600 *	ug/l	--	--	1080	--	--
Magnesium	NSA	NSA	ug/l	--	--	25200	--	--
Manganese	NSA	88 *	ug/l	--	--	135	--	--
Mercury	2	3.7 *	ug/l	--	--	0.037 U	--	--
Sodium	NSA	NSA	ug/l	--	--	27900	--	--
Group: VOCs								
Benzene	5	0.41	ug/l	0.93 J	0.23 U	0.49 J	0.19 U	0.23 U
Ethylbenzene	700	1.5	ug/l	0.44 J	0.27 U	3.9	0.4 J	0.27 U
Xylenes, Total	10000	20 *	ug/l	0.2 U	0.25 U	0.58 J	0.2 U	0.25 U
Group: SVOCs								
1,2-dichlorobenzene	600	37 *	ug/l	--	--	0.21 U	--	--
Bis(2-ethylhexyl) phthalate	6	4.8	ug/l	--	--	0.66 U	--	--
Naphthalene	NSA	0.14	ug/l	--	--	1.51	--	--

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals

Analytes not listed on the table were not detected in any samples

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-6

Site 3

Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 1	Boring 1	Boring 2	Boring 2	Boring 3	Boring 3
					Sample Name:	S-03-08-01-1-2	S-03-08-01-2-4	S-03-08-02-1-2	S-03-08-02-2-4	S-03-08-03-1-2	S-03-08-03-2-4
					Parent Sample:						
					Date Sampled:	10/22/2008	10/22/2008	10/22/2008	10/22/2008	10/22/2008	10/22/2008
					Depth:	1-2 ft	2-4 ft	1-2 ft	2-4 ft	1-2 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**						
Group: Metals											
Aluminum	30027	7700 *	99000	55000	mg/kg	**30300 J**	**32200 J**	**26800 J**	**29300 J**	**18000 J**	**24300 J**
Antimony	1	3.1 *	41 *	0.66	mg/kg	0.47 J	0.91 UJ	0.26 UJ	1.2 J	0.25 UJ	0.72 J
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**65.6**	**79.1**	**19.2**	**112**	**4.6**	**122**
Barium	101.8	1500 *	19000	300	mg/kg	123	142	48.7	7.1 J	50.4	5.3 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.18 U	0.16 J	0.097 J	0.2 J	0.016 U	0.21 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.7	0.8 J	0.25 J	0.61 J	0.085 J	0.63 J
Calcium	105848	NSA	NSA	NSA	mg/kg	1080	2710	13100	1850	13400	991
Chromium	69.8	0.29	5.6	2.1	mg/kg	**98**	**120**	**77.4**	**167**	**40.7**	**134**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**40.4**	**45.3**	**16.8**	**7.1**	**13.4**	**2.6 J**
Copper	83.65	310 *	4100 *	51	mg/kg	47.5 J	73.3 J	72.9 J	47.2 J	53.6 J	53.2 J
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.53	0.46	0.064 U	0.079 U	0.065 U	0.082 U
Iron	47064	5500 *	72000	640	mg/kg	**51900**	**79500**	**45400**	**95300**	**32400**	**90100**
Lead	27.52	400 *	800 *	NSA	mg/kg	18.3 J	19.9	6.7	11	4.9	8.3
Magnesium	5131	NSA	NSA	NSA	mg/kg	391 J	772	10100	329 J	8940	260 J
Manganese	1184	180 *	2300 *	57	mg/kg	**12800 J**	**6530 J**	**537 J**	**219 J**	**414 J**	161 J
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.057	0.13	0.021 J	0.2	0.014 J	0.015 U
Nickel	23.01	150 *	2000 *	48	mg/kg	29.3	24.2	36.2	15.3	28.2	10.4
Potassium	1459	NSA	NSA	NSA	mg/kg	292 J	297 J	551 J	227 J	775 J	163 J
Selenium	1	39 *	510 *	0.95	mg/kg	3 U	2.3	0.81	3.7	0.78	2.3
Silver	0.22	39 *	510 *	1.6	mg/kg	0.13 U	2 J	1.6	3	1.1	2.7
Sodium	237.5	NSA	NSA	NSA	mg/kg	111 J	93.6 J	295 J	85.5 J	615 J	71.6 J
Thallium	1.1	0.078 *	1 *	0.026	mg/kg	**4 J**	**2.9 J**	**0.77 J**	**0.67 J**	**0.72 J**	**0.78 J**
Tin	NSA	4700 *	61000	5500	mg/kg	2.5 J	2.9 J	4.5 J	3.8 J	3.9 J	3.4 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**155**	**185**	**163**	**291**	**104**	**262**
Zinc	81.04	2300 *	31000	680	mg/kg	72.2	65.9	61.9	48.9	45.6	33.7
Group:Pesticides											
4,4-DDD	0.51	2000	7200	66	ug/kg	0.26 U	0.26 U	92.7	0.84 U	0.24 U	0.28 U
4,4-DDE	3.37	1400	5100	46	ug/kg	0.4 U	0.4 U	16.1	1.3 U	0.37 U	0.42 U
4,4-DDT	2.65	1700	7000	67	ug/kg	3.7	0.37 U	24.1	1.2 U	5.3	0.39 U
alpha-Chlordane	0.64	1600	6500	13	ug/kg	2.4	0.49 U	51.5	1.6 U	221	0.52 U

Table 5-6
Site 3
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 1	Boring 1	Boring 2	Boring 2	Boring 3	Boring 3
					Sample Name:	S-03-08-01-1-2	S-03-08-01-2-4	S-03-08-02-1-2	S-03-08-02-2-4	S-03-08-03-1-2	S-03-08-03-2-4
					Parent Sample:						
					Date Sampled:	10/22/2008	10/22/2008	10/22/2008	10/22/2008	10/22/2008	10/22/2008
					Depth:	1-2 ft	2-4 ft	1-2 ft	2-4 ft	1-2 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**						
Dieldrin	NSA	30	110	0.17	ug/kg	0.31 U	0.31 U	0.29 U	1 U	9	0.33 U
Endosulfan I	NSA	37000 *	370000 *	3000	ug/kg	0.32 U	0.33 U	2.6	1.1 U	0.3 U	0.35 U
Gamma-chlordane	NSA	1600	6500	13	ug/kg	2.8	0.36 U	58.1	1.2 U	244	0.38 U
Heptachlor	NSA	110	380	1.2	ug/kg	0.42 U	0.43 U	0.4 U	1.4 U	62.9	0.45 U
Group: Herbicides											
Dichlorprop	NSA	NSA	NSA	NSA	ug/kg	13 U	13 U	12 U	14 U	117	14 U
Pentachlorophenol	NSA	890	2700	1.7	ug/kg	24.5	57.8	0.97 U	1.1 U	0.95 U	1.1 U
Group: VOCs											
Acetone	NSA	6100000 *	63000000	4500	ug/kg	2.2 U	5.4 J	23.9	2.8 U	1.2 U	2.8 U
Carbon disulfide	NSA	82000	370000	310	ug/kg	0.51 U	0.5 U	0.43 J	0.66 U	0.27 U	0.66 U
Group: Total Petroleum Hydrocarbons											
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	1.7 U	1.7 U	18.7	1.8 U	1.5 U	1.8 U

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and TPH.

Analytes not listed on the table were not detected in any samples

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-6
Site 3
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 4	Boring 4	Boring 4
					Sample Name:	08-OC-22-DP1	S-03-08-04-1-2	S-03-08-04-2-4
					Parent Sample:	S-03-08-04-1-2		
					Date Sampled:	10/22/2008	10/22/2008	10/22/2008
					Depth:	1-2 ft	1-2 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**			
Group: Metals								
Aluminum	30027	7700 *	99000	55000	mg/kg	**28700 J**	**25700 J**	**26400 J**
Antimony	1	3.1 *	41 *	0.66	mg/kg	1.2 J	0.92 J	0.89 J
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**80.7**	**78.1**	**25.3**
Barium	101.8	1500 *	19000	300	mg/kg	6.7 J	14.3 J	6.2 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.21 J	0.19 J	0.41 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.54 J	0.54 J	0.31 J
Calcium	105848	NSA	NSA	NSA	mg/kg	1470	1290	1440
Chromium	69.8	0.29	5.6	2.1	mg/kg	**104**	**99.9**	**81.8**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**3.3 J**	**3.4 J**	1.3 J
Copper	83.65	310 *	4100 *	51	mg/kg	47.6 J	42.4 J	53.3 J
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.079 UJ	0.076 U	0.074 U
Iron	47064	5500 *	72000	640	mg/kg	**51900**	**66300**	**53300**
Lead	27.52	400 *	800 *	NSA	mg/kg	3.9	6.2	6.1
Magnesium	5131	NSA	NSA	NSA	mg/kg	313 J	285 J	372 J
Manganese	1184	180 *	2300 *	57	mg/kg	178 J	**231 J**	**449 J**
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.041	0.037	0.02 J
Nickel	23.01	150 *	2000 *	48	mg/kg	12.9	11.6	9.6
Potassium	1459	NSA	NSA	NSA	mg/kg	202 J	160 J	223 J
Selenium	1	39 *	510 *	0.95	mg/kg	1.4	1.5	0.93
Silver	0.22	39 *	510 *	1.6	mg/kg	1.8	1.9	1.4
Sodium	237.5	NSA	NSA	NSA	mg/kg	106 J	96.7 J	81.5 J
Thallium	1.1	0.078 *	1 *	0.026	mg/kg	**0.73 J**	**0.42 J**	0.16 U
Tin	NSA	4700 *	61000	5500	mg/kg	3.2 J	3.1 J	3.2 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**173**	**166**	**82.4**
Zinc	81.04	2300 *	31000	680	mg/kg	36.2	32.7	31.8
Group:Pesticides								
4,4-DDD	0.51	2000	7200	66	ug/kg	0.27 U	0.27 U	0.27 U
4,4-DDE	3.37	1400	5100	46	ug/kg	0.41 U	0.41 U	0.41 U
4,4-DDT	2.65	1700	7000	67	ug/kg	0.38 U	0.38 U	0.38 U
alpha-Chlordane	0.64	1600	6500	13	ug/kg	0.5 U	0.5 U	0.51 U

Table 5-6
Site 3
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 4	Boring 4	Boring 4
					Sample Name:	08-OC-22-DP1	S-03-08-04-1-2	S-03-08-04-2-4
					Parent Sample:	S-03-08-04-1-2		
					Date Sampled:	10/22/2008	10/22/2008	10/22/2008
					Depth:	1-2 ft	1-2 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**			
Dieldrin	NSA	30	110	0.17	ug/kg	0.32 U	0.32 U	0.32 U
Endosulfan I	NSA	37000 *	370000 *	3000	ug/kg	0.34 U	0.34 U	0.34 U
Gamma-chlordane	NSA	1600	6500	13	ug/kg	0.37 U	0.37 U	0.37 U
Heptachlor	NSA	110	380	1.2	ug/kg	0.44 U	0.44 U	0.44 U
Group: Herbicides								
Dichlorprop	NSA	NSA	NSA	NSA	ug/kg	13 U	13 U	14 U
Pentachlorophenol	NSA	890	2700	1.7	ug/kg	1.1 U	1.1 U	1.1 U
Group: VOCs								
Acetone	NSA	6100000 *	63000000	4500	ug/kg	2.2 U	1.7 U	2.4 U
Carbon disulfide	NSA	82000	370000	310	ug/kg	0.51 U	0.41 U	0.57 U
Group: Total Petroleum Hydrocarbons								
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	1.8 U	1.7 U	1.8 U

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and TPH.

Analytes not listed on the table were not detected in any samples

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-7
Site 3
Summary of Analytes Detected in Groundwater

Sample Location:				G-03-MW-05A	G-03-MW-05A	G-03-MW-05A	G-03-MW-05A	G-03-MW-05B	G-03-MW-05B	G-03-MW-05B
Sample Name:				G-03-07-MW-05A	G-03-07-MW-05A	G-03-09-MW-5A	G-03-10-MW-05A	07-JA-09-DP	G-03-07-MW-05B	G-03-07-MW-05B
Parent Sample:								G-03-07-MW-05B		
Date Sampled:				1/9/2007	6/13/2007	3/11/2009	8/17/2010	1/9/2007	1/9/2007	6/13/2007
Analyte	**EPA MCL**	**EPA RSL**	**Units**							
Group: Metals (Total)										
Calcium	NSA	NSA	ug/l	135000	--	--	--	117000	119000	--
Chromium	100	0.043	ug/l	0.8 U	--	--	--	10.5	0.8 U	--
Iron	NSA	2600 *	ug/l	224	--	--	--	R	R	--
Magnesium	NSA	NSA	ug/l	5890	--	--	--	28100	28200	--
Manganese	NSA	88 *	ug/l	19.2	--	--	--	81.6	78.1	--
Sodium	NSA	NSA	ug/l	17200	--	--	--	38800	39100	--
Group: VOCs										
Chloroform	80	0.19	ug/l	0.22 U	0.25 U	0.31 J	0.23 U	0.22 U	0.22 U	0.25 U
Trichloroethene	5	2	ug/l	4.6	3	5.5	3.7	0.29 U	0.29 U	0.26 U
Group: SVOCs										
1,2-dichlorobenzene	600	37 *	ug/l	0.21 U	--	--	--	4.4	0.21 U	--
1,4-dichlorobenzene	75	0.43	ug/l	0.18 U	--	--	--	1.5 J	0.18 U	--
Naphthalene	NSA	0.14	ug/l	0.026 U	--	--	--	0.796	0.026 U	--

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals

Analytes not listed on the table were not detected in any samples

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

R = Value is Rejected

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-8
Site 4
Summary of Analytes in Surface Soil

					Sample Location:	Boring 1	Boring 2	Boring 3	Boring 4	Boring 5	Boring 6
					Sample Name:	S-04-08-01-0-2	S-04-08-02-0-2	S-04-08-03-0-2	S-04-08-04-0-2	S-04-08-05-0-2	S-04-08-06-0-2
					Date Sampled:	10/20/2008	10/20/2008	10/20/2008	10/20/2008	10/20/2008	10/20/2008
					Depth:	0-2 ft	0-2 ft	0-2 ft	0-2 ft	0-2 ft	0-2 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**						
Group: PCBs					ug/kg	ND	ND	ND	ND	ND	ND

Samples were analyzed for PCBs. No compounds were detected in any samples.
Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001
ND = Not detected.

Table 5-9
Site 4
Summary of Analytes Detected in Groundwater

Sample Location:				G-03-MW-10A	G-03-MW-10A	G-03-MW-10A	G-03-MW-10B	G-03-MW-10B	G-03-MW-10B
Sample Name:				G-03-07-MW-10A	G-03-08-MW-10A	G-03-09-MW-10A	G-03-07-MW-10B	G-03-08-MW-10B	G-03-09-MW-10B
Date Sampled:				6/13/2007	1/8/2008	3/10/2009	6/12/2007	1/8/2008	3/10/2009
Analyte	**EPA MCL**	**EPA RSL**	**Units**						
Group: Metals (Dissolved)									
Barium	2000	730 *	ug/l	8.9 J	--	--	79.4 J	--	--
Chromium	100	0.043	ug/l	2 J	--	--	5.1 J	--	--
Mercury	2	3.7 *	ug/l	0.037 U	--	--	0.38	--	--
Nickel	NSA	73 *	ug/l	2.8 U	--	--	3.4 J	--	--
Vanadium	NSA	18 *	ug/l	2.8 J	--	--	3.2 J	--	--
Zinc	NSA	1100 *	ug/l	5.2 J	--	--	6.5 J	--	--
Group: Metals (Total)									
Barium	2000	730 *	ug/l	9.4 J	--	--	76.7 J	--	--
Chromium	100	0.043	ug/l	4.7 J	--	--	1.5 J	--	--
Mercury	2	3.7 *	ug/l	0.36	--	--	0.15 J	--	--
Nickel	NSA	73 *	ug/l	2.8 U	--	--	42.3	--	--
Vanadium	NSA	18 *	ug/l	4.6 J	--	--	1.9 J	--	--
Zinc	NSA	1100 *	ug/l	4.8 J	--	--	5.6 J	--	--

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals.

Analytes not listed on the table were not detected in any samples.

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-10

Site 5

Summary of Analytes in Subsurface Soil

Sample Location:						Boring 1	Boring 1	Boring 2	Boring 2
Sample Name:						S-05-08-01-1-2	S-05-08-01-2-4	S-05-08-02-1-2	S-05-08-02-2-4
Date Sampled:						10/20/2008	10/20/2008	10/20/2008	10/20/2008
Depth:						1-2 ft	2-4 ft	1-2 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**				
Group: PCBs					ug/kg	ND	ND	ND	ND

Samples were analyzed for PCBs. No compounds were detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

ND = Not detected.

Table 5-11
Site 6
Summary of Analytes Detected in Surface Soil

					Sample Location:	Boring 1	Boring 2	Boring 3	Boring 3
					Sample Name:	S-06-08-01-0-2	S-06-08-02-0-2	08-12-02-DP1	S-06-08-03-0-2
					Parent Sample:			S-06-08-03-0-2	
					Date Sampled:	12/2/2008 & 2/4/2009	12/2/2008 & 2/4/2009	12/2/2008	12/2/2008 & 2/4/2009
					Depth:	0-2 ft	0-2 ft	0-2 ft	0-2 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**				
Group:Pesticides									
4,4-DDD	0.51	2000	7200	2.5	ug/kg	1.7	0.25 U	0.26 U	0.25 U
4,4-DDE	3.37	1400	5100	2.5	ug/kg	9.8	0.38 U	0.41 U	0.39 U
alpha-Chlordane	0.64	1600	6500	NSA	ug/kg	0.46 U	0.46 U	6.7	0.48 U
gamma-Chlordane	NSA	1600	6500	NSA	ug/kg	0.34 U	2.4	7.5	0.35 U
Group: Herbicides									
Pentachlorophenol	NSA	890	2700	2	ug/kg	2	4	5.6	4.7

Samples were analyzed for organochlorine pesticides, organophosphorus pesticides, and herbicides.

Analytes not listed on the table were not detected in any samples

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-12
Site 6
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 2	Boring 3
Sample Name:						S-06-08-01-2-4	S-06-08-02-2-4	S-06-08-03-2-4
Date Sampled:						12/2/2008 & 2/4/2009	12/2/2008 & 2/4/2009	12/2/2008 & 2/4/2009
Depth:						2-4 ft	2-4 ft	2-4 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**			
Group:Pesticides								
alpha-Chlordane	0.64	1600	6500	13	ug/kg	0.52 U	0.53 U	16.8
gamma-Chlordane	NSA	1600	6500	13	ug/kg	0.38 U	0.39 U	18.2
Group: Herbicides								
Pentachlorophenol	NSA	890	2700	1.7	ug/kg	14	8.5	1.1 UJ

Samples were analyzed for organochlorine pesticides, organophosphorus pesticides, and herbicides.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-13
Site 6
Summary of Analytes Detected in Sediment

				Sample Location:	Boring 1	Boring 2	Boring 3
				Sample Name:	SED-06-08-01	SED-06-08-02	SED-06-08-03
				Date Sampled:	12/2/2008 & 2/4/2009	12/2/2008 & 2/4/2009	12/2/2008 & 2/4/2009
Analyte	**EPA RSL Res**	**EPA RSL Ind**	**EPA Eco**	**Units**			
Group:Pesticides							
4,4-DDE	14000	51000	3.3	ug/kg	0.46 U	0.88 U	6.9
alpha-Chlordane	16000	65000	1.7	ug/kg	0.57 U	16.5	69
gamma-Chlordane	16000	65000	1.7	ug/kg	0.41 U	10.4	40.5
Heptachlor epoxide	530	1900	NSA	ug/kg	0.37 U	0.7 U	4.1

Samples were analyzed for organochlorine pesticides, organophosphorus pesticides, and herbicides.

Analytes not listed on the table were not detected in any samples.

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil multipied by 10 for Sediment, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil multipied by 10 for Sediment, June 2011

EPA Eco = EPA Region 4 ecological screening values for sediment: USEPA, 2001

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA Eco are in blue font.

Table 5-14
Site 7
Summary of Analytes Detected in Surface Soil

Sample Location:						Boring 1
Sample Name:						S-07-08-01-0-2
Date Sampled:						10/23/2008
Depth Interval:						0-2 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**	
Group: Metals						
Aluminum	30027	7700 *	99000	50	mg/kg	**25200**
Antimony	1	3.1 *	41 *	3.5	mg/kg	1.1 J
Arsenic	43.87	0.39	1.6	10	mg/kg	**43.8**
Barium	101.8	1500 *	19000	165	mg/kg	23.4 J
Beryllium	0.647	16 *	200 *	1.1	mg/kg	0.32 J
Cadmium	0.858	7 *	80 *	1.6	mg/kg	0.77
Calcium	105848	NSA	NSA	NSA	mg/kg	37900
Chromium	69.8	0.29	5.6	0.4	mg/kg	**102**
Cobalt	16.57	2.3 *	30 *	20	mg/kg	**6.6**
Copper	83.65	310 *	4100 *	40	mg/kg	45.9
Cyanide	NSA	160 *	2000 *	0.9	mg/kg	0.2 J
Iron	47064	5500 *	72000	200	mg/kg	**42600**
Lead	27.52	400 *	800 *	50	mg/kg	39.3
Magnesium	5131	NSA	NSA	NSA	mg/kg	1250
Manganese	1184	180 *	2300 *	100	mg/kg	**578**
Mercury	0.32	0.78 *	10 *	NSA	mg/kg	0.12
Nickel	23.01	150 *	2000 *	30	mg/kg	17.2
Potassium	1459	NSA	NSA	NSA	mg/kg	591 J
Selenium	1	39 *	510 *	0.81	mg/kg	1.7
Sodium	237.5	NSA	NSA	NSA	mg/kg	87 J
Tin	NSA	4700 *	61000	53	mg/kg	3.6 J
Vanadium	145.4	39 *	520 *	2	mg/kg	**163 J**
Zinc	81.04	2300 *	31000	50	mg/kg	73.6
Group:Pesticides						
4,4-DDD	0.51	2000	7200	2.5	ug/kg	24.2
4,4-DDE	3.37	1400	5100	2.5	ug/kg	34.1
4,4-DDT	2.65	1700	7000	2.5	ug/kg	40.8
Dieldrin	NSA	30	110	0.5	ug/kg	4.4
Group: VOCs						
Acetone	NSA	6100000 *	63000000	NSA	ug/kg	20.3
Group: SVOCs						
Benzo[a]anthracene	NSA	150	2100	NSA	ug/kg	13.2
Chrysene	NSA	15000	210000	NSA	ug/kg	7.61 J
Group: Total Petroleum Hydrocarbons						
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	13.7

Samples were analyzed for metals, PCBs, organochlorine pesticides, organophosphorus pesticides, herbicides, VOCs, SVOCs, and TPH.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-15
Site 7
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 1
Sample Name:						08-OC-23-DP1	S-07-08-01-2-4
Parent Sample:						S-07-08-01-2-4	
Date Sampled:						10/23/2008	10/23/2008
Depth Interval:						2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL**	**EPA RSL Ind**	**EPA SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	55000	mg/kg	**9450**	**10900**
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**7.2**	**7.9**
Barium	101.8	1500 *	19000	300	mg/kg	12.4 J	17.1 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.21 J	0.14 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.29 U	0.34 J
Calcium	105848	NSA	NSA	NSA	mg/kg	261000	176000
Chromium	69.8	0.29	5.6	2.1	mg/kg	**13.7**	**15.7**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**5.7 J**	**6.4**
Copper	83.65	310 *	4100 *	51	mg/kg	16	15.8
Iron	47064	5500 *	72000	640	mg/kg	**16500**	**12200**
Lead	27.52	400 *	800 *	NSA	mg/kg	1.4 J	1.3 J
Magnesium	5131	NSA	NSA	NSA	mg/kg	2610	2780
Manganese	1184	180 *	2300 *	57	mg/kg	**368**	**353**
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.015 J	**6**
Nickel	23.01	150 *	2000 *	48	mg/kg	7.3	6.6
Potassium	1459	NSA	NSA	NSA	mg/kg	1150 J	1150
Selenium	1	39 *	510 *	0.95	mg/kg	5.7 J	2.9 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	69.9 J	69.7 J
Tin	NSA	4700 *	61000	5500	mg/kg	2.2 J	1.9 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**45.8 J**	31.3 J
Zinc	81.04	2300 *	31000	680	mg/kg	18.9	19.4
Group: VOCs							
1,1-dichloroethene	NSA	24000 *	110000 *	120	ug/kg	1.2 J	1 J
Acetone	NSA	6100000 *	63000000	4500	ug/kg	3.7 J	1.8 U
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	10.4 J	1.6 UJ

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and T

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-16
Site 7
Summary of Analytes Detected in Groundwater

Sample Location:				G-03-MW-19A	G-03-MW-19A	G-03-MW-19B	G-03-MW-19B	G-07-01
Sample Name:				G-03-08-MW-19A	G-03-08-MW-19A	G-03-08-MW-19B	G-03-08-MW-19B	G-07-09-01
Date Sampled:				1/8/2008	5/13/2008	1/8/2008	5/13/2008	1/29/2009
Analyte	**EPA MCL**	**EPA RSL**	**Units**					
Group: Metals (Dissolved)								
Arsenic	10	0.045	ug/l	6 U	--	9.4	--	--
Barium	2000	730 *	ug/l	120 J	--	87.4 J	--	--
Cobalt	NSA	1.1 *	ug/l	2.3 J	--	2.1 J	--	--
Group: Metals (Total)								
Arsenic	10	0.045	ug/l	6 U	--	9	--	--
Barium	2000	730 *	ug/l	145 J	--	90.5 J	--	--
Cobalt	NSA	1.1 *	ug/l	5.4 J	--	3 J	--	--
Copper	1300	150 *	ug/l	4.5 J	--	2.2 U	--	--
Vanadium	NSA	18 *	ug/l	9.8 J	--	1.8 U	--	--
Zinc	NSA	1100 *	ug/l	5.7 J	--	3.4 J	--	--
Group: VOCs								
Acetone	NSA	2200 *	ug/l	2.9 U	2.1 U	2.9 U	2.1 U	16

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-17
Site 8
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 1	Boring 2	Boring 2
Sample Name:						S-08-08-01-2-4	S-08-08-01-4-6	S-08-08-02-1-2	S-08-09-02-4-6
Date Sampled:						10/22/2008	10/22/2008	10/22/2008	1/28/2009
Depth Interval:						2-4 ft	4-6 ft	1-2 ft	4-6 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**				
Group: Metals									
Aluminum	30027	7700 *	99000	55000	mg/kg	**25900 J**	**31800 J**	**16700 J**	**29300**
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**14.1**	**33.7**	**11.9**	**18.7**
Barium	101.8	1500 *	19000	300	mg/kg	83.4	141	57.9	156
Beryllium	0.647	16 *	200 *	58	mg/kg	0.48 J	0.58 J	0.22 J	0.58 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.31 J	0.3 J	0.28 J	0.42 J
Calcium	105848	NSA	NSA	NSA	mg/kg	13000	4680	138000	6560
Chromium	69.8	0.29	5.6	2.1	mg/kg	**42.3**	**66.3**	**62.8**	**62.3**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**17.4**	**56.6**	**8.8**	**13.3**
Copper	83.65	310 *	4100 *	51	mg/kg	38.1 J	61.1 J	32.3 J	54.6
Iron	47064	5500 *	72000	640	mg/kg	**25500**	**49400**	**19600**	**37200**
Lead	27.52	400 *	800 *	NSA	mg/kg	4.6	12	27.7	8.7
Magnesium	5131	NSA	NSA	NSA	mg/kg	2010	1570	3850	2220
Manganese	1184	180 *	2300 *	57	mg/kg	**191 J**	**2050 J**	**408 J**	**316**
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.084	0.076	0.045	0.15
Nickel	23.01	150 *	2000 *	48	mg/kg	11.5	20.5	12.1	12.6
Potassium	1459	NSA	NSA	NSA	mg/kg	915 J	672 J	702 J	964 J
Selenium	1	39 *	510 *	0.95	mg/kg	0.35 U	1.1	0.34 U	2.5
Silver	0.22	39 *	510 *	1.6	mg/kg	0.81 J	1.5	0.41 J	0.17 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	129 J	168 J	217 J	143 J
Thallium	1.1	0.078 *	1 *	0.026	mg/kg	**0.23 J**	**0.65 J**	0.17 U	**0.23 J**
Tin	NSA	4700 *	61000	5500	mg/kg	2.5 J	2.9 J	2.8 J	--
Vanadium	145.4	39 *	520 *	180	mg/kg	**70.2**	**104**	**70.7**	**139**
Zinc	81.04	2300 *	31000	680	mg/kg	69.6	72.5	40	90.6 J
Group: VOCs									
2-butanone	NSA	2800000 *	20000000	1500	ug/kg	1.8 UJ	15.1	6.3 J	360 U
Acetone	NSA	6100000 *	63000000	4500	ug/kg	25.7	184	91.2	350 U
Carbon disulfide	NSA	82000	370000	310	ug/kg	3 J	2.4 J	1.5 J	81 U
Xylenes, Total	NSA	63000	270000	200	ug/kg	0.24 U	0.39 J	0.37 U	49 U
Group: Total Petroleum Hydrocarbons									
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	1.8 U	1.9 U	129	87.4

Table 5-17

Site 8

Summary of Analytes Detected in Subsurface Soil

Notes:
Samples were analyzed for VOCs, SVOCs, metals, and TPH.
Analytes not listed on the table were not detected in any samples.
Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011
[1] = PR Environmental Quality Board value, not EPA RSL
-- = Not Analyzed
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL Res are bolded.
Detected concentrations exceeding the EPA RSL Ind are shaded gray.
Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-18
Site 8
Summary of Analytes Detected in Groundwater

			Sample Location:	G-03-MW-23	G-03-MW-23
			Sample Name:	G-03-08-MW-23	G-03-09-MW-23
			Date Sampled:	5/13/2008	1/7/2009
Analyte	**EPA MCL**	**EPA RSL**	**Unit**		
Group: Metals (Dissolved)					
Barium	2000	730 *	ug/l	120 J	--
Calcium	NSA	NSA	ug/l	132000	--
Chromium	100	0.043	ug/l	1.1 J	--
Cobalt	NSA	1.1 *	ug/l	2.8 J	--
Iron	NSA	2600 *	ug/l	18.4 J	--
Magnesium	NSA	NSA	ug/l	16800	--
Manganese	NSA	88 *	ug/l	321	--
Nickel	NSA	73 *	ug/l	4 J	--
Potassium	NSA	NSA	ug/l	2020 J	--
Sodium	NSA	NSA	ug/l	35300	--
Vanadium	NSA	18 *	ug/l	1.6 J	--
Zinc	NSA	1100 *	ug/l	9.9 J	--
Group: Metals (Total)					
Aluminum	NSA	3700 *	ug/l	77.3 J	--
Barium	2000	730 *	ug/l	121 J	--
Calcium	NSA	NSA	ug/l	131000	--
Chromium	100	0.043	ug/l	0.9 J	--
Cobalt	NSA	1.1 *	ug/l	3 J	--
Iron	NSA	2600 *	ug/l	102	--
Magnesium	NSA	NSA	ug/l	16700	--
Manganese	NSA	88 *	ug/l	347	--
Nickel	NSA	73 *	ug/l	4.8 J	--
Potassium	NSA	NSA	ug/l	1990 J	--
Sodium	NSA	NSA	ug/l	35200	--
Vanadium	NSA	18 *	ug/l	2 J	--

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals unle
Analytes not listed on the table were not detected in any samples.
EPA MCL = EPA Maximum Contaminant Level, June 2011
EPA RSL = EPA Tapwater Regional Screening Level, June 2011
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
-- = Not Analyzed
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL are shaded gray.
Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-19
Site 9
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 1	Boring 2	Boring 2	Boring 3
Sample Name:						S-09-08-01-2-4	S-09-08-01-4-6	S-09-08-02-2-4	S-09-08-02-4-6	08-OC-21-DP1
Parent Sample:										S-09-08-03-2-4
Date Sampled:						10/21/2008	10/21/2008	10/21/2008	10/21/2008	10/21/2008
Depth Interval:						2-4 ft	4-6 ft	2-4 ft	4-6 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**					
Group: Metals										
Aluminum	30027	7700 *	99000	55000	mg/kg	**20300**	**14600**	**20700**	**20000**	**23400**
Antimony	1	3.1 *	41 *	0.66	mg/kg	0.35 J	0.31 U	0.3 U	0.31 U	0.31 U
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**35.7**	**53.8**	**165**	**94.3**	**239 J**
Barium	101.8	1500 *	19000	300	mg/kg	6.9 J	6 J	184	65.2	13.6 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.13 J	0.18 J	0.68	0.41 J	0.75
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.39 J	0.55 J	0.67 J	0.48 J	1.3 J
Calcium	105848	NSA	NSA	NSA	mg/kg	1590	539 J	15300	1880	2180 J
Chromium	69.8	0.29	5.6	2.1	mg/kg	**35.4**	**62.6**	**145**	**90.5**	**142**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	1.9 J	**2.5 J**	**104**	**32.7**	**24**
Copper	83.65	310 *	4100 *	51	mg/kg	29.6	31.8	87.8	53.5	75.7
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.067 U	0.075 U	0.59	0.25 J	0.074 U
Iron	47064	5500 *	72000	640	mg/kg	**37900**	**61900**	**100000**	**76000**	**127000**
Lead	27.52	400 *	800 *	NSA	mg/kg	3.3	7.6	22.9	12.1	17.9
Magnesium	5131	NSA	NSA	NSA	mg/kg	332 J	209 J	422 J	186 J	506 J
Manganese	1184	180 *	2300 *	57	mg/kg	42.7	99.1	**7150**	**2110**	**1020 J**
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.048	0.017 J	0.027 J	0.44	0.1
Nickel	23.01	150 *	2000 *	48	mg/kg	4.4 J	3.1 J	17	10.4	21.4 J
Potassium	1459	NSA	NSA	NSA	mg/kg	477 J	364 J	619 J	423 J	476 J
Selenium	1	39 *	510 *	0.95	mg/kg	1.6	2.1	10.7	5.6	6.5
Silver	0.22	39 *	510 *	1.6	mg/kg	0.13 U	0.14 U	1.3 J	0.14 U	0.14 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	43.5 J	22.4 J	40.5 J	28 J	46.2 J
Tin	NSA	4700 *	61000	5500	mg/kg	1.8 J	1.6 J	1.2 J	1.6 J	1.3 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**140**	**169**	**222**	**172**	**232**
Zinc	81.04	2300 *	31000	680	mg/kg	15.2	15.8	67.7	47.4	74.3 J
Group: VOCs										
Acetone	NSA	6100000 *	63000000	4500	ug/kg	2 U	2.3 U	2 U	2.1 U	10.6 J
Toluene	NSA	500000	4500000	1600	ug/kg	0.3 U	0.86 J	0.3 U	0.33 U	1.7
Xylenes, Total	NSA	63000	270000	200	ug/kg	0.28 U	0.88 J	0.28 U	0.3 U	0.96 J
Group: Total Petroleum Hydrocarbons										
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	1.7 U	1.8 U	34.5	15.4	1.8 U

Table 5-19
Site 9
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 3	Boring 3
Sample Name:						S-09-08-03-2-4	S-09-08-03-4-6
Parent Sample:							
Date Sampled:						10/21/2008	10/21/2008
Depth Interval:						2-4 ft	4-6 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	55000	mg/kg	**22100**	**22100**
Antimony	1	3.1 *	41 *	0.66	mg/kg	0.32 U	0.31 U
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**138 J**	**66.1**
Barium	101.8	1500 *	19000	300	mg/kg	8.7 J	11.7 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.48 J	0.24 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.79 J	0.52 J
Calcium	105848	NSA	NSA	NSA	mg/kg	1470 J	1130
Chromium	69.8	0.29	5.6	2.1	mg/kg	**184**	**68.8**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**17.2**	**5.1 J**
Copper	83.65	310 *	4100 *	51	mg/kg	66.8	49.6
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.085 U	0.076 U
Iron	47064	5500 *	72000	640	mg/kg	**119000**	**50100**
Lead	27.52	400 *	800 *	NSA	mg/kg	12.2	4.9
Magnesium	5131	NSA	NSA	NSA	mg/kg	340 J	371 J
Manganese	1184	180 *	2300 *	57	mg/kg	**592 J**	167
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.023 J	0.041 J
Nickel	23.01	150 *	2000 *	48	mg/kg	12.2 J	8
Potassium	1459	NSA	NSA	NSA	mg/kg	422 J	438 J
Selenium	1	39 *	510 *	0.95	mg/kg	3.5	1.2
Silver	0.22	39 *	510 *	1.6	mg/kg	0.15 U	0.14 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	38.4 J	40 J
Tin	NSA	4700 *	61000	5500	mg/kg	0.79 U	1.9 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**206**	**166**
Zinc	81.04	2300 *	31000	680	mg/kg	51 J	28.8
Group: VOCs							
Acetone	NSA	6100000 *	63000000	4500	ug/kg	1.8 U	2.1 U
Toluene	NSA	500000	4500000	1600	ug/kg	0.27 U	0.32 U
Xylenes, Total	NSA	63000	270000	200	ug/kg	0.25 U	0.29 U
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	1.9 U	1.8 U

Table 5-19
Site 9
Summary of Analytes Detected in Subsurface Soil

Notes:

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and TPH.

Analytes not listed on the table were not detected in any samples

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

^{1} = PR Environmental Quality Board value, not EPA RSL

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-20
Site 10
Summary of Analytes Detected in Surface Soil

Sample Location:						Boring 1	Boring 2	Boring 3
Sample Name:						S-10-08-01-0-2	S-10-08-02-0-2	S-10-08-03-0-2
Date Sampled:						10/22/2008	10/22/2008	10/22/2008
Depth Interval:						0-2 ft	0-2 ft	0-2 ft
Analyte Name	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**			
Group: VOCs								
Acetone	NSA	6100000 *	63000000	NSA	ug/kg	41.1	14.7	2 U
Group: Total Petroleum Hydrocarbons								
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	34.8	33.3	10.1

Samples were analyzed for VOCs and TPH.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-21
Site 10
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 1	Boring 2	Boring 3
					Sample Name:	S-10-08-01-2-4	S-10-08-02-2-4	S-10-08-03-2-4
					Date Sampled:	10/22/2008	10/22/2008	10/22/2008
					Depth Interval:	2-4 ft	2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**			
Group: VOCs								
Acetone	NSA	6100000 *	63000000	4500	ug/kg	42.9	18.1	69.7 J
Carbon disulfide	NSA	82000	370000	310	ug/kg	1.3 J	0.9 J	0.48 U

Samples were analyzed for VOCs and TPH.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-22
Site 10
Summary of Analytes Detected in Groundwater

Sample Location:				G-03-MW-20	G-03-MW-20
Sample Name:				G-03-08-MW-20	G-03-09-MW-20
Date Sampled:				5/13/2008	1/7/2009
Analyte	**EPA MCL**	**EPA RSL**	**Units**		
Group: Metals (Dissolved)					
Arsenic	10	0.045	ug/l	2 J	--
Barium	2000	730 *	ug/l	83.1 J	--
Calcium	NSA	NSA	ug/l	95300	--
Chromium	100	0.043	ug/l	0.6 J	--
Iron	NSA	2600 *	ug/l	43.3 J	--
Magnesium	NSA	NSA	ug/l	26400	--
Manganese	NSA	88 *	ug/l	208	--
Potassium	NSA	NSA	ug/l	2760 J	--
Selenium	50	18 *	ug/l	2.1 J	--
Sodium	NSA	NSA	ug/l	56500	--
Vanadium	NSA	18 *	ug/l	0.8 J	--
Group: Metals (Total)					
Aluminum	NSA	3700 *	ug/l	569	--
Arsenic	10	0.045	ug/l	2.2 J	--
Barium	2000	730 *	ug/l	86.1 J	--
Calcium	NSA	NSA	ug/l	99400	--
Chromium	100	0.043	ug/l	2.1 J	--
Cobalt	NSA	1.1 *	ug/l	0.6 J	--
Copper	1300	150 *	ug/l	3.2 J	--
Iron	NSA	2600 *	ug/l	791	--
Magnesium	NSA	NSA	ug/l	26800	--
Manganese	NSA	88 *	ug/l	219	--
Nickel	NSA	73 *	ug/l	1.8 J	--
Potassium	NSA	NSA	ug/l	2800 J	--
Selenium	50	18 *	ug/l	4.1 J	--
Sodium	NSA	NSA	ug/l	56900	--
Vanadium	NSA	18 *	ug/l	3 J	--
Zinc	NSA	1100 *	ug/l	4.2 J	--
Group: VOCs					
Trichloroethene	5	2	ug/l	1.2	0.62 J

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals, unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-23
Site 11
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 2	Boring 3	Boring 4	Boring 4
Sample Name:						S-11-08-01-2-4	S-11-08-02-2-4	S-11-08-03-2-4	08-OC-21-DP2	S-11-08-04-2-4
Parent Sample:									S-11-08-04-2-4	
Date Sampled:						10/21/2008	10/21/2008	10/21/2008	10/21/2008	10/21/2008
Depth Interval:						2-4 ft	2-4 ft	2-4 ft	2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**					
Group: Metals										
Aluminum	30027	7700 *	99000	55000	mg/kg	**20600**	**23700**	**21500**	**25300**	**22500**
Antimony	1	3.1 *	41 *	0.66	mg/kg	0.3 U	0.39 J	0.96 J	0.32 U	0.32 U
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**62.8**	**85.8**	**119**	**48.3**	**41**
Barium	101.8	1500 *	19000	300	mg/kg	49.3	5 J	5.7 J	13.6 J	14.7 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.53 J	0.43 J	0.56 J	0.43 J	0.46 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.89	0.68	0.51 J	0.63 J	0.55 J
Calcium	105848	NSA	NSA	NSA	mg/kg	6180	1570	5330	9830 J	18000 J
Chromium	69.8	0.29	5.6	2.1	mg/kg	**84.1**	**116**	**140**	**67.4**	**57**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**23.7**	**7.4**	**5.7 J**	**4.3 J**	**4.6 J**
Copper	83.65	310 *	4100 *	51	mg/kg	58.1	54	55.9	58	50.8
Cyanide	NSA	160 *	2000 *	7.4	mg/kg	0.53	0.081 U	0.082 U	0.084 U	0.083 U
Iron	47064	5500 *	72000	640	mg/kg	**50100**	**65200**	**70000**	**55200**	**44500**
Lead	27.52	400 *	800 *	NSA	mg/kg	15.2	5.8	9.2	12.7	14.3
Magnesium	5131	NSA	NSA	NSA	mg/kg	288 J	261 J	436 J	1380	1480
Manganese	1184	180 *	2300 *	57	mg/kg	**3040**	**213**	**220**	176	**200**
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.12	0.082	0.07	0.3	0.23
Nickel	23.01	150 *	2000 *	48	mg/kg	15	12.8	13.2	8.5	9.6
Potassium	1459	NSA	NSA	NSA	mg/kg	392 J	388 J	431 J	522 J	513 J
Selenium	1	39 *	510 *	0.95	mg/kg	1.6	2.7	4.3	1.8	1.6
Sodium	237.5	NSA	NSA	NSA	mg/kg	67.4 J	49.4 J	34.2 J	101 J	94.5 J
Tin	NSA	4700 *	61000	5500	mg/kg	2.2 J	2.5 J	2.3 J	2 J	2.6 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**155**	**215**	**241**	**153**	**131**
Zinc	81.04	2300 *	31000	680	mg/kg	57.8	40.5	42.7	37.4	39.7
Group: VOCs										
Acetone	NSA	6100000 *	63000000	4500	ug/kg	52.3	2.5 U	51.9	29.4	41.7
Toluene	NSA	500000	4500000	1600	ug/kg	0.66 J	0.38 U	0.39 U	0.33 U	0.32 U
Group: Total Petroleum Hydrocarbons										
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	44.3	1.9 U	87.9	38.7	37.5

Table 5-23
Site 11
Summary of Analytes Detected in Subsurface Soil

Notes:
Samples were analyzed for VOCs, Metals, PCBs, and TPH.
Analytes not listed on the table were not detected in any samples.
Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011
[1] = PR Environmental Quality Board value, not EPA RSL
-- = Not Analyzed
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL Res are bolded.
Detected concentrations exceeding the EPA RSL Ind are shaded gray.
Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-24

Site 12

Summary of Analytes Detected in Surface Soil

					Sample Location:	Location 1	Location 2	Location 3	Location 3	Location 4
					Sample Name:	SS-12-07-01-0.5	SS-12-07-02-0.5	07-AP-24-DP	SS-12-07-03-0.5	SS-12-07-04-0.5
					Parent Sample:			SS-12-07-03-0.5		
					Date Sampled:	4/24/2007 & 12/2/2008	4/24/2007 & 12/2/2008	4/24/2007	4/24/2007 & 12/2/2008	4/24/2007 & 12/2/2008
					Depth Interval:	0-0.5 ft	0-0.5 ft	0-0.5 ft	0-0.5 ft	0-0.5 ft
Analyte	**Background**	**EPA RSL RES**	**EPA RSL IND**	**Eco SSL**	**Units**					
Group: Metals										
Aluminum	30027	7700 *	99000	50	mg/kg	**19100 J**	**17000 J**	**16400 J**	**17500 J**	**18400 J**
Arsenic	43.87	0.39	1.6	10	mg/kg	**7.8**	**7.9**	**7.4**	**7.9**	**6.9**
Barium	101.8	1500 *	19000	165	mg/kg	38.1	51	46.6	45.5	56.5
Beryllium	0.647	16 *	200 *	1.1	mg/kg	0.2 J	0.31 J	0.21 J	0.23 J	0.22 J
Cadmium	0.858	7 *	80 *	1.6	mg/kg	0.28 J	0.2 U	1.2	1.4	0.76
Calcium	105848	NSA	NSA	NSA	mg/kg	54800 J	5320 J	7200 J	8260 J	15500 J
Chromium	69.8	0.29	5.6	0.4	mg/kg	**27.2**	**19.6**	**22.9**	**25.8**	**22.8**
Cobalt	16.57	2.3 *	30 *	20	mg/kg	**9.4 J**	**8 J**	**6.8 J**	**6.8 J**	**8.9 J**
Copper	83.65	310 *	4100 *	40	mg/kg	34	29.2	28.6	31	34.7
Iron	47064	5500 *	72000	200	mg/kg	**22400 J**	**20200 J**	**19300 J**	**21100 J**	**23400 J**
Lead	27.52	400 *	800 *	50	mg/kg	21.1	8.7	38.8	46.5	29.6
Magnesium	5131	NSA	NSA	NSA	mg/kg	3240	2000	1700	1790	2300
Manganese	1184	180 *	2300 *	100	mg/kg	**406**	**404**	**324**	**231**	**403**
Mercury	0.32	0.78 *	10 *	NSA	mg/kg	0.097	0.074	0.15	0.15	0.092
Nickel	23.01	150 *	2000 *	30	mg/kg	10.7	6.6	6.7	6.7	7.1
Potassium	1459	NSA	NSA	NSA	mg/kg	588 J	855	762	802	759
Selenium	1	39 *	510 *	0.81	mg/kg	0.94 U	1.1 U	0.95 U	1 U	1 U
Silver	0.22	39 *	510 *	2	mg/kg	0.31 J	0.22 U	0.19 U	0.2 U	0.2 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	95 U	110 U	96 U	100 U	100 U
Thallium	1.1	0.078 *	1 *	1	mg/kg	1 U	1.2 U	1 U	1.1 U	1.1 U
Vanadium	145.4	39 *	520 *	2	mg/kg	**69.7**	**60.5**	**62.5**	**69.7**	**77.6**
Zinc	81.04	2300 *	31000	50	mg/kg	78	39.6	42.2	43.7	42.7
Group:Pesticides										
4,4-DDE	3.37	1400	5100	2.5	ug/kg	2.2	0.49 U	0.43 U	0.45 U	0.44 U
4,4-DDT	2.65	1700	7000	2.5	ug/kg	3.7	0.61 U	0.53 U	1.9	0.54 U
Group: SVOCs										
Benzo[a]anthracene	NSA	150	2100	NSA	ug/kg	21.8	0.31 U	0.27 U	0.28 U	0.28 U
Benzo[a]pyrene	NSA	15	210	100	ug/kg	14.7	0.74 U	0.64 U	0.68 U	0.66 U
Benzo[b]fluoranthene	NSA	150	2100	NSA	ug/kg	19.8	1.9 U	1.6 U	1.7 U	1.7 U

Table 5-24
Site 12
Summary of Analytes Detected in Surface Soil

Sample Location:						Location 1	Location 2	Location 3	Location 3	Location 4
Sample Name:						SS-12-07-01-0.5	SS-12-07-02-0.5	07-AP-24-DP	SS-12-07-03-0.5	SS-12-07-04-0.5
Parent Sample:								SS-12-07-03-0.5		
Date Sampled:						4/24/2007 & 12/2/2008	4/24/2007 & 12/2/2008	4/24/2007	4/24/2007 & 12/2/2008	4/24/2007 & 12/2/2008
Depth Interval:						0-0.5 ft	0-0.5 ft	0-0.5 ft	0-0.5 ft	0-0.5 ft
Analyte	**Background**	**EPA RSL RES**	**EPA RSL IND**	**Eco SSL**	**Units**					
Benzo[k]fluoranthene	NSA	1500	21000	NSA	ug/kg	16.2	0.83 U	0.73 U	0.77 U	0.75 U
Bis(2-ethylhexyl) phthalate	NSA	35000	120000	NSA	ug/kg	56 U	63 U	56.3 J	58 U	57 U
Chrysene	NSA	15000	210000	NSA	ug/kg	18.9	0.55 U	0.48 U	0.51 U	0.5 U
Fluoranthene	NSA	230000 *	2200000 *	100	ug/kg	33.9 J	17 U	15 U	16 U	16 U
Phenanthrene	NSA	1700000 *	17000000	100	ug/kg	28.5	0.53 U	0.46 U	0.49 U	0.48 U
Pyrene	NSA	170000 *	1700000 *	100	ug/kg	28.2 J	17 U	15 U	16 U	15 U
Group: Total Petroleum Hydrocarbons										
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	18.8	47.9	--	13.7	10.7

Samples were analyzed for SVOCs, pesticides, PCBs, herbicides, metals, and TPH unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-25
Site 12
Summary of Analytes Detected in Sediment

				Sample Location:	Location 1	Location 2	Location 3	Location 4	Location 4	Location 5
				Sample Name:	SD-12-07-01	SD-12-07-02	SD-12-07-03	07-JN-12-DP4	SD-12-07-04	SD-12-07-05
				Parent Sample:				SD-12-07-04		
				Date Sampled:	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009
Analyte	**EPA RSL Res**	**EPA RSL Ind**	**EPA Eco**	**Units**						
Group: Metals										
Arsenic	3.9	16	7.24	mg/kg	**21.7**	**23**	**35.8**	**17.2**	**22**	**26.2**
Barium	15000 *	190000	NSA	mg/kg	100	119	231	130	110	88.3
Beryllium	160 *	2000 *	NSA	mg/kg	0.28 J	0.2 J	0.41 J	0.29 J	0.19 J	0.17 J
Cadmium	70 *	800 *	1	mg/kg	0.45 J	0.33 J	0.72	0.44 J	0.41 J	0.28 J
Chromium	2.9	56	52.3	mg/kg	**24.5**	**16**	**23.1**	**20**	**15.2**	**18.4**
Cobalt	23 *	300 *	NSA	mg/kg	8.6	8 J	15.2	8.8	7.3 J	6.6 J
Copper	3100 *	41000 *	18.7	mg/kg	28.9	15.6	23.6	20	12.7	11.6
Lead	400 *	8000 *	30.2	mg/kg	22.1	9	9.6	8.1	9	6.8
Mercury	7.8 *	100 *	0.13	mg/kg	0.14	0.084	0.085	0.13	0.056	0.031 J
Nickel	1500 *	20000 *	15.9	mg/kg	8.2	4.8 J	8	5.8	4.6 J	3.4 J
Selenium	390 *	5100 *	NSA	mg/kg	2.7	2.6 J	3.5	2.6	2 J	2.3 J
Silver	390 *	5100 *	2	mg/kg	0.18 U	0.3 U	0.69 J	0.27 J	0.24 U	0.22 U
Tin	47000 *	610000	NSA	mg/kg	2.4 J	3.5 J	1.2 J	1.4 J	2.8 J	2.4 J
Vanadium	390 *	5200 *	NSA	mg/kg	53	34.7	56.2	41.1	28.9	32.7
Zinc	23000 *	310000	124	mg/kg	80.5	41	51.6	45	40.8	38.8
Group:Pesticides										
4,4-DDD	20000	72000	3.3	ug/kg	2.3 U	1.8 U	1.9 U	1.8 U	274	1.4 U
4,4-DDE	14000	51000	3.3	ug/kg	2.3 U	1.9 U	2 U	1.9 U	34.1	1.4 U
4,4-DDT	17000	70000	3.3	ug/kg	2.9 U	2.3 U	2.4 U	2.3 U	12	6.8
alpha-Chlordane	16000	65000	1.7	ug/kg	2.5 U	2.1 U	2.2 U	2 U	--	55.2
Dieldrin	300	1100	3.3	ug/kg	2.4 U	1.9 U	2 U	1.9 U	11.6	1.4 U
Gamma-chlordane	16000	65000	1.7	ug/kg	2.5 U	2.1 U	2.2 U	2 U	--	67.9
GROUP: SVOCs										
Benzo[a]pyrene	150	2100	330	ug/kg	1.2 U	0.98 UJ	1 U	0.98 U	0.8 U	0.73 U
Benzo[b]fluoranthene	1500	21000	NSA	ug/kg	2.9 U	2.5 UJ	2.6 U	2.5 U	2 U	1.8 U
Benzo[g,h,i]perylene	1700000 *	17000000 *	NSA	ug/kg	1.3 U	1.1 UJ	1.2 U	1.1 U	0.91 U	0.83 U
Benzo[k]fluoranthene	15000	210000	NSA	ug/kg	1.3 U	1.1 UJ	1.2 U	1.1 U	0.9 U	0.82 U
Chrysene	150000	2100000	330	ug/kg	0.87 U	0.73 UJ	0.78 U	0.74 U	0.6 U	0.55 U
Dibenz[a,h]anthracene	150	2100	330	ug/kg	1 U	0.85 UJ	0.91 U	0.86 U	0.7 U	0.64 U
Fluoranthene	2300000 *	22000000 *	330	ug/kg	27 U	23 U	25 U	0.71 U	25.3 J	0.53 U

Table 5-25
Site 12
Summary of Analytes Detected in Sediment

Sample Location:					Location 1	Location 2	Location 3	Location 4	Location 4	Location 5
Sample Name:					SD-12-07-01	SD-12-07-02	SD-12-07-03	07-JN-12-DP4	SD-12-07-04	SD-12-07-05
Parent Sample:								SD-12-07-04		
Date Sampled:					6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009
Analyte	**EPA RSL Res**	**EPA RSL Ind**	**EPA Eco**	**Units**						
Indeno[1,2,3-c,d]pyrene	1500	21000	NSA	ug/kg	1.2 U	1 UJ	1.1 U	1 U	0.84 U	0.76 U
Phenanthrene	17000000 *	170000000	330	ug/kg	0.83 U	0.7 U	0.75 U	0.71 U	26.6	0.52 U
Pyrene	1700000 *	17000000 *	330	ug/kg	27 U	23 U	24 U	0.69 U	23.5 J	0.51 U
Group: Total Petroleum Hydrocarbons										
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	mg/kg	2.5 U	2.7 U	3 U	--	3 U	3.9 U

Samples were analyzed for pesticides, herbicides, TPH, SVOCs, VOCs, PCBs, and metals, unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil multipied by 10 for Sediment, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil multipied by 10 for Sediment, June 2011

EPA Eco = EPA Region 4 ecological screening values for sediment: USEPA, 2001

-- = Not Analyzed

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA Eco are in blue font.

Table 5-25
Site 12
Summary of Analytes Detected in Sediment

Sample Location:					Location 6	Location 6
Sample Name:					09-FE-04-DP2	SD-12-07-06
Parent Sample:					SD12-09-6	
Date Sampled:					2/4/2009	6/12/2007 & 2/4/2009
Analyte	**EPA RSL Res**	**EPA RSL Ind**	**EPA Eco**	**Units**		
Group: Metals						
Arsenic	3.9	16	7.24	mg/kg	--	**16.4**
Barium	15000 *	190000	NSA	mg/kg	--	107
Beryllium	160 *	2000 *	NSA	mg/kg	--	0.2 J
Cadmium	70 *	800 *	1	mg/kg	--	0.36 J
Chromium	2.9	56	52.3	mg/kg	--	**18**
Cobalt	23 *	300 *	NSA	mg/kg	--	6.6 J
Copper	3100 *	41000 *	18.7	mg/kg	--	15.8
Lead	400 *	8000 *	30.2	mg/kg	--	5.8
Mercury	7.8 *	100 *	0.13	mg/kg	--	0.061
Nickel	1500 *	20000 *	15.9	mg/kg	--	4 J
Selenium	390 *	5100 *	NSA	mg/kg	--	1.9 J
Silver	390 *	5100 *	2	mg/kg	--	0.24 U
Tin	47000 *	610000	NSA	mg/kg	--	2.9 J
Vanadium	390 *	5200 *	NSA	mg/kg	--	29.9
Zinc	23000 *	310000	124	mg/kg	--	34.8
Group:Pesticides						
4,4-DDD	20000	72000	3.3	ug/kg	--	1.5 U
4,4-DDE	14000	51000	3.3	ug/kg	--	1.5 U
4,4-DDT	17000	70000	3.3	ug/kg	--	1.8 U
alpha-Chlordane	16000	65000	1.7	ug/kg	--	1.6 U
Dieldrin	300	1100	3.3	ug/kg	--	1.5 U
Gamma-chlordane	16000	65000	1.7	ug/kg	--	1.6 U
GROUP: SVOCs						
Benzo[a]pyrene	150	2100	330	ug/kg	--	122
Benzo[b]fluoranthene	1500	21000	NSA	ug/kg	--	174
Benzo[g,h,i]perylene	1700000 *	17000000 *	NSA	ug/kg	--	62.8
Benzo[k]fluoranthene	15000	210000	NSA	ug/kg	--	52.6
Chrysene	150000	2100000	330	ug/kg	--	150
Dibenz[a,h]anthracene	150	2100	330	ug/kg	--	25.6
Fluoranthene	2300000 *	22000000 *	330	ug/kg	--	414

Table 5-25
Site 12
Summary of Analytes Detected in Sediment

				Sample Location:	Location 6	Location 6
				Sample Name:	09-FE-04-DP2	SD-12-07-06
				Parent Sample:	SD12-09-6	
				Date Sampled:	2/4/2009	6/12/2007 & 2/4/2009
Analyte	**EPA RSL Res**	**EPA RSL Ind**	**EPA Eco**	**Units**		
Indeno[1,2,3-c,d]pyrene	1500	21000	NSA	ug/kg	--	63.8
Phenanthrene	17000000 *	170000000	330	ug/kg	--	251
Pyrene	1700000 *	17000000 *	330	ug/kg	--	344
Group: Total Petroleum Hydrocarbons						
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	mg/kg	63.2	78.2

Samples were analyzed for pesticides, herbicides, TPH, SVOCs, VOCs, PCBs, and metals, unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil multipied by 10 for Sediment, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil multipied by 10 for Sediment, June 2011

EPA Eco = EPA Region 4 ecological screening values for sediment: USEPA, 2001

-- = Not Analyzed

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA Eco are in blue font.

Table 5-26
Site 12
Summary of Analytes Detected in Surface Water

Sample Location:				Location 1	Location 2	Location 3	Location 4	Location 4	Location 5	Location 6
Sample Name:				SW-12-07-01	SW-12-07-02	SW-12-07-03	07-JN-12-DP3	SW-12-07-04	SW-12-07-05	SW-12-07-06
Parent Sample:							SW-12-07-04			
Date Sampled:				6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009	6/12/2007 & 2/4/2009
Analyte	**EPA RSL**	**EPA Eco**	**Units**							
Group: Metals (Dissolved)										
Arsenic	0.45	190.0	ug/l	4.5 U	**5 J**	**5 J**	4.5 U	**5.9 J**	4.5 U	4.5 U
Barium	7300 *	NSA	ug/l	75.2 J	113 J	107 J	101 J	104 J	105 J	99.1 J
Chromium	0.43	11	ug/l	**3.4 J**	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
Copper	1500 *	6.54	ug/l	3.8 J	3.1 J	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U
Lead	NSA	1.32	ug/l	2.8 U	3	2.8 U	2.8 U	2.8 U	2.8 U	2.8 U
Mercury	37 *	0.012	ug/l	0.068 J	0.037 J	0.055 J	0.041 J	0.054 J	0.048 J	0.041 J
Silver	180 *	0.12	ug/l	1.4 J	1 U	1 U	1 U	1 U	1 U	1 U
Vanadium	180 *	NSA	ug/l	1.9 J	2.1 J	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Zinc	11000 *	58.91	ug/l	5 J	3.4 U	3.6 J	8.7 J	3.5 J	4.4 J	4.3 J
Group: Metals (Total)										
Arsenic	0.45	190.0	ug/l	**89**	**15.8**	**10.4**	4.5 U	4.5 U	4.5 U	4.5 U
Barium	7300 *	NSA	ug/l	589	281	173 J	121 J	131 J	126 J	110 J
Beryllium	73 *	0.53	ug/l	0.4 U	0.48 J	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Chromium	0.43	11	ug/l	**3.1 J**	**8.3 J**	**1.8 J**	**1.5 J**	0.8 U	0.8 U	**1.4 J**
Cobalt	11 *	NSA	ug/l	9.5 J	9.5 J	2.7 J	2.2 J	1.8 U	1.8 U	1.8 U
Copper	1500 *	6.54	ug/l	20.7 J	46.4	42.6	3.6 J	2.7 U	3.7 J	2.7 U
Lead	NSA	1.32	ug/l	6	6.9	3.4	2.8 U	2.8 U	2.8 U	2.8 U
Mercury	37 *	0.012	ug/l	0.038 J	0.12 J	0.068 J	0.061 J	0.069 J	0.039 J	0.041 J
Nickel	730 *	87.71	ug/l	3 J	5.3 J	3.4 J	2.8 U	2.8 U	2.8 U	2.8 U
Selenium	180 *	5	ug/l	6.2 U	6.2 U	6.3 J	7.9 J	6.2 U	6.2 U	6.2 U
Vanadium	180 *	NSA	ug/l	7.8 J	23.2 J	6.1 J	5 J	1.8 U	3.7 J	3.2 J
Zinc	11000 *	58.91	ug/l	33	40.6	14.1 J	10.5 J	3.4 U	6.3 J	5.5 J
Group:Pesticides										
4,4-DDE	0.2	10.5	ug/l	0.027	0.0019 U	0.0018 U	0.0018 U	0.0017 U	0.0017 U	0.0018 U
Group: SVOCs										
Bis(2-ethylhexyl) phthalate	4.8	0.3	ug/l	1.7 J	0.66 U	0.7 U	0.69 U	0.7 U	0.66 U	0.69 U

Table 5-26
Site 12
Summary of Analytes Detected in Surface Water

Notes:
Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, TPH, and metals.
Analytes not listed on the table were not detected in any samples.
EPA RSL = EPA Tapwater Regional Screening Level * 10 for Surface Water, June 2011
EPA Eco = EPA Region 4 ecological screening values for freshwater SW, 2001.
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
-- = Not Analyzed
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL are bold.
Detected concentrations exceeding the EPA Eco are in blue font.

Table 5-27

Site 12

Summary of Analytes Detected in Groundwater and Pore Water

Sample Location:				G-12-MW-01	G-12-MW-02	G-12-MW-03	S12-PW-11-01	S12-PW-11-02	S12-PW-11-03	S12-PW-11-03
Sample Name:				G-12-07-MW-01	G-12-07-MW-02	G-12-07-MW-03	S12-PW-11-1	S12-PW-11-2	S12-PW-11-3	S12-PW-11-DP
Parent Sample:										S12-PW-11-3
Date Sampled:				6/13/2007	6/13/2007	6/13/2007	9/20/2011	9/20/2011	9/20/2011	9/20/2011
Analyte	**EPA MCL**	**EPA RSL**	**Units**							
Group: Metals (Dissolved)										
Aluminum	NSA	3700 *	ug/l	--	--	--	9.6	7.2 U	7.2 U	7.2 U
Arsenic	10	0.045	ug/l	4.5 U	4.5 U	10.3	36.7	28.6	17.7	18.2
Barium	2000	730 *	ug/l	105 J	112 J	194 J	197	332	644	673
Cadmium	5	1.8 *	ug/l	1.3 U	1.3 U	1.3 U	0.4	0.3	0.5	0.6
Calcium	NSA	NSA	ug/l	--	--	--	153000	123000	127000	133000
Chromium	100	0.043	ug/l	0.8 U	0.8 U	1.1 J	1	1.1	0.9	1.1
Cobalt	NSA	1.1 *	ug/l	1.8 U	1.8 U	1.8 U	1.2	0.3 U	7.6	7.9
Iron	NSA	2600 *	ug/l	--	--	--	9950	16100	4970	5200
Magnesium	NSA	NSA	ug/l	--	--	--	12100	12100	12200	12800
Manganese	NSA	88 *	ug/l	--	--	--	2060	1740	4450	4630
Mercury	2	3.7 *	ug/l	0.04 J	0.046 J	0.037 U	0.075 U	0.075 U	0.075 U	0.075 U
Nickel	NSA	73 *	ug/l	4.6 J	8.1 J	7.2 J	4.1	3.3	4.3	4.2
Potassium	NSA	NSA	ug/l	--	--	--	1010	2260	5370	5590
Sodium	NSA	NSA	ug/l	--	--	--	42800	33600	33500	34700
Thallium	2	0.037 *	ug/l	9.8 U	9.8 U	9.8 U	0.17 U	1	0.17 U	1.9
Vanadium	NSA	18 *	ug/l	4.8 J	3.1 J	1.8 U	0.43 U	0.43 U	0.43 U	0.43 U
Zinc	NSA	1100 *	ug/l	6.5 J	13.1 J	8.8 J	1.7 U	1.7 U	1.7 U	1.7 U
Group: Metals (Total)										
Aluminum	NSA	3700 *		--	--	--	1270	1400	532	403
Arsenic	10	0.045	ug/l	4.5 U	68.9	8.9	36.1	34.7	21.9	20.6
Barium	2000	730 *	ug/l	113 J	204	177 J	194	354	672	652
Beryllium	4	7.3 *	ug/l	0.4 U	1.2	0.4 U	0.24 U	0.24 U	0.24 U	0.24 U
Cadmium	5	1.8 *	ug/l	1.3 U	2.6 J	1.3 U	0.4	0.4	0.4	0.5
Calcium	NSA	NSA	ug/l	--	--	--	144000	130000	132000	127000
Chromium	100	0.043	ug/l	73	206	74.5	4.6	4.5	1.9	1.8
Cobalt	NSA	1.1 *	ug/l	4.5 J	20.1 J	2.6 J	1.9	1.9	8.6	8.3
Copper	1300	150 *	ug/l	18.7 J	83.9	27.3	3.3	2.1	0.85 U	0.85 U
Iron	NSA	2600 *	ug/l	--	--	--	11700	20500	6760	6180
Lead	15	NSA	ug/l	3.2	14.9	2.8 U	0.94 U	5.5	0.94 U	0.94 U
Magnesium	NSA	NSA	ug/l	--	--	--	11500	12700	12700	12300
Manganese	NSA	88 *	ug/l	--	--	--	2170	2080	4650	4450

Table 5-27

Site 12

Summary of Analytes Detected in Groundwater and Pore Water

Sample Location:				G-12-MW-01	G-12-MW-02	G-12-MW-03	S12-PW-11-01	S12-PW-11-02	S12-PW-11-03	S12-PW-11-03
Sample Name:				G-12-07-MW-01	G-12-07-MW-02	G-12-07-MW-03	S12-PW-11-1	S12-PW-11-2	S12-PW-11-3	S12-PW-11-DP
Parent Sample:										S12-PW-11-3
Date Sampled:				6/13/2007	6/13/2007	6/13/2007	9/20/2011	9/20/2011	9/20/2011	9/20/2011
Analyte	**EPA MCL**	**EPA RSL**	**Units**							
Mercury	2	3.7 *	ug/l	0.071 J	0.063 J	0.037 U	0.075 U	0.075 U	0.075 U	0.075 U
Nickel	NSA	73 *	ug/l	35.6 J	90.7	36.1 J	5.8	4.2	4.6	4.2
Potassium	NSA	NSA	ug/l	--	--	--	5.8	4.2	4.6	4.2
Silver	NSA	18 *	ug/l	1 U	1.6 J	1 U	0.72 U	0.72 U	0.72 U	0.72 U
Sodium	NSA	NSA	ug/l	--	--	--	41900	35200	34500	33400
Thallium	2	0.037 *	ug/l	9.8 U	9.8 U	9.8 U	1.4	0.17 U	1.5	2.7
Vanadium	NSA	18 *	ug/l	13.9 J	124	6.4 J	5.5	6.8	1.7	1.2
Zinc	NSA	1100 *	ug/l	18.1 J	651	16.5 J	5.9	7.8	1.9	2.9
Group: VOCs			ug/l							
Carbon disulfide	NSA	100 *	ug/l	0.14 U	0.46 J	0.14 U	0.18 U	0.18 U	0.18 U	0.18 U
Chloroform	80	0.19	ug/l	5.3	0.46 J	0.25 U	0.21 U	0.21 U	0.21 U	0.21 U
Group: SVOCs										
Bis(2-ethylhexyl) phthalate	6	4.8	ug/l	0.67 U	0.66 U	0.66 U	0.67 U	1.3 J	0.59 U	7.5

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

EPA MCL = EPA Maximum Contaminant Level, June 2011

EPA RSL = EPA Tapwater Regional Screening Level, June 2011 EPA

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

-- = Not Analyzed

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL are shaded gray.

Detected concentrations exceeding the EPA MCL are in blue font.

Table 5-28
Site 13
Summary of Analytes Detected in Surface Soil

					Sample Location:	Boring 1	Boring 2	Boring 3	Boring 4	Boring 5
					Sample Name:	S-13-08-01-0-2	S-13-08-02-0-2	S-13-08-03-0-2	S-13-08-04-0-2	S-13-08-05-0-2
					Date Sampled:	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009
					Depth Interval:	0-2 ft	0-2 ft	0-2 ft	0-2 ft	0-2 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**					
Group: Metals										
Aluminum	30027	7700 *	99000	50	mg/kg	**15700**	**16900**	**15700**	**16300**	**13800**
Antimony	1	3.1 *	41 *	3.5	mg/kg	0.98 J	0.42 J	0.31 J	0.3 U	0.33 J
Arsenic	43.87	0.39	1.6	10	mg/kg	**11.4**	**11.5**	**2.4**	**4.6**	**6**
Barium	101.8	1500 *	19000	165	mg/kg	67.8	93.3	37.3	35.6	31.9
Beryllium	0.647	16 *	200 *	1.1	mg/kg	0.78	0.26 J	0.17 J	0.22 J	0.23 J
Cadmium	0.858	7 *	80 *	1.6	mg/kg	0.42 J	0.029 U	0.027 U	0.03 U	0.028 U
Calcium	105848	NSA	NSA	NSA	mg/kg	4670	18400	4820	4950	15000
Chromium	69.8	0.29	5.6	0.4	mg/kg	**22.9**	**22.1**	**9**	**11.9**	**13.4**
Cobalt	16.57	2.3 *	30 *	20	mg/kg	**18.4**	**17.1**	**4.6 J**	**5.1 J**	**9.6**
Copper	83.65	310 *	4100 *	40	mg/kg	18.4	21.6	19.4	18.4	17.4
Cyanide	NSA	160 *	2000 *	0.9	mg/kg	0.22 J	0.067 U	0.072 U	0.074 U	0.097 J
Iron	47064	5500 *	72000	200	mg/kg	**22200**	**21000**	**14900**	**16800**	**14600**
Lead	27.52	400 *	800 *	50	mg/kg	24.7	5.5	3.1	7.6	20.7
Magnesium	5131	NSA	NSA	NSA	mg/kg	1830	1950	2770	1620	1550
Manganese	1184	180 *	2300 *	100	mg/kg	**1140**	**1230**	59.6	**262**	**472**
Nickel	23.01	150 *	2000 *	30	mg/kg	7.9	8.2	3.3 J	3.7 J	4.2 J
Potassium	1459	NSA	NSA	NSA	mg/kg	728 J	622 J	2270	549 J	595 J
Selenium	1	39 *	510 *	0.81	mg/kg	2.8	1.4	0.34 J	1.3	1.2
Silver	0.22	39 *	510 *	2	mg/kg	0.27 J	0.13 U	0.12 U	0.14 U	0.13 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	93.2 J	250 J	223 J	155 J	111 J
Thallium	1.1	0.078 *	1 *	1	mg/kg	**0.99 J**	**0.36 J**	0.15 U	0.16 U	0.15 U
Tin	NSA	4700 *	61000	53	mg/kg	3.6 J	2.7 J	2.7 J	2.9 J	3 J
Vanadium	145.4	39 *	520 *	2	mg/kg	**52.6**	**46.5**	24.9	32.9	34.6
Zinc	81.04	2300 *	31000	50	mg/kg	47.8	34.2	24.5	25.4	36.7
Mercury	0.32	0.78 *	10 *	NSA	mg/kg	0.11	0.073	0.013 U	0.38	0.069
Group:Pesticides										
4,4-DDD	0.51	2000	7200	2.5	ug/kg	0.26 U	0.26 U	0.24 U	0.27 U	0.25 U
4,4-DDE	3.37	1400	5100	2.5	ug/kg	0.39 U	0.4 U	0.38 U	0.42 U	0.38 U
4,4-DDT	2.65	1700	7000	2.5	ug/kg	7	0.37 U	0.35 U	0.39 U	0.36 U
alpha-Chlordane	0.64	1600	6500	NSA	ug/kg	0.48 U	0.5 U	0.46 U	0.52 U	0.47 U
Dieldrin	NSA	30	110	0.5	ug/kg	0.31 U	0.32 U	0.29 U	0.33 U	0.3 U

Table 5-28
Site 13
Summary of Analytes Detected in Surface Soil

Sample Location:						Boring 1	Boring 2	Boring 3	Boring 4	Boring 5
Sample Name:						S-13-08-01-0-2	S-13-08-02-0-2	S-13-08-03-0-2	S-13-08-04-0-2	S-13-08-05-0-2
Date Sampled:						12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009
Depth Interval:						0-2 ft	0-2 ft	0-2 ft	0-2 ft	0-2 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**					
Gamma-chlordane	NSA	1600	6500	NSA	ug/kg	0.35 U	0.36 U	0.33 U	0.37 U	0.34 U
Group: Herbicides										
2,4-D	NSA	69000 *	770000 *	NSA	ug/kg	288	10 U	9.7 U	11 U	10 U
Pentachlorophenol	NSA	890	2700	2	ug/kg	110	30.9	0.98 U	13.4	35.7
Group: VOCs										
1,1-dichloroethene	NSA	24000 *	110000 *	NSA	ug/kg	0.66 U	1.7 J	2.1 J	0.63 U	1.7 J
Acetone	NSA	6100000 *	63000000	NSA	ug/kg	2.7 U	144	2.5 U	2.6 U	2.3 UJ
Group: SVOCs										
Benzo[g,h,i]perylene	NSA	170000 *	1700000 *	NSA	ug/kg	0.68 U	0.69 U	0.64 U	0.71 U	0.65 U
Group: Total Petroleum Hydrocarbons										
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	11	14.5	1.6 U	1.8 U	51.6

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and TPH unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-28
Site 13
Summary of Analytes Detected in Surface Soil

					Sample Location:	Boring 6	Boring 7
					Sample Name:	S-13-08-06-0-2	S-13-08-07-0-2
					Date Sampled:	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009
					Depth Interval:	0-2 ft	0-2 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	50	mg/kg	**15300**	**22100**
Antimony	1	3.1 *	41 *	3.5	mg/kg	0.33 J	1.4 J
Arsenic	43.87	0.39	1.6	10	mg/kg	**6.7**	**14.6**
Barium	101.8	1500 *	19000	165	mg/kg	42.2	81.2
Beryllium	0.647	16 *	200 *	1.1	mg/kg	0.21 J	0.1 J
Cadmium	0.858	7 *	80 *	1.6	mg/kg	0.029 U	0.37 J
Calcium	105848	NSA	NSA	NSA	mg/kg	17800	16500
Chromium	69.8	0.29	5.6	0.4	mg/kg	**17.7**	**33.1**
Cobalt	16.57	2.3 *	30 *	20	mg/kg	**7.2**	**16.4**
Copper	83.65	310 *	4100 *	40	mg/kg	22.9	46.5
Cyanide	NSA	160 *	2000 *	0.9	mg/kg	0.066 J	0.08 U
Iron	47064	5500 *	72000	200	mg/kg	**19400**	**27300**
Lead	27.52	400 *	800 *	50	mg/kg	**562**	158
Magnesium	5131	NSA	NSA	NSA	mg/kg	1920	4550
Manganese	1184	180 *	2300 *	100	mg/kg	**350**	**995**
Nickel	23.01	150 *	2000 *	30	mg/kg	4.3 J	13.8
Potassium	1459	NSA	NSA	NSA	mg/kg	827 J	775 J
Selenium	1	39 *	510 *	0.81	mg/kg	1.3	1.8
Silver	0.22	39 *	510 *	2	mg/kg	0.13 U	0.14 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	98.6 J	177 J
Thallium	1.1	0.078 *	1 *	1	mg/kg	0.16 U	0.17 U
Tin	NSA	4700 *	61000	53	mg/kg	3.3 J	3.9 J
Vanadium	145.4	39 *	520 *	2	mg/kg	**44.5**	**86.5**
Zinc	81.04	2300 *	31000	50	mg/kg	75.7	141
Mercury	0.32	0.78 *	10 *	NSA	mg/kg	0.41	0.35
Group:Pesticides							
4,4-DDD	0.51	2000	7200	2.5	ug/kg	0.25 U	67.2
4,4-DDE	3.37	1400	5100	2.5	ug/kg	0.38 U	469
4,4-DDT	2.65	1700	7000	2.5	ug/kg	0.36 U	543
alpha-Chlordane	0.64	1600	6500	NSA	ug/kg	0.47 U	15.6
Dieldrin	NSA	30	110	0.5	ug/kg	0.3 U	4.1

Table 5-28
Site 13
Summary of Analytes Detected in Surface Soil

					Sample Location:	Boring 6	Boring 7
					Sample Name:	S-13-08-06-0-2	S-13-08-07-0-2
					Date Sampled:	12/2/2008 & 2/5/2009	12/2/2008 & 2/5/2009
					Depth Interval:	0-2 ft	0-2 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**		
Gamma-chlordane	NSA	1600	6500	NSA	ug/kg	0.34 U	18.9
Group: Herbicides							
2,4-D	NSA	69000 *	770000 *	NSA	ug/kg	9.9 U	11 U
Pentachlorophenol	NSA	890	2700	2	ug/kg	7.7	5.4
Group: VOCs							
1,1-dichloroethene	NSA	24000 *	110000 *	NSA	ug/kg	1.1 J	0.77 U
Acetone	NSA	6100000 *	63000000	NSA	ug/kg	2.4 U	3.2 UJ
Group: SVOCs							
Benzo[g,h,i]perylene	NSA	170000 *	1700000 *	NSA	ug/kg	32.5	0.71 U
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	86.7	136

Samples were analyzed for VOCs, SVOCs, organochlorine pesticides, organophosphorus pesticides, PCBs, herbicides, metals, and TPH unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-29
Site 13
Summary of Analytes Detected in Subsurface Soil

					Sample Location:	Boring 7	
					Sample Name:	08-12-02-DP2	S-13-08-07-2-4
					Parent Sample:	S-13-08-07-2-4	
					Date Sampled:	12/2/2008	12/2/2008 & 2/5/2009
					Depth Interval:	2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	55000	mg/kg	**22300 J**	**14000 J**
Antimony	1	3.1 *	41 *	0.66	mg/kg	0.98 J	0.31 J
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**18.9**	**14.2**
Barium	101.8	1500 *	19000	300	mg/kg	72.3 J	47.9 J
Beryllium	0.647	16 *	200 *	58	mg/kg	0.25 J	0.22 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.57 J	0.24 J
Calcium	105848	NSA	NSA	NSA	mg/kg	15900 J	76900 J
Chromium	69.8	0.29	5.6	2.1	mg/kg	**36.5**	**22.4**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**14.4**	**12.3**
Copper	83.65	310 *	4100 *	51	mg/kg	53.1 J	30.6 J
Iron	47064	5500 *	72000	640	mg/kg	**28600**	**22400**
Lead	27.52	400 *	800 *	NSA	mg/kg	185 J	71 J
Magnesium	5131	NSA	NSA	NSA	mg/kg	3540 J	2270 J
Manganese	1184	180 *	2300 *	57	mg/kg	**809**	**696**
Nickel	23.01	150 *	2000 *	48	mg/kg	15	8.2
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.54	0.11
Potassium	1459	NSA	NSA	NSA	mg/kg	823 J	601 J
Selenium	1	39 *	510 *	0.95	mg/kg	2.7	1.1
Sodium	237.5	NSA	NSA	NSA	mg/kg	144 J	108 J
Tin	NSA	4700 *	61000	5500	mg/kg	4.3 J	3 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**90.1 J**	**53.2 J**
Zinc	81.04	2300 *	31000	680	mg/kg	159 J	68.5 J
Group:Pesticides							
4,4-DDD	0.51	2000	7200	66	ug/kg	22.6 J	0.26 UJ
4,4-DDE	3.37	1400	5100	46	ug/kg	365 J	0.4 UJ
4,4-DDT	2.65	1700	7000	67	ug/kg	136 J	0.37 UJ
alpha-Chlordane	0.64	1600	6500	13	ug/kg	7.1 J	0.49 UJ
Gamma-chlordane	NSA	1600	6500	13	ug/kg	7.9 J	0.36 UJ
Group: Herbicides							
Pentachlorophenol	NSA	890	2700	1.7	ug/kg	7.4	4
Group: VOCs							
1,1-dichloroethene	NSA	24000 *	110000 *	120	ug/kg	1.2 J	0.54 U
Group: SVOCs							
Acenaphthylene	NSA	3600	18000	0.47	ug/kg	0.44 UJ	13.7 J
Benzo[a]anthracene	NSA	150	2100	10	ug/kg	0.27 UJ	80.3 J
Benzo[a]pyrene	NSA	15	210	3.5	ug/kg	0.64 UJ	**87.8 J**
Benzo[b]fluoranthene	NSA	150	2100	35	ug/kg	1.6 UJ	**174 J**
Benzo[g,h,i]perylene	NSA	170000 *	1700000 *	120000	ug/kg	0.72 UJ	24.7 J
Benzo[k]fluoranthene	NSA	1500	21000	350	ug/kg	0.72 UJ	118 J
Bis(2-ethylhexyl) phthalate	NSA	35000	120000	1100	ug/kg	62.5 J	21 U
Chrysene	NSA	15000	210000	1100	ug/kg	0.48 UJ	106 J
Dibenz[a,h]anthracene	NSA	15	210	11	ug/kg	0.56 UJ	12.5 J
Fluoranthene	NSA	230000 *	2200000 *	160000	ug/kg	19 U	112

Table 5-29

Site 13

Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 7	
Sample Name:						08-12-02-DP2	S-13-08-07-2-4
Parent Sample:						S-13-08-07-2-4	
Date Sampled:						12/2/2008	12/2/2008 & 2/5/2009
Depth Interval:						2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**		
Indeno[1,2,3-c,d]pyrene	NSA	150	2100	120	ug/kg	0.67 UJ	29.1 J
Pyrene	NSA	170000 *	1700000 *	120000	ug/kg	19 U	109
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	37.7 J	196 J

Samples were analyzed for VOCs, SVOCs, TPH, metals, PCBs, herbicides, organochlorine pesticides, and organophosphours pesticides unless otherwise noted.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011

[1] = PR Environmental Quality Board value, not EPA RSL

-- = Not Analyzed

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the EPA SSL are in blue font.

Table 5-30
Site 13
Summary of Analytes Detected in Groundwater

			Sample Location:	G-13-07
			Sample Name:	G-13-09-07
			Date Sampled:	1/29/2009
Analylte	**EPA MCL**	**EPA RSL**	**Unit**	
Group: Pesticides	No compounds were detected			
Group: PCBs				
Group: Herbicides				
Group: VOCs				
Group: SVOCs				

Table 5-31
Site 15
Summary of Analytes Detected in Surface Soil

					Sample Location:	Boring 1	Boring 2
					Sample Name:	S-15-08-01-0-1	S-15-08-02-0-1
					Date Sampled:	10/20/2008	10/20/2008
					Depth Interval:	0-1 ft	0-1 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**Eco SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	50	mg/kg	**25700**	**24600**
Antimony	1	3.1 *	41 *	3.5	mg/kg	2.7 J	1.6 J
Arsenic	43.87	0.39	1.6	10	mg/kg	**6**	**20.5**
Barium	101.8	1500 *	19000	165	mg/kg	52.6	29.7
Beryllium	0.647	16 *	200 *	1.1	mg/kg	1.4	0.28 J
Cadmium	0.858	7 *	80 *	1.6	mg/kg	1.4	0.48 J
Calcium	105848	NSA	NSA	NSA	mg/kg	42900	40400
Chromium	69.8	0.29	5.6	0.4	mg/kg	**48.3 J**	**44.1 J**
Cobalt	16.57	2.3 *	30 *	20	mg/kg	**17.4**	**6.3**
Copper	83.65	310 *	4100 *	40	mg/kg	111	30.9
Iron	47064	5500 *	72000	200	mg/kg	**41300**	**31100**
Lead	27.52	400 *	800 *	50	mg/kg	32.1	14
Magnesium	5131	NSA	NSA	NSA	mg/kg	13200	2750
Manganese	1184	180 *	2300 *	100	mg/kg	**917**	**480**
Mercury	0.32	0.78 *	10 *	NSA	mg/kg	0.032 J	0.1
Nickel	23.01	150 *	2000 *	30	mg/kg	35.2	10
Potassium	1459	NSA	NSA	NSA	mg/kg	529 J	609 J
Selenium	1	39 *	510 *	0.81	mg/kg	0.64	0.93
Silver	0.22	39 *	510 *	2	mg/kg	0.14 J	0.13 U
Sodium	237.5	NSA	NSA	NSA	mg/kg	405 J	143 J
Thallium	1.1	0.078 *	1 *	1	mg/kg	**1.1 J**	**0.35 J**
Tin	NSA	4700 *	61000	53	mg/kg	13.6	3.7 J
Vanadium	145.4	39 *	520 *	2	mg/kg	**162**	**89.6**
Zinc	81.04	2300 *	31000	50	mg/kg	260 J	62.8 J
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100 [1]	NSA	NSA	mg/kg	233	19.9

Samples were analyzed for metals and TPH.

Analytes not listed on the table were not detected in any samples.

Background = Fort Buchanan Surface Soil Background Values

EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011

EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011

Eco SSL = US EPA Region 4 Ecological Screening Values for Soil, 2001

[1] = PR Environmental Quality Board value, not EPA RSL

* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.

NSA = No Screening Criteria Available

J = Estimated

U = Not Detected, reported value is the method detection limit

Detected concentrations exceeding the EPA RSL Res are bolded.

Detected concentrations exceeding the EPA RSL Ind are shaded gray.

Detected concentrations exceeding the Eco SSL are in blue font.

Table 5-32
Site 15
Summary of Analytes Detected in Subsurface Soil

Sample Location:						Boring 1	Boring 2
Sample Name:						S-15-08-01-2-4	S-15-08-02-2-4
Date Sampled:						10/20/2008	10/20/2008
Depth Interval:						2-4 ft	2-4 ft
Analyte	**Background**	**EPA RSL Res**	**EPA RSL Ind**	**EPA SSL**	**Units**		
Group: Metals							
Aluminum	30027	7700 *	99000	55000	mg/kg	**27500**	**19000**
Antimony	1	3.1 *	41 *	0.66	mg/kg	2.7 J	1.3 J
Arsenic	43.87	0.39	1.6	0.0013	mg/kg	**45.2**	**18**
Barium	101.8	1500 *	19000	300	mg/kg	38.2	28.8
Beryllium	0.647	16 *	200 *	58	mg/kg	0.44 J	0.13 J
Cadmium	0.858	7 *	80 *	1.4	mg/kg	0.55 J	0.27 J
Calcium	105848	NSA	NSA	NSA	mg/kg	28900	2540
Chromium	69.8	0.29	5.6	2.1	mg/kg	**89.3 J**	**36.8 J**
Cobalt	16.57	2.3 *	30 *	0.49	mg/kg	**9.3**	**3.8 J**
Copper	83.65	310 *	4100 *	51	mg/kg	62.2	15.6
Iron	47064	5500 *	72000	640	mg/kg	**45800**	**32900**
Lead	27.52	400 *	800 *	NSA	mg/kg	21.4	5.5
Magnesium	5131	NSA	NSA	NSA	mg/kg	1790	880
Manganese	1184	180 *	2300 *	57	mg/kg	**917**	105
Mercury	0.32	0.78 *	10 *	0.033	mg/kg	0.1	0.048
Nickel	23.01	150 *	2000 *	48	mg/kg	14	3.3 J
Potassium	1459	NSA	NSA	NSA	mg/kg	618 J	446 J
Selenium	1	39 *	510 *	0.95	mg/kg	2	1.6
Sodium	237.5	NSA	NSA	NSA	mg/kg	125 J	43.5 J
Thallium	1.1	0.078 *	1 *	0.026	mg/kg	**0.8 J**	**0.25 J**
Tin	NSA	4700 *	61000	5500	mg/kg	4.4 J	3.1 J
Vanadium	145.4	39 *	520 *	180	mg/kg	**139**	**80.2**
Zinc	81.04	2300 *	31000	680	mg/kg	60.3 J	15.3 J
Group: Total Petroleum Hydrocarbons							
TPH-DRO (C10-C28)	NSA	100[1]	NSA	NSA	mg/kg	45.1	1.7 U

Samples were analyzed for metals and TPH.
Analytes not listed on the table were not detected in any samples.
Background = Fort Buchanan Surface Soil Background Values
EPA RSL Res = US EPA Regional Screening Levels for Residential Soil, June 2011
EPA RSL Ind = US EPA Regional Screening Levels for Industrial Soil, June 2011
EPA SSL = US EPA Risk-Based Regional Screening Levels for Soil (for protection of GW), June 2011
[1] = PR Environmental Quality Board value, not EPA RSL
-- = Not Analyzed
* A noncarcinogen; the value has been divided by 10 to achieve a hazard index of 0.1.
NSA = No Screening Criteria Available
J = Estimated
U = Not Detected, reported value is the method detection limit
Detected concentrations exceeding the EPA RSL Res are bolded.
Detected concentrations exceeding the EPA RSL Ind are shaded gray.
Detected concentrations exceeding the EPA SSL are in blue font.

S-01-08-04-0-2
10/23/2008

Benzo[a]anthracene	277	ug/kg
Benzo[a]pyrene	421	ug/kg
Benzo[b]fluoranthene	430	ug/kg
Benzo[g,h,i]perylene	285	ug/kg
Benzo[k]fluoranthene	381	ug/kg
Chrysene	366	ug/kg
Fluoranthene	269	ug/kg
Indeno[1,2,3-c,d]pyrene	258	ug/kg
Pyrene	304	ug/kg
4,4-DDD	50	ug/kg
4,4-DDE	98	ug/kg
4,4-DDT	517	ug/kg

S-01-08-03-0-2
10/23/2008

Benzo[a]anthracene	149	ug/kg
Benzo[a]pyrene	196	ug/kg
Benzo[b]fluoranthene	192	ug/kg
Benzo[g,h,i]perylene	142	ug/kg
Benzo[k]fluoranthene	150	ug/kg
Chrysene	152	ug/kg
Fluoranthene	180	ug/kg
Indeno[1,2,3-c,d]pyrene	126	ug/kg
Pyrene	192	ug/kg
4,4-DDD	14.9	ug/kg
4,4-DDE	31	ug/kg
4,4-DDT	55	ug/kg

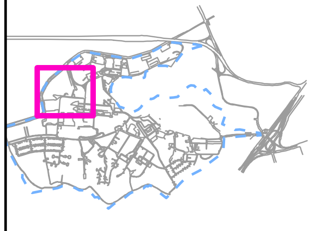
S-01-08-01-0-2
10/23/2008

4,4-DDD	52.6	ug/kg
4,4-DDE	970	ug/kg
4,4-DDT	302	ug/kg
Dieldrin	3.3	ug/kg

S-01-08-02-0-2
10/23/2008

4,4-DDE	9.7	ug/kg
4,4-DDT	6.2	ug/kg

Area Shown in Main Map



Legend

● Soil Sample Location

▭ Installation Boundary

Notes:
White data boxes indicate surface soil.

Gray data boxes indicate subsurface soil.

Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and herbicides.

Results in blue exceed the EPA Region 4 Ecological Surface Soil screening levels.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed site screening criteria. Complete results are shown in Tables 5-1 and 5-2.

ug/kg = micrograms per kilogram

EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 1/SWMU 1
Old Hazardous Waste Containers

Figure 5-1
Soil Sample Locations and ConcentrationsAbove Criteria
at Site 1/SWMU 1

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site1Results.mxd

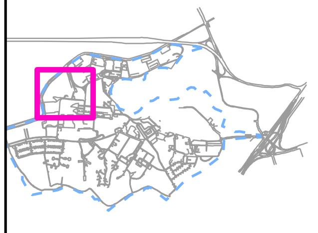
G-03-07-MW-11A

6/12/2007			
1,1,2-trichloroethane		0.73J	ug/l
1,2-dichloroethane		0.31J	ug/l
Chloroform		0.56J	ug/l
Tetrachloroethene		11.1	ug/l
Trichloroethene		175	ug/l
Chromium	D	1.3J	ug/l
Cobalt	D	2.5J	ug/l
1/9/2008			
1,1,2-trichloroethane		0.69J	ug/l
Chloroform		0.62J	ug/l
Tetrachloroethene		10.5	ug/l
Trichloroethene		187	ug/l
5/14/2008			
Chloroform		0.62J	ug/l
Cis-1,2-dichloroethene		16.8	ug/l
Tetrachloroethene		10.2	ug/l
Trichloroethene		171	ug/l
1/6/2009			
1,1,2-trichloroethane		0.81J	ug/l
1,2-dichloroethane		0.36J	ug/l
Chloroform		0.75J	ug/l
Cis-1,2-dichloroethene		21	ug/l
Tetrachloroethene		9.8	ug/l
Trichloroethene		163	ug/l
Vinyl chloride		0.45J	ug/l
8/18/2010			
1,1,2-trichloroethane		0.51J	ug/l
1,1,2-trichloroethane		0.52J	ug/l (FD)
Chloroform		0.4J	ug/l
Chloroform		0.38J	ug/l (FD)
Cis-1,2-dichloroethene		21	ug/l
Cis-1,2-dichloroethene		20	ug/l (FD)
Tetrachloroethene		7	ug/l
Tetrachloroethene		7.5	ug/l (FD)
Trichloroethene		174	ug/l
Trichloroethene		179	ug/l (FD)

G-03-07-MW-11B

6/12/2007			
1,1,2-trichloroethane		1.3	ug/l
Tetrachloroethene		11.5	ug/l
Trichloroethene		186	ug/l
Vinyl chloride		0.83J	ug/l
Arsenic	D	6J	ug/l
Chromium	T	0.8J	ug/l
1/9/2008			
1,1,2-trichloroethane		1.2	ug/l
Tetrachloroethene		8.3	ug/l
Trichloroethene		207	ug/l
Vinyl chloride		0.62J	ug/l
5/14/2008			
1,1,2-trichloroethane		1.3	ug/l
Cis-1,2-dichloroethene		16.6	ug/l
Tetrachloroethene		9.8	ug/l
Trichloroethene		229	ug/l
Vinyl chloride		0.71J	ug/l
1/6/2009			
1,1,2-trichloroethane		1J	ug/l
Cis-1,2-dichloroethene		14	ug/l
Tetrachloroethene		6.7	ug/l
Trichloroethene		240	ug/l

Area Shown in Main Map



Legend

⊕ NW Boundary Wells

▭ Installation Boundary

Notes:

Yellow data boxes indicate groundwater.

Groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, herbicides, metals, and total petroleum hydrocarbons.

Results in blue exceed the EPA Regional Screening Level table's Maximum Contaminant Level, June 2011

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Table 5-3.

T = total fraction
D = dissolved fraction
FD = field duplicate result
J = estimated value
ug/l = micrograms per liter

0 37.5 75
Meters

N

Fort Buchanan, Puerto Rico

Site 1/SWMU 1
Old Hazardous Waste Containers

Figure 5-2
Groundwater Sample Locations
and Concentrations
Above Criteria at Site 1/SWMU 1

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Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site1ResultsGW.mxd

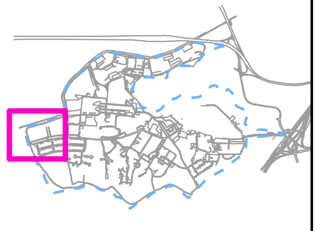
12/1/2006
SB-03-06-01-(4-8)
4 - 8 ft bgs
Arsenic 37.2 + mg/kg
Chromium 72.4J mg/kg
SB-03-06-01-(20-24)
20 - 24 ft bgs
Chromium 12.5J + mg/kg

10/20/2006
SB-03-06-03-(4-8)
4 - 8 ft bgs
Arsenic 61.8 mg/kg
Chromium 109 mg/kg
Cobalt 37.7 mg/kg
SB-03-06-03-(20-22)
20 - 22 ft bgs
Chromium 24.5 + mg/kg

11/13/2006
SB-03-06-04-(4-8)
4 - 8 ft bgs
Arsenic 34.1J + mg/kg
Chromium 49.7J + mg/kg
SB-03-06-04-(37-36)
37 - 36 ft bgs
Arsenic 4.7J + mg/kg
Chromium 13.2J + mg/kg

12/6/2006
SB-03-06-02-(4-8)
4 - 8 ft bgs
Arsenic 45.4 mg/kg
Chromium 89.3J mg/kg
SB-03-06-02-(26-28)
26 - 28 ft bgs
Chromium 14.9J + mg/kg

Area Shown in Main Map



Legend

● Soil Boring Location

⬚ Installation Boundary

Notes:

Gray data boxes indicate subsurface samples.

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and total petroleum hydrocarbons.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Table 5-4.

mg/kg = milligrams per kilogram
J = estimated value
+ = reported result is below
site background

EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 2/SWMU 3
Pesticides and Chemicals Burial Trench

Figure 5-3
Soil Sample Locations
and Concentrations
Above Criteria at Site 2/SWMU 3

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site2ResultsSO.mxd

G-03-07-MW-03A
1/9/2007

Chromium	T	19.8	ug/l

G-03-07-MW-04A
1/9/2007

Benzene		0.53J	ug/l
Iron	T	3450	ug/l
Manganese	T	92.2	ug/l

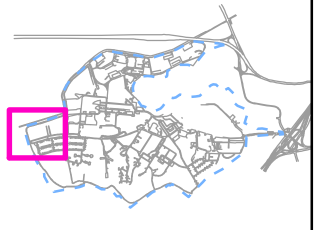
6/12/2007

Benzene		0.93J	ug/l

G-03-07-MW-04B
1/9/2007

Benzene	0.49J	ug/l
Ethylbenzene	3.9	ug/l
Naphthalene	1.51	ug/l
Manganese	135	ug/l

Area Shown in Main Map



Legend

● Well/Boring Location

▭ Installation Boundary

Notes:

Yellow data boxes indicate groundwater samples.

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011

Results shown exceed site screening criteria. Complete results are shown in Table 5-5.

ug/l = micrograms per liter
T = total fraction

Fort Buchanan, Puerto Rico

Site 2/SWMU 3
Pesticides and Chemicals Burial Trench

Figure 5-4
Groundwater Sample Locations
and Concentrations
Above Criteria at Site 2/SWMU 3

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10/22/2008

S-03-08-04-1-2

1 - 2 ft bgs

Arsenic	78.1	mg/kg
Arsenic	80.7	mg/kg (FD)
Chromium	99.9	mg/kg
Chromium	104	mg/kg (FD)

S-03-08-04-2-4

2 - 4 ft bgs

Arsenic	25.3 +	mg/kg
Chromium	81.8	mg/kg

10/22/2008

S-03-08-03-1-2

1 - 2 ft bgs

Arsenic	4.6 +	mg/kg
Chromium	40.7 +	mg/kg

S-03-08-03-2-4

2 - 4 ft bgs

Arsenic	122	mg/kg
Chromium	134	mg/kg
Iron	90100	mg/kg

10/22/2008

S-03-08-02-1-2

1 - 2 ft bgs

Arsenic	19.2 +	mg/kg
Chromium	77.4	mg/kg

S-03-08-02-2-4

2 - 4 ft bgs

Arsenic	112	mg/kg
Chromium	167	mg/kg
Iron	95300	mg/kg

10/22/2008

S-03-08-01-1-2

1 - 2 ft bgs

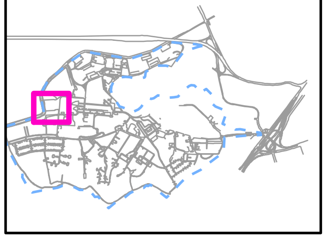
Arsenic	65.6	mg/kg
Chromium	98	mg/kg
Cobalt	40.4	mg/kg
Manganese	12800J	mg/kg
Thallium	4J	mg/kg

S-03-08-01-2-4

2 - 4 ft bgs

Arsenic	79.1	mg/kg
Chromium	120	mg/kg
Cobalt	45.3	mg/kg
Iron	79500	mg/kg
Manganese	6530J	mg/kg
Thallium	2.9J	mg/kg

Area Shown in Main Map



Legend

● Soil Boring Location

▭ Installation Boundary

Notes:

Gray data boxes indicate subsurface samples.

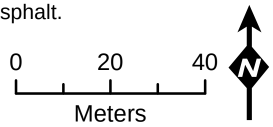
Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Table 5-6.

FD = field duplicate result
mg/kg = milligrams per kilogram
J = estimated value
+ = reported result is below site background level

Site area is paved; all samples were collected from beneath asphalt.



EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 3/SWMU 4
Spent Solvent Storage Area

Figure 5-5
Soil Sample Locations
and Concentrations
Above Criteria at Site 3/SWMU 4

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\site3Results.mxd

G-03-07-MW-05B
1/9/2007

1,4-dichlorobenzene		1.5J	ug/l (FD)
Naphthalene		0.796	ug/l (FD)
Chromium	T	10.5	ug/l (FD)

G-03-07-MW-05A

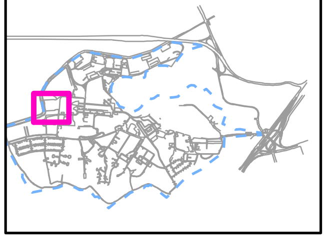
1/9/2007		
Trichloroethene	4.6	ug/l
6/13/2007		
Trichloroethene	3	ug/l
3/11/2009		
Chloroform	0.31J	ug/l
Trichloroethene	5.5	ug/l
8/17/2010		
Trichloroethene	3.7	ug/l

Fort Buchanan, Puerto Rico

Site 3/SWMU 4
Spent Solvent Storage Area

Figure 5-6
Groundwater Sample Locations
and Concentrations Above Criteria
at Site 3/SWMU 4

Area Shown in Main Map



Legend

⊕ NW Boundary Wells

▭ Installation Boundary

Notes:

Yellow data boxes indicate groundwater samples.

Groundwater samples were anlayzed for SVOCs, VOCs, pesticides, PCBs, herbicides, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011.

Results in blue exceed the EPA RSL Maximum Contaminant Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Table 5-7.

T= total fraction
FD = field duplicate result
ug/l = micrograms per liter
J = estimated value

Site area is paved; all samples were collected from beneath asphalt.

0 20 40
Meters
N

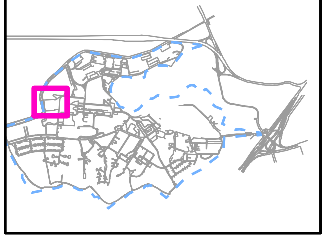
EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site3ResultsGW.mxd

G-03-07-MW-10A
6/13/2007
Chromium D 2J ug/l
Chromium T 4.7J ug/l

G-03-07-MW-10B
6/12/2007
Chromium D 5.1J ug/l
Chromium T 1.5J ug/l

Area Shown in Main Map



Legend

⊕ NW Boundary Wells
● Soil Sample Locations
- - Installation Boundary

Notes:

White boxes indicate soil samples, which were collected from 0-2' and were analyzed for PCBs. No compounds were detected in any soil samples.

Yellow data boxes indicate groundwater.

Groundwater was analyzed for VOC, SVOC, pesticides, PCBs, herbicides, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011

Results in blue exceed the EPA RSL Maximum Contaminant Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Table5-9.

ug/l = micrograms per liter
J = estimated value

0 20 40
Meters
N

Fort Buchanan, Puerto Rico

Site 4/SWMU 5
PCB Transformer Storage Area

Figure 5-7
Groundwater and Soil Sample Locations and Concentrations Above Criteria at Site 4/SWMU 5

EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site4ResultsGW.mxd

SED-06-08-03
12/2/2008
4,4-DDE 6.9 ug/kg
alpha-Chlordane 69 ug/kg
gamma-Chlordane 40.5 ug/kg

SED-06-08-02
12/2/2008
alpha-Chlordane 16.5 ug/kg
gamma-Chlordane 10.4 ug/kg

S-06-08-03-0-2
12/2/2008
Pentachlorophenol 4.7 ug/kg
Pentachlorophenol 5.6 ug/kg (FD)

S-06-08-01-0-2
12/2/2008
4,4-DDE 9.8 ug/kg

S-06-08-02-0-2
12/2/2008
Pentachlorophenol 4 ug/kg

Legend

Sample Location

🟩	Sediment
●	Soil Boring
⬚	Installation Boundary

Notes:
White data boxes indicate surface soil.
Gray data boxes indicate subsurface soil.
Green data boxes indicate sediment.

Samples were analyzed for pesticides and herbicides.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011. Results in blue exceed the EPA Region 4 Ecolocical Surface Soil Screening Levels.

Results shown exceed screening criteria. Complete results are shown in Tables 5-11 through 5-13.

mg/kg = milligrams per kilogram

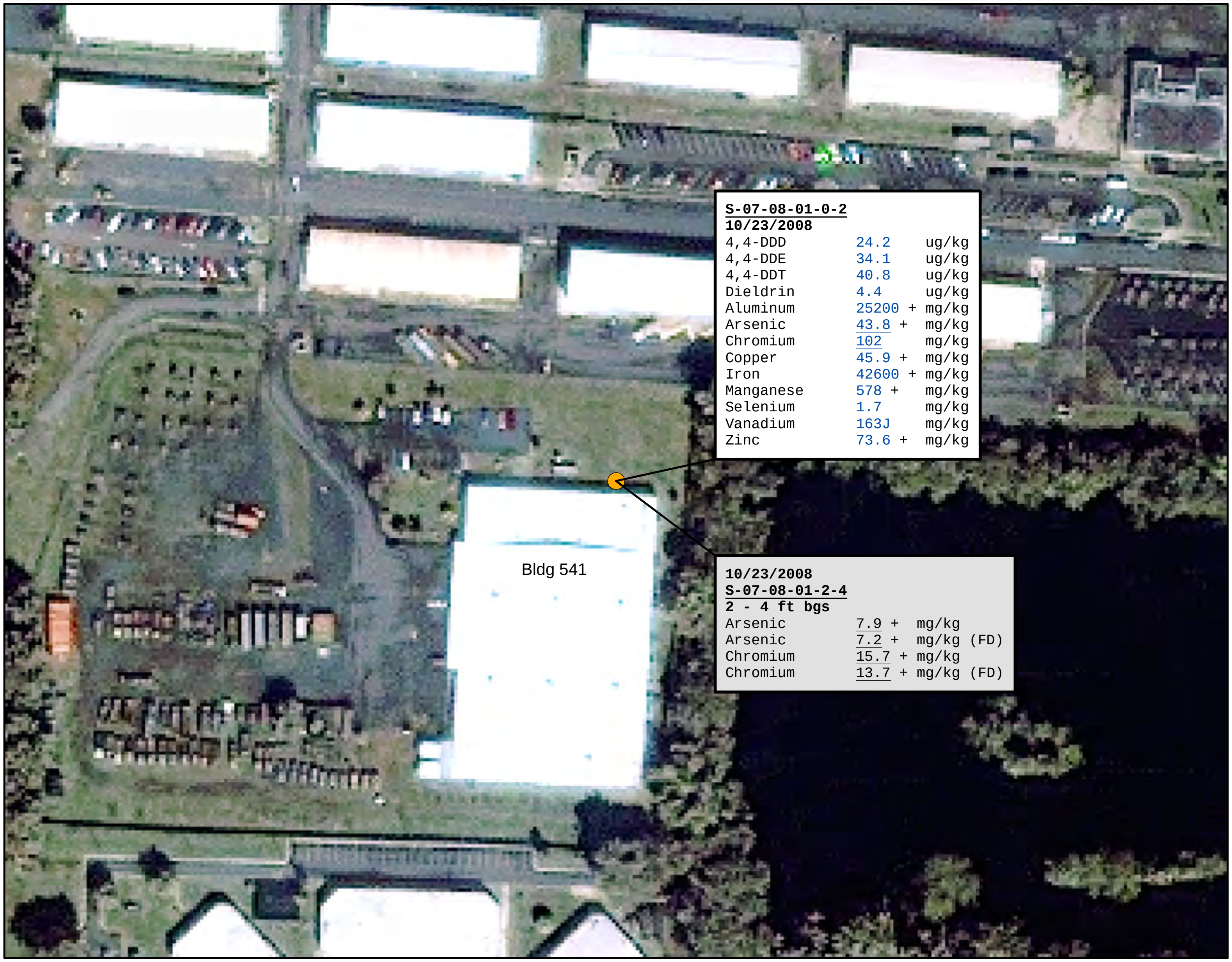
Fort Buchanan, Puerto Rico

Site 6
Pesticide Storage Area

Figure 5-8
Soil and Sediment Sample Locations and Concentrations Above Criteria at Site 6

EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site6Results.mxd



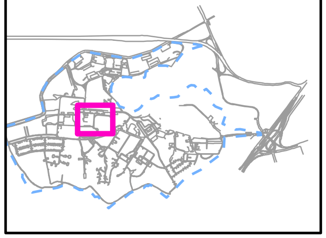
S-07-08-01-0-2
10/23/2008

4,4-DDD	24.2	ug/kg
4,4-DDE	34.1	ug/kg
4,4-DDT	40.8	ug/kg
Dieldrin	4.4	ug/kg
Aluminum	25200 +	mg/kg
Arsenic	43.8 +	mg/kg
Chromium	102	mg/kg
Copper	45.9 +	mg/kg
Iron	42600 +	mg/kg
Manganese	578 +	mg/kg
Selenium	1.7	mg/kg
Vanadium	163J	mg/kg
Zinc	73.6 +	mg/kg

10/23/2008
S-07-08-01-2-4
2 - 4 ft bgs

Arsenic	7.9 +	mg/kg
Arsenic	7.2 +	mg/kg (FD)
Chromium	15.7 +	mg/kg
Chromium	13.7 +	mg/kg (FD)

Area Shown in Main Map



Legend

● Soil Boring Location

Notes:
White data boxes indicate surface soil.

Gray data boxes indicate subsurface soil.

Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals.

Results in blue exceed the EPA Region 4 Ecological Surface Soil screening levels.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Tables 5-14 and 5-15.

FD = field duplicate result
mg/kg = milligrams per kilogram
J = estimated value
+ = reported result is below
site background

0 15 30
Meters

N

EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 7
Building 541

Figure 5-9
Soil Sample Locations
and Concentrations Above Criteria
at Site 7

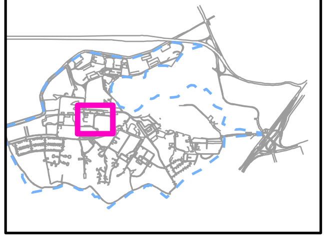
Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\site7Results.mxd

G-03-08-MW-19A
1/8/2008
Cobalt D 2.3J ug/l
Cobalt T 5.4J ug/l

G-03-08-MW-19B
1/8/2008
Arsenic D 9.4 ug/l
Arsenic T 9 ug/l
Cobalt D 2.1J ug/l
Cobalt T 3J ug/l

G-07-01

Area Shown in Main Map



Legend

⊕ NW Boundary Well

Notes:
Yellow data boxes indicate groundwater.

G-07-09-01 was analyzed for VOCs, herbicides, pesticides, and PCBs.

G-03-08-MW-19A/B were analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011.

Results in blue exceed the EPA RSL Maximum Contaminant Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Table 5-16.

T = total fraction
D = dissolved fraction
ug/l = micrograms per liter
J = estimated value

0 20 40
Meters

N

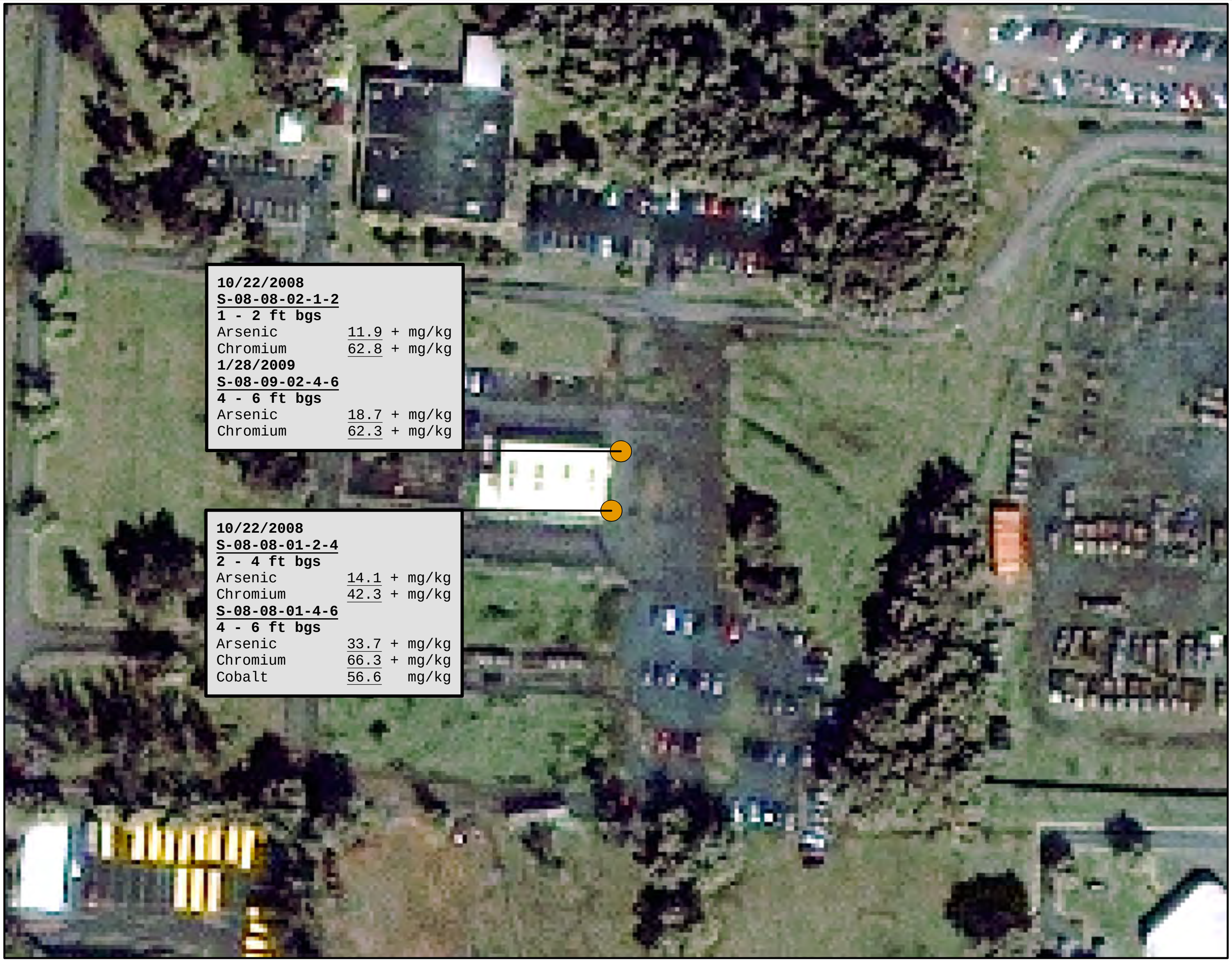
Fort Buchanan, Puerto Rico

Site 7
Building 541

Figure 5-10
Groundwater Sample Locations and Concentrations Above Criteria at Site 7

EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\site7ResultsGW.mxd



10/22/2008

S-08-08-02-1-2

1 - 2 ft bgs

Arsenic	11.9 + mg/kg
Chromium	62.8 + mg/kg

1/28/2009

S-08-09-02-4-6

4 - 6 ft bgs

Arsenic	18.7 + mg/kg
Chromium	62.3 + mg/kg

10/22/2008

S-08-08-01-2-4

2 - 4 ft bgs

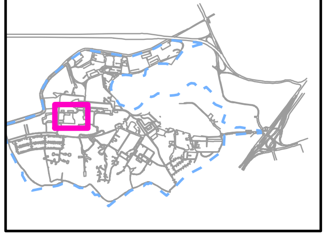
Arsenic	14.1 + mg/kg
Chromium	42.3 + mg/kg

S-08-08-01-4-6

4 - 6 ft bgs

Arsenic	33.7 + mg/kg
Chromium	66.3 + mg/kg
Cobalt	56.6 mg/kg

Area Shown in Main Map



Legend

● Soil Sample Location

▭ Installation Boundary

Notes:

Gray data box indicates subsurface soil.

Samples were analyzed for VOCs, SVOCs, total petroleum hydrocarbons, and metals.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011

Results shown exceed site screening criteria. Complete results are shown in Table 5-17.

mg/kg = milligrams per kilogram
+ = reported result is below
site background

0 10 20 40

Meters

N

Fort Buchanan, Puerto Rico

Site 8
Building S-563

Figure 5-11
Soil Sample Locations
and Concentrations Above Criteria
at Site 8

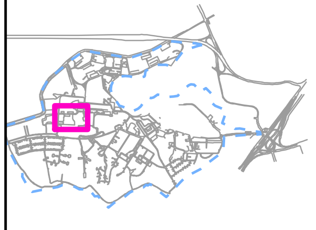
EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site8ResultsSO.mxd

G-03-08-MW-23
5/13/2008

Chromium	D	1.1J	ug/l
Chromium	T	0.9J	ug/l
Cobalt	D	2.8J	ug/l
Cobalt	T	3J	ug/l
Manganese	D	321	ug/l
Manganese	T	347	ug/l

Area Shown in Main Map



Legend

⊕ NW Boundary Well

⬚ Installation Boundary

Notes:

Yellow data box indicates groundwater.

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011

Results in blue exceed the EPA RSL Maximum Contaminant Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Table 5-18.

T= total fraction
D = dissolved fraction
ug/l = micrograms per liter
J = estimated value

0 10 20 40
Meters

N

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Fort Buchanan, Puerto Rico

Site 8
Building S-563

Figure 5-12
Groundwater Sample Locations and Concentrations Above Criteria at Site 8

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site8ResultsGW.mxd

10/21/2008

S-09-08-02-2-4

2 - 4 ft bgs

Arsenic	165	mg/kg
Chromium	145	mg/kg
Cobalt	104	mg/kg
Iron	100000	mg/kg
Manganese	7150	mg/kg

S-09-08-02-4-6

4 - 6 ft bgs

Arsenic	94.3	mg/kg
Chromium	90.5	mg/kg
Cobalt	32.7	mg/kg
Iron	76000	mg/kg

10/21/2008

S-09-08-01-2-4

2 - 4 ft bgs

Arsenic	35.7 +	mg/kg
Chromium	35.4 +	mg/kg

S-09-08-01-4-6

4 - 6 ft bgs

Arsenic	53.8	mg/kg
Chromium	62.6 +	mg/kg

10/21/2008

S-09-08-03-2-4

2 - 4 ft bgs

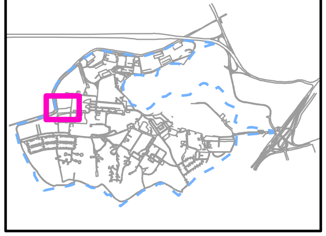
Arsenic	138J	mg/kg
Arsenic	239J	mg/kg (FD)
Chromium	184	mg/kg
Chromium	142	mg/kg (FD)
Iron	119000	mg/kg
Iron	127000	mg/kg (FD)

S-09-08-03-4-6

4 - 6 ft bgs

Arsenic	66.1	mg/kg
Chromium	68.8 +	mg/kg

Area Shown in Main Map



Legend

● Soil Boring Location

▭ Installation Boundary

Notes:

Gray data boxes indicate subsurface samples.

Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Table 5-19.

FD = field duplicate result
mg/kg = milligrams per kilogram
+ = reported result is below
site background

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Fort Buchanan, Puerto Rico

Site 9
Used Oil Staging Area

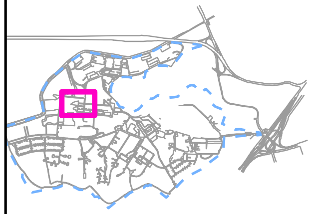
Figure 5-13
Soil Sample Locations
and Concentrations Above Criteria
at Site 9

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site9Results.mxd

G-03-08-MW-20
5/13/2008

Arsenic	D	2J	ug/l
Arsenic	T	2.2J	ug/l
Chromium	D	0.6J	ug/l
Chromium	T	2.1J	ug/l
Manganese	D	208	ug/l
Manganese	T	219	ug/l

Area Shown in Main Map



Legend

⊕ NW Boundary Well

\# Boring # and Location

Notes:

Yellow data box indicates groundwater.

Soil samples were analyzed for VOCs and total petroleum hydrocarbons. No compounds exceeded screening levels.

Groundwater samples were analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, and metals.

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011

Results in blue exceed the EPA RSL Maximum Contaminant Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Tables 5-20 through 5-22.

T = total fraction
D = dissolved fraction
ug/l = micrograms per liter
J = estimated value

0 10 20 40
Meters

N

EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 10
65th Army Reserve Command Refueling Area

Figure 5-14
Groundwater and Soil Sample Locations and Concentrations Above Criteria at Site 10

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site10Results.mxd

10/21/2008
S-11-08-03-2-4
2 - 4 ft bgs

Arsenic	119	mg/kg
Chromium	140	mg/kg

10/21/2008
S-11-08-01-2-4
2 - 4 ft bgs

Arsenic	62.8	mg/kg
Chromium	84.1	mg/kg
Manganese	3040	mg/kg

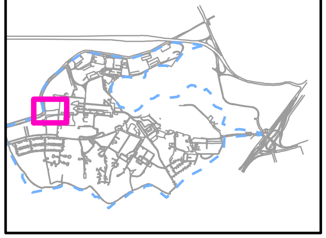
10/21/2008
S-11-08-04-2-4
2 - 4 ft bgs

Arsenic	41 +	mg/kg
Arsenic	48.3	mg/kg (FD)
Chromium	57 +	mg/kg
Chromium	67.4 +	mg/kg (FD)

10/21/2008
S-11-08-02-2-4
2 - 4 ft bgs

Arsenic	85.8	mg/kg
Chromium	116	mg/kg

Area Shown in Main Map



Legend

● Soil Boring Location

▭ Installation Boundary

Notes:

Gray data boxes indicate subsurface samples.

Samples were analyzed for VOCs,PCBs, total petroleum hydrocarbons, and metals.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011

Results shown exceed screening criteria. Complete results are shown in Table 5-23.

FD = field duplicate result
mg/kg = milligrams per kilogram
J = estimated value
+ = reported result is below
site background

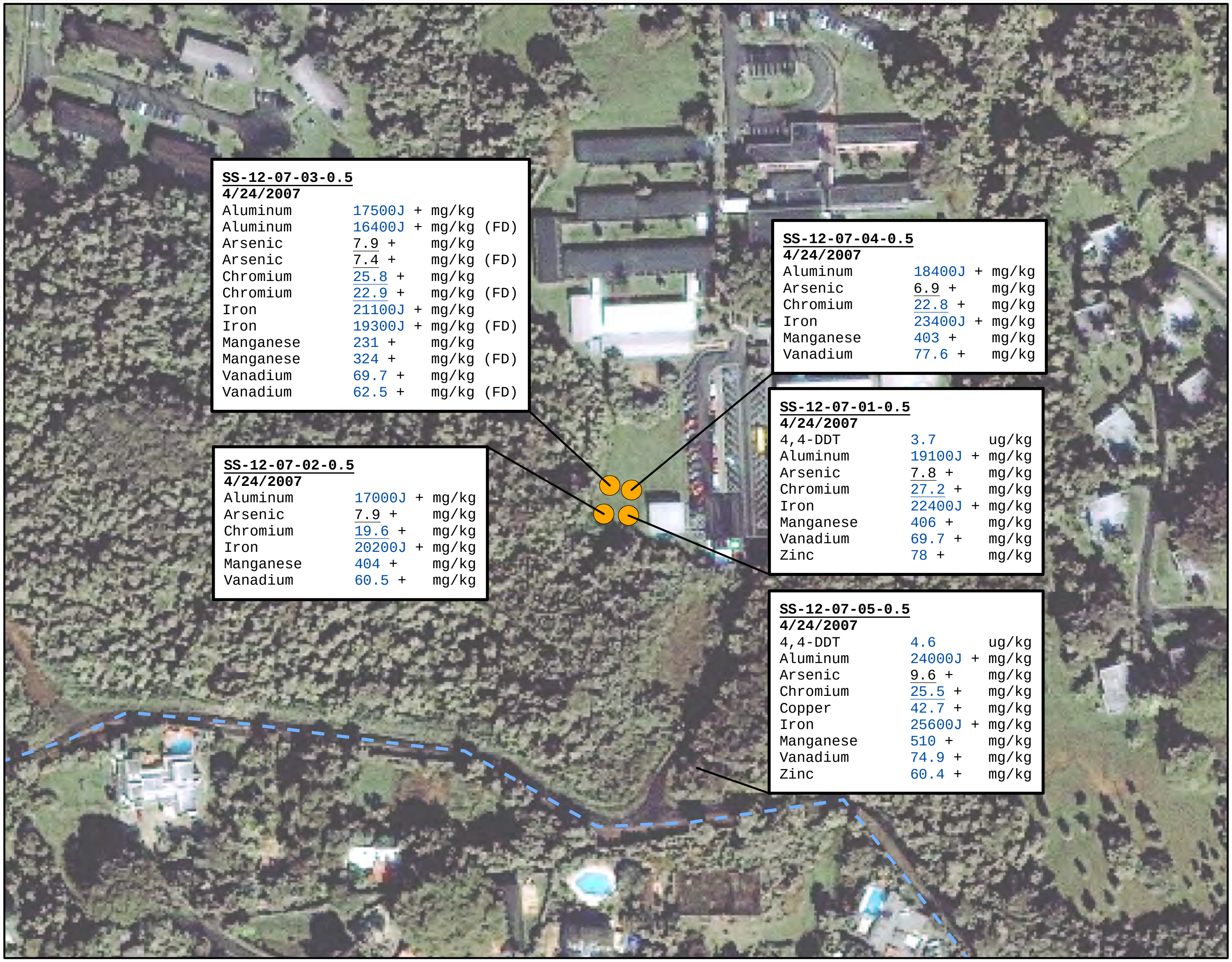
Fort Buchanan, Puerto Rico

Site 11
Heavy Equipment Storage Area

Figure 5-15
Soil Sample Locations
and Concentrations Above Criteria
at Site 11

EA Engineering, Science, and Technology

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site11Results.mxd



SS-12-07-03-0.5
4/24/2007

Aluminum	17500J +	mg/kg
Aluminum	16400J +	mg/kg (FD)
Arsenic	7.9 +	mg/kg
Arsenic	7.4 +	mg/kg (FD)
Chromium	25.8 +	mg/kg
Chromium	22.9 +	mg/kg (FD)
Iron	21100J +	mg/kg
Iron	19300J +	mg/kg (FD)
Manganese	231 +	mg/kg
Manganese	324 +	mg/kg (FD)
Vanadium	69.7 +	mg/kg
Vanadium	62.5 +	mg/kg (FD)

SS-12-07-04-0.5
4/24/2007

Aluminum	18400J +	mg/kg
Arsenic	6.9 +	mg/kg
Chromium	22.8 +	mg/kg
Iron	23400J +	mg/kg
Manganese	403 +	mg/kg
Vanadium	77.6 +	mg/kg

SS-12-07-02-0.5
4/24/2007

Aluminum	17000J +	mg/kg
Arsenic	7.9 +	mg/kg
Chromium	19.6 +	mg/kg
Iron	20200J +	mg/kg
Manganese	404 +	mg/kg
Vanadium	60.5 +	mg/kg

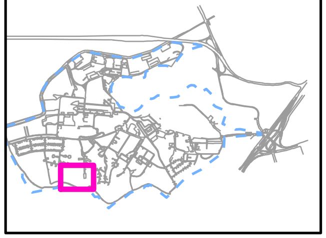
SS-12-07-01-0.5
4/24/2007

4,4-DDT	3.7	ug/kg
Aluminum	19100J +	mg/kg
Arsenic	7.8 +	mg/kg
Chromium	27.2 +	mg/kg
Iron	22400J +	mg/kg
Manganese	406 +	mg/kg
Vanadium	69.7 +	mg/kg
Zinc	78 +	mg/kg

SS-12-07-05-0.5
4/24/2007

4,4-DDT	4.6	ug/kg
Aluminum	24000J +	mg/kg
Arsenic	9.6 +	mg/kg
Chromium	25.5 +	mg/kg
Copper	42.7 +	mg/kg
Iron	25600J +	mg/kg
Manganese	510 +	mg/kg
Vanadium	74.9 +	mg/kg
Zinc	60.4 +	mg/kg

Area Shown in Main Map



Legend

Sample Locations

● Surface Soil

Installation Boundary

Notes:
White data boxes indicate surface soil.

Soil samples were analyzed for SVOCs, pesticides, PCBs, herbicides, metals, and total petroleum hydrocarbons.

Results in blue exceed the EPA Region 4 Ecological Surface Soil screening levels.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Table 5-24.

FD = field duplicate result
J = estimated value
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
+ = reported result is below site background

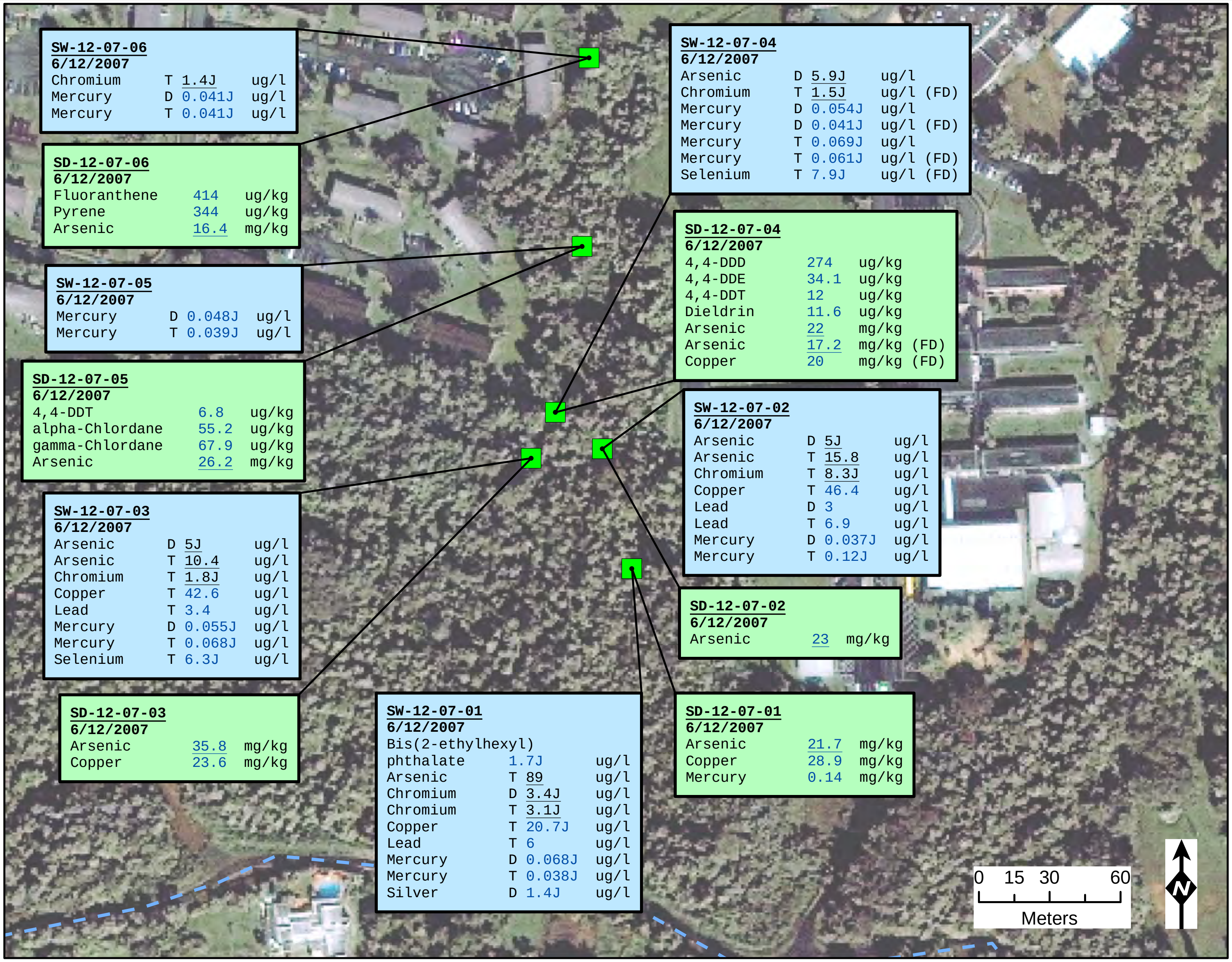
EA Engineering, Science, and Technology

Fort Buchanan, Puerto Rico

Site 12
Old Landfill

Figure 5-16
Soil Sample Locations
and Concentrations Above Criteria
at Site 12

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site12SOResults.mxd



SW-12-07-06
6/12/2007

Chromium	T	1.4J	ug/l
Mercury	D	0.041J	ug/l
Mercury	T	0.041J	ug/l

SD-12-07-06
6/12/2007

Fluoranthene	414	ug/kg
Pyrene	344	ug/kg
Arsenic	16.4	mg/kg

SW-12-07-05
6/12/2007

Mercury	D	0.048J	ug/l
Mercury	T	0.039J	ug/l

SD-12-07-05
6/12/2007

4,4-DDT	6.8	ug/kg
alpha-Chlordane	55.2	ug/kg
gamma-Chlordane	67.9	ug/kg
Arsenic	26.2	mg/kg

SW-12-07-03
6/12/2007

Arsenic	D	5J	ug/l
Arsenic	T	10.4	ug/l
Chromium	T	1.8J	ug/l
Copper	T	42.6	ug/l
Lead	T	3.4	ug/l
Mercury	D	0.055J	ug/l
Mercury	T	0.068J	ug/l
Selenium	T	6.3J	ug/l

SD-12-07-03
6/12/2007

Arsenic	35.8	mg/kg
Copper	23.6	mg/kg

SW-12-07-01
6/12/2007

Bis(2-ethylhexyl) phthalate		1.7J	ug/l
Arsenic	T	89	ug/l
Chromium	D	3.4J	ug/l
Chromium	T	3.1J	ug/l
Copper	T	20.7J	ug/l
Lead	T	6	ug/l
Mercury	D	0.068J	ug/l
Mercury	T	0.038J	ug/l
Silver	D	1.4J	ug/l

SW-12-07-04
6/12/2007

Arsenic	D	5.9J	ug/l
Chromium	T	1.5J	ug/l (FD)
Mercury	D	0.054J	ug/l
Mercury	D	0.041J	ug/l (FD)
Mercury	T	0.069J	ug/l
Mercury	T	0.061J	ug/l (FD)
Selenium	T	7.9J	ug/l (FD)

SD-12-07-04
6/12/2007

4,4-DDD	274	ug/kg
4,4-DDE	34.1	ug/kg
4,4-DDT	12	ug/kg
Dieldrin	11.6	ug/kg
Arsenic	22	mg/kg
Arsenic	17.2	mg/kg (FD)
Copper	20	mg/kg (FD)

SW-12-07-02
6/12/2007

Arsenic	D	5J	ug/l
Arsenic	T	15.8	ug/l
Chromium	T	8.3J	ug/l
Copper	T	46.4	ug/l
Lead	D	3	ug/l
Lead	T	6.9	ug/l
Mercury	D	0.037J	ug/l
Mercury	T	0.12J	ug/l

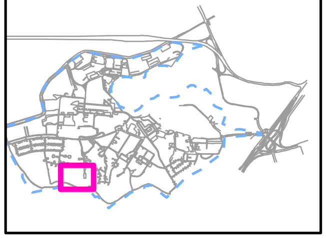
SD-12-07-02
6/12/2007

Arsenic	23	mg/kg

SD-12-07-01
6/12/2007

Arsenic	21.7	mg/kg
Copper	28.9	mg/kg
Mercury	0.14	mg/kg

Area Shown in Main Map



Legend

Sample Locations

🟩 Sed/Surface Water

▭ Installation Boundary

Notes:
Green data boxes indicate SD.
Blue data boxes indicate SW.

Surface water samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, and metals.

Sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and total petroleum hydrocarbons.

Results in blue exceed the EPA Region 4 Ecological screening levels.

Underlined results exceed the EPA Regional Screening Levels (Industrial Soil*10 for sediment) (Tapwater*10 for surface water)

Only results exceeding screening criteria are shown. Complete results are shown in Tables 5-25 and 5-26.

FD = field duplicate result
ug/kg = micrograms per kilogram
mg/kg = milligram per kilogram
ug/l = milligram per liter
J = estimated value
D = dissolved fraction
T = total fraction

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Fort Buchanan, Puerto Rico

Site 12
Old Landfill

Figure 5-17
Sediment and Surface Water
Sample Locations and Concentrations
Above Criteria at Site 12

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\site12SWSDResults.mxd

S12-PW-11-1
9/20/2011

Arsenic	D	36.7	ug/l
Arsenic	T	36.1	ug/l
Chromium	D	1	ug/l
Chromium	T	4.6	ug/l
Cobalt	D	1.2	ug/l
Cobalt	T	1.9	ug/l
Iron	D	9950	ug/l
Iron	T	11700	ug/l
Manganese	D	2060	ug/l
Manganese	T	2170	ug/l
Thallium	T	1.4	ug/l

S12-PW-11-2
9/20/2011

Arsenic	D	28.6	ug/l
Arsenic	T	34.7	ug/l
Chromium	D	1.1	ug/l
Chromium	T	4.5	ug/l
Cobalt	T	1.9	ug/l
Iron	D	16100	ug/l
Iron	T	20500	ug/l
Manganese	D	1740	ug/l
Manganese	T	2080	ug/l
Thallium	D	1	ug/l

S12-PW-11-03
9/20/2011

Bis(2-ethylhexyl) phthalate		7.5	ug/l (FD)
Arsenic	D	17.7	ug/l
Arsenic	D	18.2	ug/l (FD)
Arsenic	T	21.9	ug/l
Arsenic	T	20.6	ug/l (FD)
Chromium	D	0.9	ug/l
Chromium	D	1.1	ug/l (FD)
Chromium	T	1.9	ug/l
Chromium	T	1.8	ug/l (FD)
Cobalt	D	7.6	ug/l
Cobalt	D	7.9	ug/l (FD)
Cobalt	T	8.6	ug/l
Cobalt	T	8.3	ug/l (FD)
Iron	D	4970	ug/l
Iron	D	5200	ug/l (FD)
Iron	T	6760	ug/l
Iron	T	6180	ug/l (FD)
Manganese	D	4450	ug/l
Manganese	D	4630	ug/l (FD)
Manganese	T	4650	ug/l
Manganese	T	4450	ug/l (FD)
Thallium	D	1.9	ug/l (FD)
Thallium	T	1.5	ug/l
Thallium	T	2.7	ug/l (FD)

G-12-07-MW-03
6/13/2007

Arsenic	D	10.3	ug/l
Arsenic	T	8.9	ug/l
Chromium	D	1.1J	ug/l
Chromium	T	74.5	ug/l
Cobalt	T	2.6J	ug/l

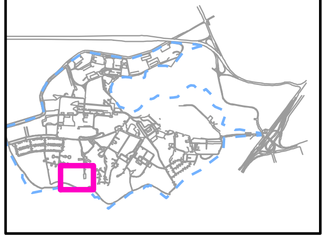
G-12-07-MW-02
6/13/2007

Chloroform	T	0.46J	ug/l
Arsenic	T	68.9	ug/l
Cadmium	T	2.6J	ug/l
Chromium	T	206	ug/l
Cobalt	T	20.1J	ug/l
Nickel	T	90.7	ug/l
Vanadium	T	124	ug/l

G-12-07-MW-01
6/13/2007

Chloroform	T	5.3	ug/l
Chromium	T	73	ug/l
Cobalt	T	4.5J	ug/l

Area Shown in Main Map



Legend

Sample Locations

●	Pore Water
⊕	Groundwater
▭	Installation Boundary

Notes:

Purple data boxes indicate pore water.
Yellow data boxes indicate groundwater.

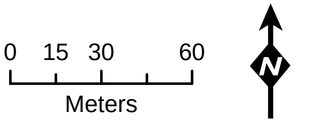
Pore water and groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, herbicides, and metals.

Results in blue exceed the EPA Regional Screening Level table's Maximum Contaminant Level, June 2011

Underlined results exceed the EPA Tapwater Regional Screening Levels, June 2011.

Only results exceeding screening criteria are shown. Complete results are shown in Table 5-27.

FD = field duplicate result
ug/l = milligram per liter
J = estimated value
D = dissolved fraction
T = total fraction



Fort Buchanan, Puerto Rico

Site 12
Old Landfill

Figure 5-18
Pore Water and Groundwater
Sample Locations and Concentrations
Above Criteria at Site 12

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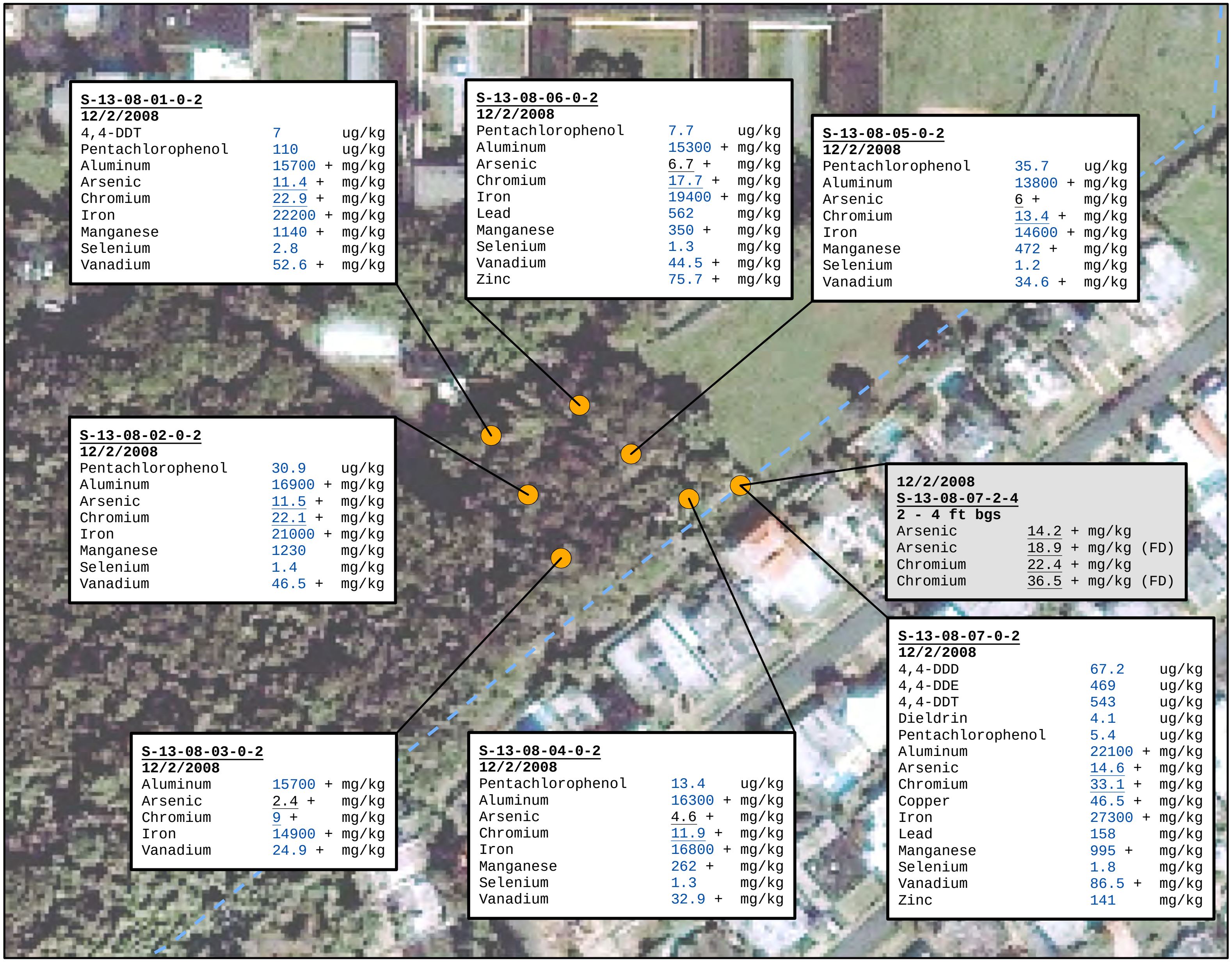
Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site12GWPoreWaterResults.mxd



S-13-08-01-0-2
12/2/2008

4,4-DDT	7		ug/kg
Pentachlorophenol	110		ug/kg
Aluminum	15700	+	mg/kg
Arsenic	11.4	+	mg/kg
Chromium	22.9	+	mg/kg
Iron	22200	+	mg/kg
Manganese	1140	+	mg/kg
Selenium	2.8		mg/kg
Vanadium	52.6	+	mg/kg

S-13-08-06-0-2
12/2/2008

Pentachlorophenol	7.7		ug/kg
Aluminum	15300	+	mg/kg
Arsenic	6.7	+	mg/kg
Chromium	17.7	+	mg/kg
Iron	19400	+	mg/kg
Lead	562		mg/kg
Manganese	350	+	mg/kg
Selenium	1.3		mg/kg
Vanadium	44.5	+	mg/kg
Zinc	75.7	+	mg/kg

S-13-08-05-0-2
12/2/2008

Pentachlorophenol	35.7		ug/kg
Aluminum	13800	+	mg/kg
Arsenic	6	+	mg/kg
Chromium	13.4	+	mg/kg
Iron	14600	+	mg/kg
Manganese	472	+	mg/kg
Selenium	1.2		mg/kg
Vanadium	34.6	+	mg/kg

S-13-08-02-0-2
12/2/2008

Pentachlorophenol	30.9		ug/kg
Aluminum	16900	+	mg/kg
Arsenic	11.5	+	mg/kg
Chromium	22.1	+	mg/kg
Iron	21000	+	mg/kg
Manganese	1230		mg/kg
Selenium	1.4		mg/kg
Vanadium	46.5	+	mg/kg

12/2/2008
S-13-08-07-2-4
2 - 4 ft bgs

Arsenic	14.2	+	mg/kg	
Arsenic	18.9	+	mg/kg	(FD)
Chromium	22.4	+	mg/kg	
Chromium	36.5	+	mg/kg	(FD)

S-13-08-07-0-2
12/2/2008

4,4-DDD	67.2		ug/kg
4,4-DDE	469		ug/kg
4,4-DDT	543		ug/kg
Dieldrin	4.1		ug/kg
Pentachlorophenol	5.4		ug/kg
Aluminum	22100	+	mg/kg
Arsenic	14.6	+	mg/kg
Chromium	33.1	+	mg/kg
Copper	46.5	+	mg/kg
Iron	27300	+	mg/kg
Lead	158		mg/kg
Manganese	995	+	mg/kg
Selenium	1.8		mg/kg
Vanadium	86.5	+	mg/kg
Zinc	141		mg/kg

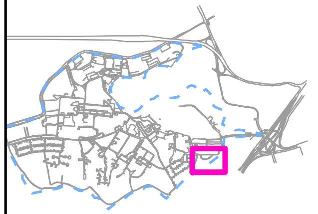
S-13-08-03-0-2
12/2/2008

Aluminum	15700	+	mg/kg
Arsenic	2.4	+	mg/kg
Chromium	9	+	mg/kg
Iron	14900	+	mg/kg
Vanadium	24.9	+	mg/kg

S-13-08-04-0-2
12/2/2008

Pentachlorophenol	13.4		ug/kg
Aluminum	16300	+	mg/kg
Arsenic	4.6	+	mg/kg
Chromium	11.9	+	mg/kg
Iron	16800	+	mg/kg
Manganese	262	+	mg/kg
Selenium	1.3		mg/kg
Vanadium	32.9	+	mg/kg

Area Shown in Main Map



Legend

● Soil Boring Location

┆ Installation Boundary

Notes:
White data boxes indicate surface soil.

Gray data boxes indicate subsurface soil.

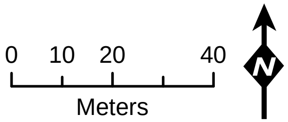
Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, total petroleum hydrocarbons, and metals.

Results in blue exceed the EPA Region 4 Ecological Surface Soil screening levels.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Tables 5-28 through 5-30.

FD = field duplicate result
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
+ = reported result is below site background



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Site 13
Potential Hazardous Material Burial Site

Figure 5-19
Soil Sample Locations
and Concentrations Above Criteria
at Site 13

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\Site13Results.mxd

S-15-08-02-0-1
10/20/2008

Aluminum	24600 +	mg/kg
Arsenic	20.5 +	mg/kg
Chromium	44.1J +	mg/kg
Iron	31100 +	mg/kg
Manganese	480 +	mg/kg
Selenium	0.93 +	mg/kg
Vanadium	89.6 +	mg/kg
Zinc	62.8J +	mg/kg

10/20/2008
S-15-08-02-2-4
2 - 4 ft bgs

Arsenic	18 +	mg/kg
Chromium	36.8J +	mg/kg

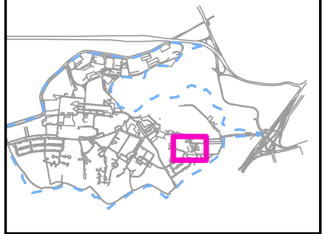
S-15-08-01-0-1
10/20/2008

Aluminum	25700 +	mg/kg
Arsenic	6 +	mg/kg
Beryllium	1.4	mg/kg
Chromium	48.3J +	mg/kg
Copper	111	mg/kg
Iron	41300 +	mg/kg
Manganese	917 +	mg/kg
Nickel	35.2	mg/kg
Thallium	1.1J +	mg/kg
Vanadium	162	mg/kg
Zinc	260J	mg/kg

10/20/2008
S-15-08-01-2-4
2 - 4 ft bgs

Arsenic	45.2	mg/kg
Chromium	89.3J	mg/kg

Area Shown in Main Map



Legend

● Soil Samples

Notes:
White data boxes indicate surface soil from 0-1'.

Gray data boxes indicate subsurface soil from 2-4'.

Samples were analyzed for total petroleum hydrocarbons, and metals.

Results in blue exceed the EPA Region 4 Ecological Surface Soil screening levels.

Underlined results exceed the EPA Industrial Soil Regional Screening Levels, June 2011.

Results shown exceed screening criteria. Complete results are shown in Tables 5-31 and 5-32.

mg/kg = milligrams per kilogram
J = estimated value
\+ = reported result is below site background level

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Fort Buchanan, Puerto Rico

Site 15
Building S-159

Figure 5-20
Soil Sample Locations
and Concentrations Above Criteria
at Site 15

Path: \\LOVETONFEDERAL\GISData\PuertoRico\FtBuchanan\MXD\RFI_Revision\site15Results.mxd

6 MIGRATION PATHWAYS

Determination of the level of risk posed by potential impacts to environmental media at RFI Sites requires characterization of migration pathways (either direct or indirect) from source areas to possible points of exposure for human and ecological receptors. Complete migration pathways will be evaluated in the Human Health and Ecological Risk Assessments (Section 7) to determine if there is receptor-based exposure. It should be noted that direct contact with impacted media (soil, sediment, groundwater, or surface water) is not considered a migration pathway, but will be considered in the Human Health and Ecological Risk Assessments.

In general, impacted soil is considered the primary source, from which contaminants may migrate through a secondary environmental media (i.e., groundwater, sediment, surface water, or ambient air) to a point of exposure. Migration pathways for soil, sediment, groundwater, surface water, and ambient air are discussed in the following sections.

6.1 SOIL MIGRATION PATHWAYS

6.1.1 Leaching to Groundwater

Migration from impacted subsurface soil to groundwater, known as ‘leaching,’ is considered a potentially complete pathway. However, the concentration of a constituent in groundwater is related to the concentration in impacted subsurface soil located near the water table. Because the water table is shallow, the groundwater velocity is low, the distribution of analytes in impacted soils is mostly heterogeneous, and groundwater concentrations are much simpler to monitor over time – the leaching of organics and inorganics to groundwater will be evaluated by analyzing the concentrations of constituents in groundwater analytical data. This approach is particularly appropriate for the areas around the DPW complex and the northwest boundary of Fort Buchanan, because groundwater monitoring is expected to continue for the foreseeable future and groundwater impacts are expected to be associated with the TCE plume rather than low-level soil leaching.

6.1.2 Erosion of Surface Soil to Surface Water and Sediment

Impacted surface soil can migrate to surface water or sediment via erosion. At Fort Buchanan, most surface water runoff is confined to the El Toro Creek channel. However, potential erosion of surface soil is considered negligible because the channel is concrete-lined and doesn’t have a natural sediment creek floor. There is a greater potential for erosion of soil into the unaltered stretch of creek at Site 12, especially since it is at the bottom of a steep ravine.

6.2 GROUNDWATER MIGRATION PATHWAYS

Impacted groundwater can disburse throughout an aquifer and contaminants can be released to surface water, subsurface soil, and volatile contaminants can eventually be released to air. At the Sites addressed in this RFI, complete groundwater pathways have not been identified except in the area of the northwest boundary (EA 2012). The groundwater analytical results for areas outside of the NWBA (i.e. Sites 12 and 13) show little impact in terms of groundwater contaminants.

Information on the lithology in and around the RFI Sites indicates that the opportunity for soils to leach contaminants to groundwater is limited. Most of the land area occupying Fort Buchanan consists of stiff clays, through which permeation is difficult under normal conditions. This is supported by the many instances where concentrations of analytes above protection of groundwater SSLs were found subsurface soil, but elevated concentrations of these same analytes were not observed in associated groundwater (Section 5).

6.3 AIR MIGRATION PATHWAYS

Contaminants can be found in air as a volatilized gas or adsorbed to soil particles that are lifted into the air by wind. Exposure occurs when a potential receptor inhales ambient air containing VOCs, or contaminated fugitive dust. Specific migration pathways of constituents to air are:

- Subsurface volatilization from subsurface soil and groundwater and diffusion through the soil column to the ground surface
- Subsurface volatilization from subsurface soil and groundwater and diffusion into excavations
- Volatilization and diffusion from surface water
- Fugitive dust emissions from wind erosion of exposed surface soils
- Fugitive dust emissions from wind erosion of exposed subsurface soils during excavation activities
- Vapor intrusion into indoor air from subsurface soil and groundwater

There are two principal transport mechanisms to ambient air: 1) volatilization, flux, and dispersion; and 2) wind erosion of fugitive dust, transport, and dispersion. The following discussion summarizes each transport mechanism for each of these potential pathways and evaluates their significance based on site activities.

6.3.1 Subsurface Volatilization and Diffusion Through the Soil Column into Ambient Air

Subsurface volatilization (from subsurface soil and groundwater) and diffusion through the soil column to ambient air is a potential migration pathway. The concentration in ambient air at the source is attenuated, due to dispersion, downwind of the source at a potential receptor's location. Given the nature of the contaminants found in the subsurface (mostly metals rather than VOCs), and the Sites' lithology, this pathway's contribution to receptor exposure at the Sites evaluated herein is negligible.

6.3.2 Subsurface Volatilization and Diffusion into Excavations

Subsurface vapors (from subsurface soil and groundwater) can migrate and collect in exposed excavations and is considered a potential migration pathway.

6.3.3 Volatilization and Diffusion from Surface Water

Vapors may volatilize and diffuse from surface water, creating a potential migration pathway.

6.3.4 Fugitive Dust Emissions from Wind Erosion of Exposed Surface Soils

Fugitive dust emissions from wind erosion of exposed surface soils are considered a potential migration pathway. Wind erosion is the entrainment of dust particles in air by the action of turbulent air currents and is observed when wind moves across an exposed, erodible surface at speeds greater than approximately five meters per second. Particulates that can be inhaled have an aerodynamic diameter of 10 microns or less. Since barren or sparsely vegetated areas are susceptible to wind erosion, and there are few of these areas at Fort Buchanan, this pathway's contribution to receptor exposure at the Sites evaluated herein is negligible.

6.3.5 Fugitive Dust Emissions During Excavation Activities

Fugitive dust emissions from wind erosion of exposed subsurface soils during excavation activities are considered a potential migration pathway. Wind erosion is the entrainment of dust particles in air by the action of turbulent air currents and is observed when wind moves across an exposed, erodible surface at speeds greater than approximately five meters per second. Particulates, which can be inhaled, have an aerodynamic diameter of 10 microns or less. Fugitive dust emission from excavation activities is considered a potential migration pathway.

6.3.6 Subsurface Soil Vapor Intrusion into Indoor Air

Volatile contaminants present in subsurface soil can migrate through the soil column. If impacted soil is under a building or near a building's perimeter, the volatiles can enter the building's air through cracks in the foundation. Given the nature of the contaminants found in the subsurface (mostly metals rather than VOCs), and the Sites' lithology, this pathway's contribution to receptor exposure at the Sites evaluated herein is negligible. However, it should be noted that this is a pathway of concern for the area above the NWBA groundwater plume. The NWBA RFI included an evaluation of the potential for contaminated groundwater to adversely impact other media, such as air. Potential concerns were identified for the commercial worker due to inhalation of indoor air. These concerns were driven by the TCE-contaminated groundwater in the NWBA, and are being addressed in a CMS prepared specifically for the NWBA.

6.4 SUMMARY OF MIGRATION PATHWAY ANALYSIS

Conclusions regarding each migration pathway and its significance are summarized below:

- Leaching to Groundwater - Migration from impacted subsurface soil to groundwater may occur at the RFI sites and is considered a potentially complete pathway. The leaching of organics and inorganics to groundwater was evaluated by analyzing the concentrations of constituents in groundwater analytical data.
- Off-site Migration of Groundwater –The NWBA RFI evaluated the potential for off-site migration, and found that the identified TCE plume does extend beyond the boundary of Fort Buchanan (EA 2012). This groundwater plume is being addressed in a CMS prepared specifically for the NWBA.
- Migration of Groundwater to Surface Water – Groundwater discharges to surface water at Site 12 and this is considered a potentially complete pathway.
- Erosion of Surface Soil to Surface Water and Sediment – Impacted surface soil can migrate to surface water and sediment through runoff and erosion. The potential for erosion of surface soil to sediment considered negligible because the channel of El Toro Creek is concrete-lined and does not have a natural sediment creek floor. There is a greater potential for erosion of soil into the unaltered stretch of creek at Site 12, especially since it is at the bottom of a steep ravine.
- Air Migration Pathways – The following pathways were considered potential migration pathways for air: subsurface volatilization and diffusion through the ground surface from subsurface soil and groundwater; subsurface volatilization and diffusion into excavations from subsurface soil and groundwater; volatilization and diffusion from surface water; fugitive dust emissions from wind erosion of exposed surface soils; fugitive dust emissions from wind erosion of exposed subsurface soils during excavation activities; and vapor intrusion into indoor air from groundwater.

7 RISK ASSESSMENTS

Human Health and Ecological Risk Assessments have been completed for the 14 Sites addressed in this RFI. This section presents summaries of the risk assessment processes utilized and the findings of each assessment. The full text of the HHRA is included in Appendix D and the Baseline Ecological Risk Assessment (BERA) is included in Appendix E.

7.1 HUMAN HEALTH RISK ASSESSMENT

The HHRA was completed in accordance with USEPA guidance to evaluate potential human health risk under current and potential future conditions at Fort Buchanan. The HHRA included

- A hazard assessment, in which exposure media and pathways were identified and COPCs were selected for inclusion throughout the risk assessment. This is summarized in Section 7.1.1 of this RFI.
- An exposure assessment, in which the Exposure Point Concentrations (EPCs) were calculated. See Section 2 of the HHRA in Appendix D.
- A toxicity assessment, in which the relationship between extent of exposure and extent of toxic injury or disease was estimated for each COPC. See Section 3 of the HHRA in Appendix D.
- A risk characterization that integrated the results of the toxicity assessment and the exposure assessment to derive quantitative estimates of human health risk. This is summarized in Section 7.1.2 of this RFI.
- Consideration of background data that discussed the findings of the risk characterization with respect to available background data. This is summarized in Section 7.1.3 of this RFI.

7.1.1 Hazard Assessment

Currently, there are no deed restrictions prohibiting future development of any of the sites in this assessment. Therefore, hypothetical scenarios including future residential use were evaluated for all sites. The human health receptors evaluated for all sites were recreational users/trespassers (adults and adolescents), residents (adults and children), construction workers, and commercial workers. Media evaluated were surface soil, subsurface soil, sediment, surface water, and groundwater, as applicable; not all media were present at all sites. CSMs are presented in Appendix D.

As part of the hazard assessment, a data quality assessment was performed and data were included or excluded based on analytical qualifiers and the handling of duplicate samples in accordance with USEPA guidance (USEPA 1989). Maximum detected concentrations of site-specific data were then compared to the USEPA RSLs and COPCs were identified in a manner consistent with USEPA guidance.

For the purposes of this HHRA, both the residential and industrial soil RSLs were used for surface and subsurface soil. For sediment, a medium which is contacted less than soil, a ten percent increase modification of the RSL was used as a conservative measure based on the lack of RSLs for sediment. For groundwater, the USEPA RSL tap water values were used for screening purposes. For surface water, a medium which is contacted much less than tap water, a ten percent increase modification of the RSL was used as a conservative measure based on the lack of RSLs for surface water.

The hazard assessments were performed for each individual site, and the results of the screening indicated that several sites did not have any analytes detected or revealed no COPCs.

- Soil at Sites 4 and 5 was analyzed for PCBs only because these sites are associated with PCB transformer storage areas. No PCBs were detected at these sites, and therefore, no further action is required for Sites 4 and 5.

- Soil and sediment at Site 6 were analyzed for herbicides and pesticides because the site is associated with a pesticide mixing and storage area. No COPCs were identified, and therefore, no further action is required for Site 6.

- Site 10 soil was evaluated for VOCs and total petroleum hydrocarbons because the area was used for refueling. No COPCs were identified for Site 10; therefore, it will not be evaluated further. COPCs were identified in groundwater at Site 10; however, groundwater at this site was evaluated as part of the NWBA HHRA (EA 2012) and is not re-evaluated herein.

The results of the risk-based screening also indicate that several sites have similar COPCs at similar concentrations. Based on both the similar COPCs and the proximity of sites, several groupings of sites were carried through the HHRA as a whole. Sites 1, 7, and 8 were combined to form Grouping 1, Sites 2, 3, and 11 were combined to form Grouping 2, and Sites 13 and 15 were combined into Grouping 3. Sites 9 and 12 were not grouped and were assessed individually.

7.1.2 Risk Characterization

In this step, the toxicity values were combined with the estimated chemical intakes for the receptor populations to quantitatively estimate both carcinogenic and non-carcinogenic risks. Carcinogenic and non-carcinogenic risks were evaluated for each receptor on a cumulative basis across all pathways and media. Risk results were compared to the USEPA carcinogenic “acceptable risk range” of 10^{-4} to 10^{-6}. For non-carcinogens, a threshold Hazard Index (HI) of

1.0 was utilized. Unacceptable risks for potential receptors are identified when cumulative carcinogenic risks exceed the upper-bound of the “acceptable risk range” (i.e., 10^{-4}) or cumulative non-carcinogenic risks exceed an HI of 1.0 per target organ.

The results indicate there are no exceedances of the carcinogenic or non-carcinogenic risk thresholds for current users, the adult and adolescent trespasser, and commercial worker, for any site. The only potential concerns are for

- Future residential use of sites in Grouping 1 (surface and subsurface soil), sites in Grouping 2 (subsurface soil), sites in Grouping 3 (subsurface soil), and Site 9 (subsurface soil).
- Future construction worker exposure to Site 9 subsurface soil.

7.1.2.1 Grouping 1: Sites 1, 7, and 8

Carcinogenic and non-carcinogenic hazards were not identified for any of the receptors evaluated, except for resident child exposure to surface soil and subsurface soil.

For surface soil, arsenic and total chromium were the chemicals of concern (COCs) for carcinogenic risks. In addition, arsenic is the only COC in surface soil with non-carcinogenic hazards above 1. Only one surface soil sample was collected for inorganic analysis within Grouping 1, at Site 7. Therefore, the EPC used in the risk calculations is the maximum concentration. The maximum concentrations of arsenic and total chromium were elevated above both the industrial and residential soil screening levels. The maximum concentration of arsenic in surface soil (43.8 mg/kg) is consistent with the background UPL (43.9 mg/kg). The maximum concentration of total chromium in surface soil (102 mg/kg) was above the background UPL (69.8 mg/kg). It is noted that the HHRA evaluates potential risks assuming hexavalent chromium, so the carcinogenic risk results are most likely overestimated for this analyte. Therefore, no further action is recommended for surface soil because the primary risk contributor to both carcinogenic and non-carcinogenic risks (arsenic) is consistent with background UPLs. The risk results for all other COPCs are within the USEPA acceptable risk range.

For subsurface soil, cobalt is the only COC with non-carcinogenic hazards greater than 1. The maximum detection of cobalt is at Site 8 in sample location S-08-08-01 at 4 to 6 ft bgs. This was the only location that exceeds both the USEPA residential soil screening level and the background UPL. Furthermore, the HHRA risk results are based upon the maximum detected concentration because the 95% upper confidence level of the mean (UCLM) exceeds the maximum detected concentration. Since only one sample location exceeds the screening criteria, the maximum concentration was used as the EPC in the HHRA risk evaluation, and because of the depth of the sample, cobalt is not a concern for potential future resident receptors at

Grouping 1. Therefore, no further action is recommended for subsurface soil at Grouping 1.

7.1.2.2 Grouping 2: Sites 2, 3, and 11

The HHRA identified potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil.

Arsenic and total chromium contribute to the carcinogenic risk, and arsenic and manganese have non-carcinogenic hazards above 1. All concentrations of arsenic and total chromium within this grouping are above the USEPA residential and industrial soil screening levels. In addition, approximately half of the arsenic and total chromium detections are above the Fort Buchanan background UPLs. Most of the highest concentrations for both analytes were found within the top 1-4 ft of soil. It should be noted that the HHRA evaluates potential risks assuming hexavalent chromium, so the carcinogenic risk results are most likely overestimated for this analyte. However, based upon the distribution of detections for arsenic and total chromium, the shallow depths at which they were found, and the concentrations, there are potential risk concerns for residential exposure to arsenic and total chromium in subsurface soil.

Manganese is an additional COC at Grouping 2 based upon resident child exposure to subsurface soil. The maximum detection of manganese is at Site 3 in sample location S-03-08-01 at 1-2 ft bgs. Three sample locations exceed both the USEPA residential soil screening level and the Fort Buchanan soil background UPL. Manganese detections do not exceed the USEPA industrial soil screening level at any of the sample locations. The HHRA risk results for manganese are based upon the maximum concentration (12,800 mg/kg) because the 95%UCLM is greater than the maximum concentration. Manganese may present potential risk concerns for residential receptors at this grouping.

7.1.2.3 Grouping 3: Sites 13 and 15

The HHRA identified potential non-carcinogenic risk concerns for the resident child and carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Arsenic, total chromium, and benzo(a)pyrene contribute to the carcinogenic risk, and arsenic has non-carcinogenic hazards above 1. It is noted that the HHRA evaluates potential risks assuming hexavalent chromium, so the carcinogenic risk results are most likely overestimated for this analyte.

Only three subsurface soil samples were collected for inorganics and one sample for PAHs for this grouping. As a result, the risk results are based upon the maximum detected concentrations for all analytes detected. All detections of arsenic and total chromium at this grouping are above the USEPA residential and industrial soil screening levels while the benzo(a)pyrene concentration only exceeds the USEPA residential soil screening level. Only the maximum detected concentrations of arsenic (45.2 mg/kg) and total chromium (89.3 mg/kg) are greater than the Fort Buchanan background UPLs of 43.9 mg/kg and 69.8 mg/kg, respectively. The maximum detected concentrations for both analytes were found at Site 15 at sample location S-15-08-01 at 2-4 ft bgs. The concentrations of arsenic and total chromium at Site 13 are below the Fort Buchanan background UPLs. Because the maximum detected concentration is the only location that exceeds the background UPLs, only Site 15 contributes to potential risk concerns for this grouping. However, the maximum detected concentrations of arsenic and total chromium at Site 15 only minimally exceed the background UPLs. Therefore, it appears the concentration of these analytes may be consistent with background UPLs.

Benzo(a)pyrene was only detected once at Site 13, and the carcinogenic risk level of benzo(a)pyrene ($1x10^{-5}$) is within the USEPA acceptable risk range and does not reveal a concern for residential exposure.

7.1.2.4 Site 9

The HHRA identified potential non-carcinogenic risk concerns for the construction worker and resident child and carcinogenic risk concerns for the resident adult and child combined for exposure to subsurface soil. Arsenic and total chromium contribute to the carcinogenic risk, and arsenic, cobalt, iron, and manganese have non-carcinogenic hazards above 1.

All detections of arsenic and total chromium at this grouping are above the USEPA residential and industrial soil screening levels. In addition, most of the arsenic and half of the total chromium detections are above the Fort Buchanan background UPL. It is noted that the HHRA evaluates potential risks assuming hexavalent chromium, so the carcinogenic risk results are most likely overestimated for this analyte. However, based upon the distribution of detections for arsenic and total chromium and the concentrations, there are potential risk concerns for residential exposure to arsenic and total chromium in subsurface soil.

For cobalt, the detected concentrations at one sample location, S-09-08-02 at 2-4 ft and 4-6 ft, exceed both the USEPA residential soil screening level and the Fort Buchanan soil background UPL. Furthermore, the HHRA risk results for cobalt are based upon the maximum concentration (104 mg/kg) because the 95%UCLM is greater than the maximum concentration. Because only one sample location exceeds the screening criteria, because the maximum concentration was used as the EPC in the HHRA risk evaluation, and because of the depths of the samples, cobalt is not a concern for potential future resident receptors at Site 9.

For iron and manganese, approximately half of the sample locations exceed both the USEPA residential soil screening levels and the Fort Buchanan soil background UPLs. Based upon the distribution of detections for iron and manganese and the concentrations, there are potential risk concerns for residential exposure to iron and manganese in subsurface soil.

7.1.2.5 Site 12

The HHRA risk results for all receptors are below the levels of concern. Therefore, there are no concerns for potential receptors' contact with Site 12.

7.1.3 Northwest Boundary Area Groundwater

Groundwater below 10 of the 14 sites evaluated in this HHRA was evaluated as a whole in the NWBA RFI (EA 2012). This evaluation focused on the TCE plume located within the NWBA, and it presented a complete representation of potential receptors' exposure to groundwater. Therefore, a summary of the risk results from the NWBA HHRA (EA 2012) were presented in this HHRA.

Direct contact exposure to groundwater was evaluated for the off-site resident and the construction worker. In addition, the commercial worker and the resident were evaluated for potential vapor intrusion of VOCs from groundwater to indoor air. The NWBA groundwater evaluation revealed potential risk concerns for the off-site resident adult and child exposure to groundwater. The total non-carcinogenic HIs for the off-site resident child and resident adult are 67 and 37, respectively. TCE is the primary contributor to the non-carcinogenic hazards. In addition, iron, manganese, and cis-1,2-dichloroethene also have hazard quotients greater than 1 for the resident child. The total lifetime carcinogenic risk for the off-site resident (adult and child combined) exposure to groundwater is $5\text{x}10^{-4}$. This carcinogenic risk indicates that there are potential carcinogenic risk concerns for resident exposure to groundwater near the NWBA. The primary contributors to carcinogenic risks are arsenic and TCE. The highest detections of TCE are found within an area bounded by Sites 1, 8, 9, and 10. Additionally, there are potential risk concerns for vapor intrusion of VOCs from groundwater to indoor air for both the commercial worker and the resident.

7.1.4 HHRA Conclusions

The HHRA hazard assessment determined that there were no COPCs at Sites 4, 5, 6, and 10, and the Risk Characterization risk results for all receptors at Site 12 were are below the levels of concern. Therefore, there are no concerns for potential receptors at these sites.

Potential carcinogenic and non-carcinogenic hazards were identified for the resident child's exposure to surface soil (arsenic and chromium) and subsurface soil (cobalt) at Grouping 1 (Sites

1, 7, and 8). However, after consideration in the Risk Characterization, no further evaluation is warranted for surface or subsurface soil at this grouping.

Potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil were identified for Grouping 2 (Sites 2, 3, and 11). Arsenic, total chromium, and manganese were the primary contributors to risk. After consideration in the Risk Characterization, these metals are retained as potential risk concerns for residential receptors.

Potential non-carcinogenic risk concerns for the resident child and carcinogenic risk concerns for the lifetime resident exposed to subsurface soil were identified for Grouping 3 (Sites 13 and 15). The concentrations of COCs at Site 13 are below background UPLs, indicating that no further evaluation is warranted at this Site. The maximum detected concentrations of COCs at Site 15 only minimally exceed the background UPLs, suggesting the concentration of these analytes may be consistent with background and may not warrant further evaluation.

Potential non-carcinogenic risk concerns for the construction worker and resident child and carcinogenic risk concerns for the lifetime resident exposed to subsurface soil were identified for Site 9. Arsenic and total chromium contribute to the carcinogenic risk, and arsenic, cobalt, iron, and manganese contribute to non-carcinogenic hazards. After consideration in the Risk Characterization, it is concluded that there are potential risk concerns for residential exposure to arsenic, total chromium, iron, and manganese in subsurface soil. Exposure to cobalt is not a concern.

7.2 ECOLOGICAL RISK ASSESSMENT

The BERA was performed in accordance with USEPA guidance and is based upon agreements between EA, AEC, the USEPA and stakeholders. The BERA, included in Appendix E, represents the Screening-Level Ecological Risk Assessment (SLERA) and Baseline Risk Assessment Problem Formulation (BRAPF) for the Fort Buchanan RFI sites.

7.2.1 Conceptual Site Model

To develop a consistent methodology for assessment of risks through the entire BERA and across all sites, an overall CSM was developed. The overall CSM discusses the ecological setting, potential sources of chemicals, fate and transport pathways, media of concern, and exposure pathways at Fort Buchanan and is summarized in the following bullets. It should be noted that site-specific CSMs were also developed and are included in Appendix E.

- Ecological Setting: Many RFI Sites consist of paved or disturbed areas associated with grassy mowed habitats, a few support forests. Site 12 has aquatic habitat in the form of a creek, and Site 6 has an ephemeral drainage ditch.

- Potential Sources: sources among the RFI Sites consist of PCB transformer yards; petroleum, oil, and vehicle maintenance-related areas; chemical or equipment storage yards; and suspected landfills or burial areas.

- Fate and Transport: Chemicals in surface soil may have been transported to subsurface soil or into aquatic/semi-aquatic media at Site 6 and Site 12. Based on gradual slopes and the likely COPCs, transport is likely to have been limited in extent. Chemicals in subsurface soil would only reach the surface via anthropogenic activity.

- Media of Concern: Potential media of concern include surface soil (Sites 1, 4, 5, 6, 7, 10, 12, 13, 15), subsurface soil (Sites 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, 15), sediment (Site 6 and Site 12) and surface water (Site 12).

- Exposure Pathways: The following conclusions were made regarding exposure pathways:

  - Exposure pathways linking plants and soil invertebrates to either surface or subsurface soil are complete and therefore relevant for the assessment of all 14 RFI Sites.

  - Exposure to sediment and/or surface water are considered a complete and significant pathway for aquatic and benthic organisms, and are therefore relevant for the assessment of Site 6 for sediment exposure and Site 12 for sediment and water exposures.

  - Ingestion of chemicals in soil, sediment, surface water, and/or food is considered a complete and potentially significant exposure pathway. Dermal exposures and inhalation are considered insignificant.

7.2.2 SLERA Assessment and Measurement Endpoints

Assessment endpoints are clear statements of the environmental value to be protected from impacts. Assessment endpoints are usually defined in terms of an ecological entity and its attributes. The SLERA defined the following preliminary assessment endpoints to reflect the potential impacts of complete and significant exposure pathways discussed in the CSM as applicable to specific sites:

- **All 14 RFI Sites:** Viable, functional populations of organisms exposed directly or indirectly to chemicals in soil.

- **Site 6:** Viable, functional populations of organisms exposed directly or indirectly to chemicals in sediment.
- **Site 12:** Viable, functional populations of organisms exposed directly or indirectly to chemicals in sediment and surface water.

These assessment endpoints are general and are refined and revised for sites warranting evaluation in the refined assessment conducted in Step 3 as part of the BRAPF. Measurement endpoints are defined to provide metrics that can be quantified that are directly related to assessment endpoints. The following measurement endpoints are evaluated at the screening level:

- **All 14 RFI Sites:** Comparison of maximum concentrations of chemicals in surface soil and subsurface soil at individual RFI Sites to screening values protective of a broad range of potential receptors, including plants, invertebrates, and wildlife.
- **Site 6:** Comparison of maximum concentrations of chemicals in sediment to screening values protective of a broad range of potential receptors, including aquatic organisms/benthos and wildlife.
- **Site 12:** Comparison of maximum concentrations of chemicals in sediment and surface water to screening values protective of a broad range of potential receptors, including aquatic organisms/benthos and wildlife.

7.2.3 BRAPF Assessment and Measurement Endpoints

The purpose of the BRAPF (Step 3 of the ERA process) is to build upon the results of the SLERA to identify chemicals driving risks to receptors that must be carried forward into further risk assessment or risk management based on a scientific management decision point. While the results of the SLERA provide an initial list of COPCs, these results are conservative, are not specific to ecological receptors, and do not represent population level risks. Therefore, a refinement of risk calculations (typically referred to as Step 3a) is necessary as part of the BRAPF to provide more realistic, appropriate, site-specific, and relevant results for use in risk assessment and management.

The following refined assessment endpoints were defined to reflect the potential impacts of complete and significant exposure pathways discussed above and to aid in selecting representative receptor species:

All RFI Sites:

- Viability of plant communities in fields, forests, and associated riparian habitats.
- Viability of terrestrial invertebrate communities as resources for terrestrial wildlife.
- Viability of wildlife communities, including a variety of feeding guilds and taxa likely to use site habitats.

Sites 6 and 12:

- Viability of aquatic and benthic organism communities.

Because assessment endpoints are often defined in terms of ecological characteristics that are hard to measure (i.e. the health of a population or community), measurement endpoints are selected to provide a quantifiable means of characterizing risks. Measurement endpoints are quantifiable ecological characteristics that are related to each assessment endpoint (EPA 1989). Measurement endpoints have been identified for the SLERA, including a refinement of screening level models. Measurement endpoints for each assessment endpoint can be summarized as follows:

Viability of plant communities (All RFI Sites)

- Perform risk calculations comparing maximum, mean, and sample-specific exposure estimates to receptor-specific toxicological benchmarks for plants.
- Compare site-specific exposures to background exposures and evaluate factors affecting site-specific bioavailability.
- Qualitatively evaluate the quality of site habitats to determine factors that enhance or diminish the likelihood of actual impacts on plant communities.

Viability of soil invertebrate communities (All RFI Sites)

- Perform risk calculations comparing maximum, mean, and sample-specific exposure estimates to receptor-specific toxicological benchmarks for soil invertebrates.
- Compare site-specific exposures to background exposures and evaluate factors affecting site-specific bioavailability.
- Qualitatively evaluate the quality of site habitats to determine factors that enhance or diminish the likelihood of impacts on soil invertebrate communities.

Viability of wildlife communities (All RFI Sites)

- Perform risk calculations comparing maximum and mean exposure estimates to receptor-specific toxicological benchmarks for mammals and birds.
- Compare site-specific exposures to background exposures and evaluate factors affecting site-specific bioavailability.
- Qualitatively evaluate the proportion of area used by wildlife to indicate whether exposures are over-estimated.
- Qualitatively evaluate the quality of site habitats to determine factors that enhance or diminish the likelihood of impacts on wildlife.

Viability of aquatic and benthic organism communities (Sites 6 and 12)

- Perform risk calculations comparing maximum, mean, and sample-specific exposure estimates to receptor-specific toxicological benchmarks for aquatic and benthic organisms.

- Compare site-specific exposures to background exposures and evaluate factors affecting site-specific bioavailability.

- Qualitatively evaluate the quality of site habitats to determine factors that enhance or diminish the likelihood of impacts on aquatic and benthic communities.

7.2.4 BERA Conclusions for Site 1

The SLERA and refined assessment conducted as part of the BRAPF for Site 1 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities -** Based on a lack of exceedences in benchmark comparisons, the findings of the BRAPF are that COPCs do not pose a risk to plants at Site 1 and are unlikely to pose risks now or in the future.

- **Viability of Soil Invertebrate Communities** - Based on a lack of exceedences in benchmark comparisons, the findings of the BRAPF are that COPCs do not pose a risk to soil invertebrates at Site 1 and are unlikely to pose risks now or in the future.

- **Viability of Wildlife Communities -** COPCs at Site 1 are unlikely to cause risk to wildlife. Concentrations of DDTr compounds were detected in surface soil and exposure estimates exceed no-effects benchmarks. However, DDTr exposures do not exceed low-effects benchmarks. Also, the site is smaller than the home ranges for most wildlife receptors, and the area provides poor quality habitat for foraging. No COPCs exceeded benchmarks in subsurface soil. Therefore, risks are unlikely under either current or future scenarios.

7.2.5 BERA Conclusions for Site 2

The SLERA and refined assessment conducted as part of the BRAPF for Site 2 examined future potential risks from subsurface soils to terrestrial wildlife. This ERA finds the following conclusions:

- **Viability of Plant Communities -** There are seven metals (arsenic, chromium, cobalt, mercury, nickel, selenium, vanadium) in subsurface soil with concentrations exceeding plant benchmarks under the future exposure scenarios. However, based on the magnitude of exceedence, values for all metals but chromium are expected to fall below low effects levels. The mean EPC as well as more than half of the chromium and vanadium concentrations are within background. Information regarding local soils indicates that chromium, vanadium, and other metals are associated with plinthite soil naturally occurring in the subsurface, which provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil. Therefore, the finding of the risk assessment is that chemicals in subsurface soil do not pose risks to plants at Site 2 under future scenarios.

- **Viability of Soil Invertebrate Communities** - There are four metals (arsenic, chromium, mercury, selenium) in subsurface soil with concentrations exceeding soil invertebrate benchmarks under the future exposure scenarios. Based on magnitude of exceedence, HQs for arsenic, mercury, and selenium are likely to fall below low effects levels. However, the mean EPC as well as more than half of the chromium and vanadium concentrations are within background. Information regarding local soils indicates that chromium, vanadium, and other metals are associated with plinthite soil naturally occurring in the subsurface, which provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil. Therefore, the finding of the risk assessment is that chemicals in subsurface soil do not pose risks to soil invertebrates at Site 2 under future scenarios.

- **Viability of Wildlife Communities -** Exposure estimates for cadmium, selenium, and vanadium exceed no effects benchmarks. Vanadium is the only COPC for which exposure estimates exceed both low effect benchmarks and background; it exceeds for a single wildlife receptor. There are many factors that decrease the expected risk from vanadium, including the low bioavailability of vanadium in soil; the fact that subsurface soils would not support habitat for wildlife unless amended or mixed, and the existing poor habitat quality of the site. Therefore, the finding of the risk assessment is that chemicals in subsurface soil do not pose risks to wildlife at Site 2 under future scenarios.

7.2.6 BERA Conclusions for Site 3

The SLERA and refined assessment conducted as part of the BRAPF for Site 3 examined future potential risks from subsurface soils to terrestrial wildlife. This ERA finds the following conclusions:

- **Viability of Plant Communities -** There are seven metals (aluminum, arsenic, chromium, cobalt, copper, manganese, selenium, thallium, and vanadium) in subsurface soil at Site 3 with concentrations exceeding plant benchmarks under the future exposure scenarios. HQs for arsenic, cobalt, mercury, nickel, and selenium are low and concentrations of these metals are expected to fall below low effects levels. Less than half of the detections of aluminum, cobalt, manganese, and thallium exceeded background. Information regarding local soils indicates that chromium, vanadium, and other metals are associated with plinthite soil naturally occurring in the subsurface, which provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil. Therefore, the finding of the risk assessment is that chemicals in subsurface soil at Site 3 do not pose risks to plants under future scenarios.

- **Viability of Soil Invertebrate Communities** - There are four metals (arsenic, chromium, manganese, and mercury) in subsurface soil at Site 3 with mean concentrations exceeding soil invertebrate benchmarks under the future exposure scenarios. Mean concentrations of mercury do not exceed benchmarks, and maximum concentrations do not exceed background. HQs for arsenic and mercury are low and concentrations of these metals are expected to fall below low effects levels. Only 2 of the 8 detections of manganese exceed background. Information regarding local soils indicates that chromium is associated with plinthite soil naturally occurring in the subsurface, which provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil. Therefore, the finding of the risk assessment is that chemicals in subsurface soil at Site 3 do not pose risks to soil invertebrates under future scenarios.

- **Viability of Wildlife Communities -** Mean exposure estimates for aluminum, thallium, and vanadium in subsurface soils at Site 3 exceed low effects benchmarks and background. Area use factors drastically decrease exceedences, as all but one COPC for one receptor falls below 1. There are many factors that decrease the expected risk from vanadium, including the low bioavailability of vanadium in soil; the fact that subsurface soils would not support habitat for wildlife unless amended or mixed; the fact that the site is currently paved, which further decreases the likelihood of habitat restoration at the site; and the existing poor habitat quality of the site. Therefore, the finding of the risk assessment is that chemicals in subsurface soil at site 3 do not pose risks to wildlife under future scenarios.

7.2.7 BERA Conclusions for Site 4

Based on the lack of any evidence of a release of PCBs from Site 4, the SLERA finds that there is no source, there are no complete exposure pathways, and therefore no risks to ecological receptors.

7.2.8 BERA Conclusions for Site 5

Based on the lack of any evidence of a release of PCBs from Site 5, the SLERA finds that there is no source, there are no complete exposure pathways, and therefore no risks to ecological receptors.

7.2.9 BERA Conclusions for Site 6

The SLERA and refined assessment conducted as part of the BRAPF for Site 6 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities -** Based on a lack of exceedences in benchmark comparisons, the findings of the BRAPF are that COPCs do not pose a risk to plants at Site 6 and are unlikely to pose risks now or in the future.
- **Viability of Soil Invertebrate Communities** - Based on a lack of exceedences in benchmark comparisons, the findings of the BRAPF are that COPCs do not pose a risk to soil invertebrates at Site 6 and are unlikely to pose risks now or in the future.

- **Viability of Wildlife Communities -** Based on a lack of exceedences in benchmark comparisons, the findings of the BRAPF are that COPCs do not pose a risk to wildlife at Site 6 and are unlikely to pose risks now or in the future.
- **Viability of Aquatic and Benthic Organism Communities -** Based on poor habitat which limits the potential receptors and physical constraints that limit potential exposure, COPCs at Site 6 do not pose a risk to for aquatic and benthic organisms at Site 6.

7.2.10 BERA Conclusions for Site 7

The SLERA and refined assessment conducted as part of the BRAPF for Site 7 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities -** Concentrations of aluminum, arsenic, chromium, manganese, mercury, selenium, or vanadium exceed benchmarks at Site 7. However, concentrations of arsenic and manganese in surface soil are expected to fall below low effects levels. Those chemicals with the highest exceedences are consistent with naturally occurring concentrations in soil as indicated by background and association with plinthite soils. Habitat quality is more likely to limit plant communities than chemical stressors, and future scenarios would likely involve drastic changes to soil composition. Based on this information, COPCs in soil are considered not to pose a significant risk to plants at Site 7.
- **Viability of Soil Invertebrate Communities** - Concentrations of chromium, manganese, mercury, and selenium exceed benchmarks at Site 7. Manganese and mercury concentrations are below background. Selenium exceedences are low and are expected to be below low effects levels. Chromium toxicity is expected to be over-estimated based on information regarding local soils which may contain plinthite, a metal-rich material. However, habitat quality is more likely to limit soil invertebrate communities than chemical stressors, and future scenarios would likely involve drastic changes to soil composition. Based on this information, COPCs in soil are considered not to pose a significant risk to soil invertebrates at Site 7.
- **Viability of Wildlife Communities** – Based on the fact that the only COPCs with exposure estimates that exceed benchmarks demonstrate concentrations below background, COPCs at Site 7 are unlikely to pose risks to wildlife.

7.2.11 BERA Conclusions for Site 8

The SLERA and refined assessment conducted as part of the BRAPF for Site 8 examined future potential risks from subsurface soils to terrestrial wildlife. This ERA finds the following conclusions:

- **Viability of Plant Communities -** There are seven metals (aluminum, arsenic, chromium, cobalt, manganese, selenium, and vanadium) in subsurface soil with concentrations exceeding plant benchmarks under the future exposure scenarios. Based on low magnitude of exceedence, concentrations of arsenic, cobalt, manganese, and selenium are also expected to fall below low effects levels. Concentrations of arsenic, chromium, and vanadium fall below background. For aluminum and manganese, only one of the four samples detected exceeded background. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposure concentrations are likely to decrease. Therefore, the finding of the risk assessment is that chemicals in subsurface soil ate Site 8 do not pose risks to plants under future scenarios.

- **Viability of Soil Invertebrate Communities** - There are three metals (chromium, manganese, and mercury) in subsurface soil with concentrations exceeding plant benchmarks under the future exposure scenarios. Based on low magnitude of exceedence, concentrations of manganese and mercury are expected to fall below low effects levels. All chromium, all mercury, and all but one manganese detection fall below background. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposures under future scenarios would likely decrease. Therefore, the finding of the risk assessment is that chemicals in subsurface soil do not pose risks to soil invertebrates under future scenarios.

- **Viability of Wildlife Communities -** Aluminum, manganese, selenium, and vanadium exceed no effect levels for wildlife. However, exposures for manganese and selenium fall below low effects levels, and exposures for aluminum and vanadium fall below background levels. Application of area use factors decreases exceedences, and it is likely that changes to subsurface soil, which would be necessary to make it a base for habitat, would decrease exposures. Therefore, subsurface soils at Site 8 are considered unlikely to pose potential risks to wildlife if the site is exposed and re-vegetated.

7.2.12 BERA Conclusions for Site 9

The SLERA and refined assessment conducted as part of the BRAPF for Site 9 examined future potential risks from subsurface soils to terrestrial wildlife. This ERA finds the following conclusions:

- **Viability of Plant Communities -** Concentrations of aluminum, arsenic, chromium, cobalt, copper, manganese, mercury, selenium, and vanadium exceed benchmarks for plants. Of these, maximum HQs for cobalt, copper, and mercury are low and their concentrations are expected to fall below low effects levels. Mean concentrations of arsenic are low and are expected to fall below low effects levels. Concentrations of aluminum are below background. Soil types at Site 9 are likely to limit bioavailability of chromium and selenium. There is no current habitat for plants at Site 9. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposure concentrations are likely to decrease. For these reasons, the finding of the risk assessment is that chemicals in subsurface soil at Site 9 do not pose risks to plants under future exposure scenarios.

- **<u>Viability of Soil Invertebrate Communities</u>** - Concentrations of arsenic, chromium, copper, manganese, mercury, and selenium exceed benchmarks for soil invertebrates. Of these, maximum HQs for arsenic, copper, mercury, and selenium are low and their concentrations are expected to fall below low effects levels. Concentrations of aluminum are below background. Only 1 or 2 of the 6 detections of copper, manganese, and mercury exceed background and soil types at Site 9 are likely to limit bioavailability of chromium. There is no current habitat for soil invertebrates at Site 9. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposure concentrations are likely to decrease. For these reasons, the finding of the risk assessment is that chemicals in subsurface soil at Site 9 do not pose risks to soil invertebrates under future exposure scenarios.
- **<u>Viability of Wildlife Communities</u> -** While wildlife exposures exceed no-effects benchmarks for aluminum, arsenic, manganese, selenium, and vanadium, none exceed both low-effects benchmarks and background. Consideration of area use factors, habitat quality, and changes that would occur to subsurface soil further decrease the likelihood of risk. Therefore, subsurface soils at Site 9 are considered unlikely to pose potential risks to wildlife if the site is exposed and re-vegetated. Future use assumptions are highly uncertain, and it expected that soil concentrations may decrease.

7.2.13 BERA Conclusions for Site 10

At Site 10, only two chemicals were detected in environmental media: acetone and carbon disulfide. Both chemicals are commonly produced by plants and microbes in natural environments and were detected at very low concentrations near reporting limits. Toxicity data for these chemicals indicate that they are relatively non-toxic to ecological receptors likely to be found at the site. Therefore it is highly unlikely that COPCs in soil at Site 10 pose risk to ecological receptors.

7.2.14 BERA Conclusions for Site 11

The SLERA and refined assessment conducted as part of the BRAPF for Site 11 examined future potential risks from subsurface soils to terrestrial wildlife. This ERA finds the following conclusions:

- **<u>Viability of Plant Communities</u> -** Concentrations of aluminum, arsenic, chromium, cobalt, manganese, selenium, and vanadium exceed benchmarks for terrestrial plants. Of these, maximum HQs for arsenic, cobalt, and selenium are low and their concentrations are expected to fall below low effects levels. Concentrations of aluminum are below background. Only 1 of the 4 detected concentrations of cobalt and manganese exceeded background and soil types at Site 11 are likely to limit bioavailability of chromium. There is no current habitat for plants at Site 11. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposure concentrations are likely to decrease. For these reasons, the finding of the risk assessment is that chemicals in subsurface soil at Site 11 do not pose risks to plants under future exposure scenarios.

- **Viability of Soil Invertebrate Communities** - Concentrations of arsenic, chromium, manganese, mercury, and selenium exceed benchmarks for soil invertebrates. Of these, maximum HQs for arsenic, manganese, mercury, and selenium are low and their concentrations are expected to fall below low effects levels. Concentrations of mercury are below background. Only 1 of the 4 detected concentrations of manganese exceeded background and soil types at Site 11 are likely to limit bioavailability of chromium. There is no current habitat at Site 11. Subsurface soil provides a material unsuitable for establishment of habitat unless it is amended or mixed with other soil; therefore, exposure concentrations are likely to decrease. For these reasons, the finding of the risk assessment is that chemicals in subsurface soil at Site 11 do not pose risks to soil invertebrates under future exposure scenarios.

- **Viability of Wildlife Communities -** Exposure estimates for aluminum, manganese, selenium, and vanadium exceed no effects benchmarks for several feeding guilds under future exposure scenarios. Aluminum, manganese, and selenium exposures fall below either benchmarks or background levels, and vanadium exposures approach background when area use factors are considered. Vanadium bioavailability is expected to be limited by soil type, and therefore over-estimated in the risk assessment. For these reasons, subsurface soils at Site 11 are considered unlikely to pose potential risks to wildlife if the site is exposed and re-vegetated. Future use assumptions are highly uncertain, and it is expected that soil concentrations may decrease.

7.2.15 BERA Conclusions for Site 12

The SLERA and refined assessment conducted as part of the BRAPF for Site 12 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities** - Based on the fact that all chemicals with concentrations exceeding benchmarks have concentrations consistent with background, the findings of the BRAPF are that COPCs do not pose a risk to plants at Site 12.

- **Viability of Soil Invertebrate Communities** - Based on the fact that all chemicals with concentrations exceeding benchmarks have concentrations consistent with background, the findings of the BRAPF are that COPCs do not pose a risk to soil invertebrates at Site 12.

- **Viability of Wildlife Communities** - Aluminum, lead, and vanadium exceed no effects benchmarks under maximum case scenarios. However, exposures for all of these COPCs either fall below low effects benchmarks or below background levels. Therefore, COPCs in subsurface soil, sediment, and surface water at Site 12 are considered unlikely to pose potential risks to wildlife.

- **Viability of Aquatic and Benthic Organism Communities** - Based on exceedence of benchmarks, arsenic, 4,4-DDE, 4,4-DDD, 4,4-DDT, dieldrin, and alpha-chlordane in sediment are identified as chemicals that may produce risks to aquatic and benthic organisms. There is some question whether concentrations of these chemicals in sediment may be associated with regional elevated concentrations in soil. This should be considered in risk management. Barium is identified as a chemical in surface water potentially driving risks to aquatic and benthic organisms. Risk management should consider the limited quality of the stream habitat.

7.2.16 BERA Conclusions for Site 13

The SLERA and refined assessment conducted as part of the BRAPF for Site 13 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities** - Aluminum, chromium, lead, manganese, mercury, selenium, and vanadium in soils exceed benchmarks at Site 13. However, aluminum, chromium, selenium, and vanadium are unlikely to produce risks because they are consistent with natural background concentrations and/or expected to have low bioavailability in site soil types. Lead, manganese and mercury exceedences are driven by elevated concentrations at isolated locations and are not expected to exceed low effects levels. Based on this weight of evidence, COPCs in soil are considered not to pose a significant risk to plants at Site 13.

- **Viability of Soil Invertebrate Communities** - Chromium, manganese, mercury, and zinc in soils exceed benchmarks at Site 13. However, chromium and zinc are unlikely to produce risks because they are consistent with natural background concentrations and/or expected to have low bioavailability in site soil types. Manganese and mercury exceedences are driven by elevated concentrations at isolated locations and are not expected to exceed low effects levels. Based on this weight of evidence, COPCs in soil are considered not to pose a significant risk to soil invertebrates at Site 13.

- **Viability of Wildlife Communities** – Modeled doses of aluminum, lead, vanadium, and DDTr exceed no effects benchmarks for wildlife when calculated using maximum EPCs. However, doses based on mean EPCs are either below low effects benchmarks or consistent with background concentrations. When home range is considered, risk levels decrease further. Based on this information, COPCs at Site 13 are unlikely to pose risks to wildlife.

7.2.17 BERA Conclusions for Site 15

The SLERA and refined assessment conducted as part of the BRAPF for Site 15 form the basis for the following conclusions for each refined assessment endpoint:

- **Viability of Plant Communities -** Aluminum, arsenic, chromium, copper, manganese, selenium, thallium, vanadium, and zinc in soils exceed benchmarks at Site 15. However, aluminum, arsenic, chromium, manganese, selenium, vanadium, and zinc are unlikely to produce risks because they are consistent with natural background concentrations and/or expected to have low bioavailability in site soil types. Arsenic, copper, manganese, selenium, thallium, and zinc are not expected to exceed low effects levels. Based on this weight of evidence, COPCs in soil are considered not to pose a significant risk to plants at Site 15.

- **Viability of Soil Invertebrate Communities** - Chromium, copper, manganese, mercury, selenium, and zinc in soils exceed benchmarks at Site 15. However, these metals are unlikely to produce risks because they are either consistent with natural background concentrations, expected to have low bioavailability in site soil types, or are not expected to exceed low effects levels. Based on this weight of evidence, COPCs in soil are considered not to pose a significant risk to soil invertebrates at Site 15.

- **Viability of Wildlife Communities** – Modeled doses of aluminum, thallium, vanadium, and zinc exceed no effects benchmarks for wildlife when calculated using maximum EPCs. Doses based on mean EPCs for thallium and zinc fall below low effects levels and are unlikely to drive risks. Mean doses of aluminum and vanadium exceed low effects benchmarks and are higher than background concentrations. When home range is considered, risk levels decrease by 95%, bringing exposures for aluminum below low effects benchmarks and exposures for vanadium below low effects benchmarks for all but one receptor. This is considered with the fact that vanadium is unlikely to be bioavailable in local soil types and that habitat quality is poor. Based on this information, COPCs at Site 15 are unlikely to pose risks to wildlife.

7.2.18 Uncertainties

A number of uncertainties are inherent in the assessment of risks and should be considered in interpretation of results. One of the greatest uncertainties inherent to the risk assessment is the assumption that effects on individuals, as indicated by benchmark exceedences, are indicative of population-level effects. Also, assumptions made in the screening level risk assessment are highly precautionary and may over-estimate risk, while assumptions made throughout the assessment require generalizations that may result in over- or under-estimated risks.

7.2.19 BERA Conclusions

There may be a potential for risks to terrestrial receptors at a number of the Fort Buchanan RFI Sites. However, in light of site-specific information, the precautionary nature of the assumptions made in the BERA, and expected future land uses, further efforts to characterize or manage these potential risks are considered unwarranted. Benthic organisms are potentially at risk from concentrations of arsenic and pesticides in sediment and barium in water at Site 12. Consideration of background concentrations of arsenic in sediment is recommended in order to accurately conclude whether further characterization of the potential for risks to benthic organisms at this site is warranted.

8 RFI FINDINGS AND CONCLUSIONS

The field work for the RFI at Fort Buchanan was conducted from October 2006 through September 2011. Data generated from these efforts, along with some data generated as part of the NWBA RFI were included in the Nature and Extent discussion (Section 5), the HHRA (Appendix D and Section 7.1), and the BERA (Appendix E and Section 7.2). The following subsections summarize the findings and conclusions of the Site Wide RFI.

8.1 SITE-SPECIFIC FINDINGS

This section presents brief summaries of the conclusions and recommendations on a site-by-site basis. These conclusions are based on the nature and extent evaluation and the risk assessments. Conclusions are also summarized in Table 8-1.

8.1.1 Site 1, SWMU 1: Old Hazardous Waste Containers

Site 1 is associated with a 600 sq ft, concrete-floored building (Building 539) that stored various chemicals (e.g. acids, bases, solvents, and pesticides) from 1968 to 1977. Previous investigations indicated that pesticides were present in the soil around the building (Section 3.1.1). Surface soil, subsurface soil, and groundwater data were evaluated as part of this RFI.

The nature and extent evaluation found that pesticides were not present at elevated concentrations, with respect to human health screening levels, in any of the sampled media. However, DDT, DDD, and DDE were present at concentrations well above ecological screening levels in surface soil. The highest concentrations of pesticides were found at boring 1, which was located in a packed earth/gravelly area between the building and the road and upgradient of building drains. Therefore boring 1 does not represent quality ecological habitat, and it likely reflects impacts from non-site-related areas. SVOCs (specifically PAHs) were found at elevated concentrations in surface soil, primarily at borings 3 and 4. The extent of elevated PAH concentrations has been partially defined, and based on the finding of no risks in the HHRA and BERA, further evaluation of PAHs is not warranted.

VOCs were the primary compounds found at elevated concentrations in groundwater; PCE and TCE exceeded screening levels to the greatest extent. Groundwater underlying Site 1 was fully evaluated in the NWBA RFI and associated HHRA. Site 1 was not identified as a potential source area for groundwater contamination, although it is within the portion of the plume where notably elevated concentrations of TCE and PCE were found. Concerns regarding the potential risks to receptors from exposure to contaminated groundwater are being addressed in a CMS prepared specifically for the NWBA.

Site 1 was part of grouping 1 in the HHRA, which found that there are potential carcinogenic and non-carcinogenic concerns for the resident child's exposure to surface soil (from arsenic and chromium) and subsurface soil (from cobalt). However, after consideration in the Risk Characterization, it was concluded that no further evaluation is warranted for surface or subsurface soil at this grouping. Similarly, the conclusions of the BERA for Site 1 are that COPCs at the site are unlikely to pose risks to ecological receptors now or in the future.

Based on the results of the HHRA and the BERA, both of which did not identify risk concerns at Site 1 that warrant further evaluation, the RFI recommends NFA for this Site.

8.1.2 Site 2, SWMU 3: Pesticide and Chemicals Burial Trench

Site 2 consists primarily of open, maintained fields and wooded areas along PR-28. As discussed in Section 3.2, this area was first identified as a SWMU because it was suspected that a disposal trench for pesticides was located in the area. Extensive investigation had been completed at Site 2 prior to initiation of the Site Wide RFI. Despite these efforts, no evidence of a disposal area was found, and in 1995 the USEPA concurred with a recommendation for NFA at the site. When elevated concentrations of TCE were found in groundwater under the CPR facility, immediately north of the Site, additional investigation was completed as part of the NWBA RFI in an effort to determine whether or not Site 2 was a source for the TCE. This produced the groundwater and subsurface soil data evaluated in the current Site Wide RFI.

Site 2 was not identified as a source of TCE for the groundwater plume, and the current data indicate that organic compounds are not a concern in soil or groundwater at Site 2, with the possible exception of elevated concentrations of TPH found in sample SB-03-06-04-(4-8). The elevated TPH concentrations are mostly bounded within a limited area and it should be noted that the finding of TPH in surface soil immediately south of a refinery and on the edge of a road at a sharp turn where vehicle accidents are, at least anecdotally, relatively common, suggests that their source may not be limited to historic onsite activities. Furthermore, TPH was not detected in groundwater samples, indicating that migration through the soil column into groundwater is not occurring.

Some metals were found at concentrations above industrial human health screening levels and the 95% UPL of background. Elevated concentrations of metals are not bounded within Site 2, although they are consistent with concentrations found at sites around the former DPW area (to the immediate northeast). Particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

Site 2 was part of grouping 2 in the HHRA, which identified potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Arsenic, total chromium, and manganese were the primary contributors to risk. After consideration in the Risk Characterization, these metals are retained as potential risk concerns for residential receptors.

The BERA for Site 2 found that, based on a lack of complete exposure pathways, there are no risks to plants, soil invertebrates, or wildlife under current exposure scenarios. Metals were identified as COPCs for terrestrial plants, soil invertebrates, and wildlife under hypothetical future exposure scenarios. However, the assessment of future exposures using subsurface soil concentrations is highly conservative because it assumes no addition of top soil, no backfill, and no mixing of soils. This is highly unlikely because deeper soils would consist of compacted, nutrient poor material unsuitable for support of habitat. This must be considered as part of risk management to ensure risk assessment results are applied accurately.

Based on the results of the HHRA, the RFI recommends that the health concerns identified at Site 2 be considered in a CMS.

8.1.3 Site 3, SWMU 4: Spent Solvents Storage Area

Site 3 is located in an asphalt area on the southwest portion of the Building 556 yard that was used to store 55-gallon drums of spent solvents. Staining near the site was observed around 1990. Subsurface soil and groundwater data were evaluated as part of this RFI.

The nature and extent evaluation found that organic compounds are not a concern in soil because they were not detected at concentrations above residential or industrial screening levels. Metals were found at concentrations greater than both screening levels and greater than the 95% UPL of background data. In particular, some concentrations of arsenic, chromium, iron, manganese, and thallium were found to be more than twice the UPL of background data. Boring 1 and sample S-03-08-02-2-4 had some of the highest concentrations. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved area. Particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

TCE is the primary compound found at elevated concentrations in groundwater. Groundwater underlying Site 3 was fully evaluated in the NWBA RFI and associated HHRA. Site 3 was not identified as a potential source area for groundwater contamination, and it is located just within the western edge of the plume. Concerns regarding the potential risks to receptors from exposure to contaminated groundwater are being addressed in a CMS prepared specifically for the NWBA.

Site 3 was part of grouping 2 in the HHRA, which identified potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Arsenic, total chromium, and manganese were the primary contributors to risk. After consideration in the Risk Characterization, these metals are retained as potential risk concerns for residential receptors.

The BERA for Site 3 found that, based on a lack of complete exposure pathways, there are no risks to plants, soil invertebrates, or wildlife under current exposure scenarios. Metals were identified as COPCs for terrestrial plants, soil invertebrates, and wildlife under hypothetical future exposure scenarios. However, the assessment of future exposures using subsurface soil concentrations is highly conservative because it assumes no addition of top soil, no backfill, and no mixing of soils. This is highly unlikely because deeper soils would consist of compacted, nutrient poor material unsuitable for support of habitat. This must be considered as part of risk management to ensure risk assessment results are applied accurately.

Based on the results of the HHRA, the RFI recommends that the health concerns identified at Site 3 be considered in a CMS.

8.1.4 Site 4, SWMU 5: PCB Transformer Storage Area #1

Site 4 is located in an asphalt yard immediately north of the former DPW building over which PCB transformers were stored. Surface soil and groundwater data were evaluated as part of this RFI.

PCBs were the anticipated site-related COPCs based on site history. PCBs were not detected in soil or groundwater samples; this suggests that storage of PCB transformers at the site did not result in environmental contamination. In addition, the data indicate that Site 4 is not contributing to groundwater contamination in the NWBA.

The HHRA hazard assessment determined that there were no COPCs at Site 4. Therefore, there are no concerns for potential human receptors at this site. Similarly, the SLERA portion of the BERA found that there is no source, there are no complete exposure pathways, and therefore no risks to ecological receptors at Site 4.

Based on the results of the HHRA and the BERA, both of which did not identify risk concerns at Site 4, the RFI recommends NFA for this Site.

8.1.5 Site 5, SWMU 6: PCB Transformers Storage Area #2

Site 5 is an approximately 100-sq ft facility south of the former DPW building that was used in the early 1980s to store transformers. Subsurface soil data were evaluated as part of this RFI.

PCBs were the anticipated site related COPCs based on site history. PCBs were not detected in the soil samples, which suggests that storage of PCB transformers at the site did not result in environmental contamination.

The HHRA hazard assessment determined that there were no COPCs at Site 5. Therefore, there are no concerns for potential human receptors at this site. Similarly, the SLERA portion of the BERA found that there is no source, there are no complete exposure pathways, and therefore no risks to ecological receptors at Site 5.

Based on the results of the HHRA and the BERA, both of which identified no risk concerns at Site 5, the RFI recommends NFA for this Site.

8.1.6 Site 6: Pesticide Storage Area

Site 6 is a 5-by-5 ft unbermed concrete slab north of Building 138 on which pesticides and herbicides were mixed from 1975 to approximately 1985. Currently, an herbicide and pesticide mixing area situated within a bermed secondary containment unit exists on the site. Surface soil, subsurface soil, and sediment data were evaluated as part of this RFI.

The nature and extent evaluation found that one herbicide and a few pesticides were detected in soil and sediment at Site 6. None of the detected concentrations were above human health screening levels, but concentrations of pentachlorophenol and DDE found in surface soil and concentrations of DDE, alpha-chlordane, and gamma-chlordane in sediment were greater than ecological screening levels. The pesticides found in sediment do not appear to be originating from the Site, as the highest concentrations were found upgradient of the building. The pentachlorophenol found in surface soil is bounded to the west by the building and to the north and east by the samples collected in the drainage ditch.

Pentachlorophenol, alpha-chlordane, and gamma-chlordane were detected in subsurface soil at concentrations above the protection of groundwater screening levels. Groundwater data are not available for Site 6; however, data available for other Sites, suggest that the concentrations of these organics found at Site 6 are highly unlikely to result in impacts to groundwater.

The HHRA hazard assessment determined that there were no COPCs at Site 6. Therefore, there are no concerns for potential human receptors at this site. Similarly, the conclusions of the

BERA for Site 6 are that COPCs at the site are unlikely to pose risks to ecological receptors now or in the future.

Based on the results of the HHRA and the BERA, both of which identified no risk concerns at Site 6 that warrant further evaluation, the RFI recommends NFA for this Site.

8.1.7 Site 7: Building 541

Building 541 was used to store hazardous materials. The building's drainage system discharged to a 55-gallon drum containment system located immediately north of the building. Surface soil, subsurface soil, and groundwater data were evaluated as part of this RFI.

The nature and extent evaluation found that organochlorine pesticides are present in surface soil at concentrations well above ecological screening levels, but below human health screening levels. Concentrations of arsenic and chromium in surface and subsurface soil were greater than industrial screening levels; however the concentrations were less than or similar to background. Concentrations of nine metals in surface soil were greater than ecological screening levels, but only three of the metals had concentrations that were slightly greater than background.

Metals were identified as COPCs in groundwater, although the data suggest that notable contamination is not present. In addition, groundwater underlying Site 7 was fully evaluated in the NWBA RFI and associated HHRA. Site 7 was not identified as a potential source area for groundwater contamination, and the site is located outside and upgradient of the plume and suspected source area.

Site 7 was part of grouping 1 in the HHRA, which found that there are potential carcinogenic and non-carcinogenic concerns for the resident child's exposure to surface soil (from arsenic and chromium) and subsurface soil (from cobalt). However, after consideration in the Risk Characterization, it was concluded that no further evaluation is warranted for surface or subsurface soil at this grouping.

The BERA identified metals as COPCs to terrestrial plants, soil invertebrates, and wildlife at Site 7. However, based on the poor habitat quality, overly conservative assumptions regarding exposure, and the similarities between onsite concentrations and background UPLs, it is concluded that the COPCs are unlikely to pose a significant risk to ecological receptors at Site 7.

Based on the results of the HHRA and the BERA, both of which identified no risk concerns at Site 7 that warrant further evaluation, the RFI recommends NFA for this Site.

8.1.8 Site 8: Building S-563

Building S-563 was used as an automobile body shop. In the past, discarded car parts were observed in the storm drains immediately west of the building. Subsurface soil and groundwater data were evaluated for Site 8 as part of this RFI.

The nature and extent evaluation found that organic compounds were not present at elevated concentrations in either soil or groundwater, with the exception of TPH-DRO detected at 129 mg/kg in one soil sample. Arsenic, chromium, and cobalt were found in soil at concentrations greater than industrial screening levels, although only the maximum concentration of cobalt was greater than background. Elevated concentrations of chromium and cobalt were also observed in the groundwater samples, but were not found to be associated with broader groundwater contamination of the NWBA aquifer (EA 2012).

Site 8 was part of grouping 1 in the HHRA, which found that there are potential carcinogenic and non-carcinogenic concerns for the resident child's exposure to surface soil (from arsenic and chromium) and subsurface soil (from cobalt). However, after consideration in the Risk Characterization, it was concluded that no further evaluation is warranted for surface or subsurface soil at this grouping.

The BERA for Site 8 found that, based on a lack of complete exposure pathways, there are no risks to plants, soil invertebrates, or wildlife under current exposure scenarios. Metals were identified as COPCs for terrestrial plants, soil invertebrates, and wildlife under hypothetical future exposure scenarios. However, the assessment of future exposures using subsurface soil concentrations is highly conservative because it assumes no addition of top soil, no backfill, and no mixing of soils. This is highly unlikely because deeper soils would consist of compacted, nutrient poor material unsuitable for support of habitat. This must be considered as part of risk management to ensure risk assessment results are applied accurately.

Based on the results of the HHRA and the BERA, both of which identified no risk concerns at Site 8 that warrant further evaluation, the RFI recommends NFA for this Site.

8.1.9 Site 9: Used Oil Staging Area

Site 9 consists of a gravel-covered former used oil staging area south of Building T-552. Subsurface soil data were evaluated as part of this RFI.

The nature and extent evaluation found that organic compounds were not present at concentrations above industrial screening levels in subsurface soil. Metals, however, were found consistently at concentrations greater than screening levels and the 95% UPL of background data. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved area. Particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

Site 9 was evaluated individually in the HHRA, which found that there are potential non-carcinogenic risk concerns for the construction worker and resident child and carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Arsenic and total chromium contribute to the carcinogenic risk, and arsenic, cobalt, iron, and manganese contribute to non-carcinogenic hazards. After consideration in the Risk Characterization, it is concluded that there are potential risk concerns for residential exposure to arsenic, total chromium, iron, and manganese in subsurface soil. Exposure to cobalt is not a concern.

The BERA for Site 9 found that, based on a lack of complete exposure pathways, there are no risks to plants, soil invertebrates, or wildlife under current exposure scenarios. Metals were identified as COPCs for terrestrial plants, soil invertebrates, and wildlife under hypothetical future exposure scenarios. However, the assessment of future exposures using subsurface soil concentrations is highly conservative because it assumes no addition of top soil, no backfill, and no mixing of soils. This is highly unlikely because deeper soils would consist of compacted, nutrient poor material unsuitable for support of habitat. This must be considered as part of risk management to ensure risk assessment results are applied accurately.

Based on the results of the HHRA, the RFI recommends that the health concerns identified at Site 9 be considered in a CMS.

8.1.10 Site 10: 65th Army Reserve Command Refueling Area

Site 10 resulted from an approximately 6-sq ft area of stained soil in the refueling area that is currently covered by a thick concrete pad. No sampling has occurred in the area since the pad was installed. Surface soil, subsurface soil, and groundwater data were evaluated for Site 10 as part of this RFI.

The nature and extent evaluation found that organic compounds were not present at concentrations above industrial screening levels in any media at Site 10. This Site is located on the eastern edge of the identified NWBA groundwater plume, and was not identified as a source area. Three metals were detected at elevated concentrations in groundwater, but were not found to be associated with broader groundwater contamination of the NWBA aquifer (EA 2012).

The HHRA hazard assessment determined that there were no COPCs at Site 10. Therefore, there are no concerns for potential human receptors at this site.

The BERA for Site 10 found that there are no risks to plants, soil invertebrates, or wildlife. This finding is based on the fact that only two chemicals were detected at the site in soil or subsurface soil: acetone and carbon disulfide. While there are no screening values or benchmarks readily available for these chemicals, there is sufficient information to determine that, based on their concentrations and mechanisms of toxicity, there is little potential for effect on ecological receptors. These chemicals may also originate from ubiquitous sources rather than site-related releases.

Based on the results of the HHRA and the BERA, both of which identified no risk concerns at Site 10, the RFI recommends NFA for this Site.

8.1.11 Site 11: Heavy Equipment Storage Area

Site 11 refers to a heavy equipment storage area southwest of Building T-552. Historic releases of petroleum products from the equipment resulted in staining of the soil. The area is currently covered by asphalt. Subsurface soil data were evaluated for as part of this RFI.

The nature and extent evaluation found that organic compounds were not present at concentrations above industrial screening levels in subsurface soil from Site 11. Metals, however, were found consistently at concentrations greater than screening levels and the 95% UPL of background data. Elevated concentrations of metals are not bounded, although the site is within the developed, former DPW facility where industrial activities occurred across the entire paved area. Particularly elevated metals concentrations appear to be ubiquitous in this developed area on the western side of Fort Buchanan, and delineating the extent of elevated concentrations between sites may not be possible.

Site 11 was part of grouping 2 in the HHRA, which identified potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Arsenic, total chromium, and manganese were the primary contributors to risk. After consideration in the Risk Characterization, these metals are retained as potential risk concerns for residential receptors.

The BERA for Site 11 found that, based on a lack of complete exposure pathways, there are no risks to plants, soil invertebrates, or wildlife under current exposure scenarios. Metals were identified as COPCs for terrestrial plants, soil invertebrates, and wildlife under hypothetical future exposure scenarios. However, the assessment of future exposures using subsurface soil concentrations is highly conservative because it assumes no addition of top soil, no backfill, and no mixing of soils. This is highly unlikely because deeper soils would consist of compacted, nutrient poor material unsuitable for support of habitat. This must be considered as part of risk management to ensure risk assessment results are applied accurately.

Based on the results of the HHRA, the RFI recommends that the health concerns identified at Site 11 be considered in a CMS.

8.1.12 Site 12: Old Landfill

Site 12 is a former waste disposal area located adjacent to and just southwest of the elementary school. The Site consists of an upland area and an adjacent steep, rocky, ravine with a creek at the bottom. The headwaters of the creek are groundwater discharge points present at the southern end of the ravine. The creek runs north/northwest through the ravine and enters a pipe that flows under the school soccer field at the extreme north end. The ravine was used as a waste disposal area and the debris observed at the site during RFI field activities consisted of construction rubble. Surface soil, sediment, surface water, groundwater, and pore water data were evaluated for Site 12 as part of this RFI.

The nature and extent evaluation found that numerous metals were present in soil at concentrations above human health and ecological screening levels; however, all metals concentrations were below background UPLs. In sediment, arsenic, pesticides, and two PAHs were found at elevated concentrations, although the horizontal extent of elevated pesticides and PAHs was limited. Metals were also found at elevated concentrations in surface water, arsenic most notably for human health, and mercury, copper, and lead for ecological receptors. As with the other media at the site, groundwater was characterized by elevated metals concentrations, particularly concentrations of arsenic, which were consistently above the MCL.

Site 12 was evaluated individually in the HHRA, which found that there are no concerns for current or potential future receptors exposed to surface soil, surface water, sediment, and groundwater at this Site.

The BERA for Site 12 found that terrestrial plants and invertebrates were potentially at risk from metals in soil. The risk management evaluation concluded that further efforts to characterize or manage potential risks to any receptors from soil COPCs are unwarranted because onsite concentrations of all COPCs were below background concentrations. The BERA also found that benthic organisms are potentially at risk from arsenic and pesticides in sediment and barium in surface water.

During review of draft and draft final versions of the Site Wide RFI, stakeholders expressed concern regarding future containment of materials at this former landfill and the need to limit environmental disturbances because the site is protected habitat for the endangered species

Epicrates inornatus (the Puerto Rican boa). On 6 July 2011 a representative from the Army met with the U.S. Fish and Wildlife Service, PREQB, and USEPA for a field visit at Site 12. The main objective of the visit was to discuss USEPA's request (via comments on the draft final version of the Site Wide RFI) for information about a closure plan for the former landfill. The Army communicated their concern that the process of removing the existing vegetation and installing a maintenance cover may adversely impact the Puerto Rican Boa, signs of which were observed at the site during the visit. In addition, there are plans to construct a new elementary school downgradient and to the north of the landfill, and the Army is concerned that the installation of a maintenance cover could result in increased surface water runoff and contribute to local flooding.

Discussions during the site visit focused on improving access controls to the landfill area rather than considerations of a cover. The following improvements to the existing fence were recommended: extending the fence toward the new elementary school, closing gaps between the fence and its gates so that no one can enter the landfill area by squeezing between gate posts, and fixing the fence to the ground so that no one can crawl under it to gain entry to the landfill.

Based on the results of the BERA and stakeholder concerns regarding the Site's past use as a rubble landfill, the RFI recommends that Site 12 be considered in a CMS. Determinations regarding potential future actions that may be taken at Site 12 should be presented in the CMS.

8.1.13 Site 13: Potential Hazardous Material Burial Site

Site 13 refers to a potential hazardous material disposal area located south of old building S-18 (which no longer exists). It was reported that unused chemicals from the school may have been disposed of in the wooded area at this location. Surface soil, subsurface soil, and groundwater data were evaluated as part of this RFI.

The nature and extent evaluation found that numerous metals were present in surface and subsurface soil at concentrations above screening levels. Of the metals with concentrations above industrial screening levels, all concentrations were below the 95% UPLs of background data. Of the metals with concentrations above ecological screening levels, all but lead, selenium, and the maximum concentration of manganese were below the 95% UPLs of background data. Metals were also found at concentrations above protection of groundwater screening levels. However, based on data available from the NWBA RFI (EA 2012), the concentrations of these metals are not expected to result in adverse impacts to groundwater.

Pentachlorophenol was found in multiple surface soil samples at concentrations above the ecological screening level, and organochlorine pesticides were found in surface soil from boring

7 at concentrations above the ecological screening levels. In addition, boring 7 exhibited elevated concentrations of TPH-DRO in surface and subsurface soil samples. Pesticides, PAHs, and pentachlorophenol were detected in subsurface soil at concentrations above protection of groundwater SSLs. However, no organic compounds were detected in the groundwater sample, indicating that groundwater has not been adversely affected by concentrations in subsurface soil.

Site 13 was part of grouping 3 in the HHRA, which found that there are potential non-carcinogenic risk concerns for the resident child and potential carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. The concentrations of COCs at Site 13 are below background UPLs, however, indicating that no further evaluation of potential risks is warranted at this Site.

The BERA identified metals in soil as COPCs for terrestrial plants, soil invertebrates, and wildlife at Site 13. In addition, pesticides at boring 7 were identified as COPCs for wildlife (birds). The concentrations of many metals identified as COPCS are consistent with naturally occurring concentrations in soil, and it is expected that metals are present in forms unlikely to be bioavailable and thus toxicity may be overestimated. Therefore COPCs in soil are considered not to pose significant risks. In addition, because the elevated concentrations of pesticides were limited to a single sample location and when home range is considered risk levels decrease further, COPCs at Site 13 are not expected to pose risks to wildlife.

Based on the results of the HHRA and the BERA, both of which did not identify risk concerns at Site 13 that warrant further evaluation, the RFI recommends NFA for this Site.

8.1.14 Site 15: Building S-159

Site 15 is the area around Building S-159, where approximately twenty 55-gallon drums of used oil, solvents, and coolant were stored. Some of the drums are thought to have leaked as stained soil was observed in the storage area. Surface soil and subsurface soil data were evaluated for Site 15 as part of this RFI. However, after completion of the field work at Site 15 (October 2008) the area of investigation was significantly reworked. In January 2009 the area was excavated for the installation of a drainpipe. Supporting information that is available regarding the excavation is provided in Appendix K. As a result of this work at Site 15, the findings described below may no longer be representative of the Site.

The nature and extent evaluation found that numerous metals were present in surface and subsurface soil at concentrations above screening levels. Most metals were present at concentrations below background, including all concentrations detected in the most downgradient sample. Because concentrations found in the downgradient surface and subsurface soil samples were below background, the horizontal extent is limited. Four metals were present in subsurface soil at concentrations above both the protection of groundwater SSLs and background. Based on data available from the NWBA RFI (EA 2012), the concentrations of these metals are not expected to result in adverse impacts to groundwater.

TPH-DRO was detected at an elevated concentration in the upgradient surface soil sample, but concentrations found in the downgradient surface soil sample and in the subsurface soil samples were below criteria. Therefore the horizontal and vertical extent of TPH is limited

Site 15 was part of grouping 3 in the HHRA, which found that there are potential non-carcinogenic risk concerns for the resident child and carcinogenic risk concerns for the lifetime resident exposed to subsurface soil. Only Site 15 contributes to the potential risk concerns for this grouping; however, the maximum detected concentrations of COCs at Site 15 only minimally exceed the background UPLs. This suggests that the concentration of these analytes may be consistent with background and may not warrant further evaluation.

The BERA identified metals as COPCs for terrestrial plants, soil invertebrates, and wildlife at Site 15. However, the concentrations of many metals identified as COPCs are consistent with naturally occurring concentrations in soil, and it is expected that metals are present in forms unlikely to be bioavailable and thus toxicity may be overestimated. Therefore COPCs in soil are considered not to pose significant risks.

While the HHRA identified potential concerns for future residents from arsenic, these risks were driven by the concentration found in one sample, and this concentration (45.2 mg/kg) is very similar to the background UPL of 43.9 mg/kg. In addition, the area of impact was excavated in 2009. For these reasons, further evaluation of Site 15 is considered unwarranted, and the Site is recommended for NFA.

8.2 RFI CONCLUSIONS

Based on the findings of the Nature and Extent evaluation, the HHRA, and the BERA the following conclusions are reached for the 14 Sites addressed in this RFI:

- Sites 1, 4, 5, 10, 6, 7, 8, 13, and 15 are recommended for NFA.
- A CMS should be completed that considers Land Use Controls (LUCs) or deed restrictions for Sites 2, 3, 9, 11, and 12.

TABLE 8-1
Summary of RFI Findings

Site	Sampled Media	Analyses	Nature and Extent Evaluation*	HHRA	ERA	RFI Recommendations
1: Old Hazardous Waste Containers	Surface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides	Pesticides (Eco) PAHs (Eco & HH)	Grouping 1: No concerns	No concerns	No further action
1: Old Hazardous Waste Containers	Subsurface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides	Nothing above industrial screening levels	Grouping 1: No concerns	No concerns	No further action
1: Old Hazardous Waste Containers	Groundwater	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	VOCs and minor metals	**	Not evaluated	**
2: SWMU 3, Pesticides and Chemicals Burial Trench	Subsurface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Metals (e.g. As, Cr, Co) TPH-DRO and GRO	Grouping 2: Potential concerns for future resident due to arsenic, chromium, and manganese.	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	No evidence of a disposal trench. Human health concerns should be considered in a CMS.
2: SWMU 3, Pesticides and Chemicals Burial Trench	Groundwater	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	Minor VOCs and metals	**	Not evaluated	**
3: Spent Solvent Storage Area	Subsurface Soil	VOC, SVOC, Pesticides, Herbicides, Metals, TPH	Metals (e.g. As, Cr, Co, Fe, Mn, Tl)	Grouping 2: Potential concerns for future resident due to arsenic, chromium, and manganese.	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	Human health concerns should be considered in a CMS.
3: Spent Solvent Storage Area	Groundwater	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	VOCs	**	Not evaluated	**
4: PCB Storage Area #1	Surface Soil	PCBs	No PCBs detected	No concerns	No concerns	No further action
4: PCB Storage Area #1	Groundwater	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	Chromium	**	Not evaluated	**
5: PCB Storage Area #2	Subsurface Soil	PCBs	No PCBs detected	No concerns	No concerns	No further action
6: Pesticide Storage Area	Surface Soil	Pesticides, Herbicides	Pesticides and herbicides (Eco)	No concerns	No concerns	No further action

TABLE 8-1
Summary of RFI Findings

Site	Sampled Media	Analyses	Nature and Extent Evaluation*	HHRA	ERA	RFI Recommendations
6: Pesticide Storage Area	Subsurface Soil	Pesticides, Herbicides	Nothing above industrial screening levels	No concerns	No concerns	No further action
6: Pesticide Storage Area	Sediment	Pesticides, Herbicides	Pesticides (Eco)	No concerns	No concerns	No further action
7: Building 541	Surface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Pesticides (Eco) and metals (Cr, Se, Vn)	Grouping 1: No concerns	Potential risk from metals, but further investigation or action is unwarranted.	No further action
7: Building 541	Subsurface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Nothing above industrial screening levels and background	Grouping 1: No concerns	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	No further action
7: Building 541	Groundwater	VOC, SVOC, Herbicides, Pesticides, PCBs, Metals	Arsenic and cobalt	**	Not evaluated	**
8: Building S-563	Subsurface Soil	VOC, SVOC, Metals, TPH	Cobalt and TPH-DRO	Grouping 1: No concerns	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	No further action
8: Building S-563	Groundwater	VOC, SVOC, Herbicides, Pesticides, PCBs, Metals	Chromium cobalt, and manganese	**	Not evaluated	**
9: Used Oil Staging Area	Subsurface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Metals (As, Cr, Co, Fe, Mn)	Potential risks for residents from arsenic, chromium, iron, and manganese	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	Human health concerns should be considered in a CMS.
10: 65th Army Reserve Command Refueling Area	Surface Soil	VOC, TPH	Nothing above screening levels	No concerns	No concerns	No further action
10: 65th Army Reserve Command Refueling Area	Subsurface Soil	VOC, TPH	Nothing above screening levels	No concerns	No concerns	No further action

TABLE 8-1
Summary of RFI Findings

Site	Sampled Media	Analyses	Nature and Extent Evaluation*	HHRA	ERA	RFI Recommendations
10: 65th Army Reserve Command Refueling Area	Groundwater	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	Arsenic, chromium, and manganese	**	Not evaluated	**
11: Heavy Equipment Storage Area	Subsurface Soil	VOC, Metals, TPH	Arsenic, chromium, and manganese	Grouping 2: Potential concerns for future resident due to arsenic, chromium, and manganese.	Potential risk from metals to future receptors, but further investigation or action is unwarranted.	Human health concerns should be considered in a CMS.
12: Old Landfill	Surface Soil	SVOC, Pesticides, PCBs, Herbicides, Metals, TPH	DDT (all metals were below background)	No concerns	No concerns	Potential ecological risk concerns and stakeholder concerns regarding the Site's former use as a landfill should be considered in a CMS.***
12: Old Landfill	Sediment	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals, TPH	Pesticides (Eco) and metals	No concerns	Potential risks to benthic organisms from arsenic and pesticides	
12: Old Landfill	Surface Water	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals, TPH	Metals	No concerns	Potential risks to aquatic organisms from barium	
12: Old Landfill	Groundwater and Pore Water	VOC, SVOC, Pesticides, PCBs, Herbicides, Metals	Metals	No concerns	Not evaluated	
13: Potential Hazardous Material Burial Site	Surface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Metals, Herbicides (Eco), Pesticides (Eco), and TPH-DRO	Grouping 3: No concerns for this Site	Potential risk from metals and pesticides, but further investigation or action is unwarranted.	No further action***
13: Potential Hazardous Material Burial Site	Subsurface Soil	VOC, SVOC, PCBs, Pesticides, Herbicides, Metals, TPH	Metals and TPH-DRO	Grouping 3: No concerns for this Site	Potential risk from metals and pesticides, but further investigation or action is unwarranted.	No further action***
13: Potential Hazardous Material Burial Site	Groundwater	VOC, SVOC, PCBs, Pesticides, Herbicides	Nothing detected	Grouping 3: No concerns	Not evaluated	No further action***

TABLE 8-1
Summary of RFI Findings

Site	Sampled Media	Analyses	Nature and Extent Evaluation*	HHRA	ERA	RFI Recommendations
15: Building S-159	Surface Soil	Metals, TPH	Metals and TPH-DRO	Grouping 3: Potential concerns for future resident due to arsenic and chromium, but concentrations very similar to background	Potential risk from metals, but further investigation or action is unwarranted.	No further action because area of investigation has been excavated.
15: Building S-159	Subsurface Soil	Metals, TPH	Metals	Grouping 3: Potential concerns for future resident due to arsenic and chromium, but concentrations very similar to background	Potential risk from metals, but further investigation or action is unwarranted.	No further action because area of investigation has been excavated.

*Information presented for the Nature and Extent evaluation is summarized and does not necessarily present all chemicals or chemical classes with screening level exceedences. The information presented is intended to highlight those COPCs of greatest significance. For detailed information on chemicals detected at each site see Section 5 text and tables.

**Groundwater within the NWBA was fully evaluated in a RFI and HHRA (EA 2012). Risk concerns from a volatile organic compounds plume were identified, and it was recommended that they be evaluated further in a corrective measures study.

***Site is not within Northwest Boundary Area

Eco = With respect to EPA Region 4 ecological screening levels, as presented in Section 5 tables.
HH = With respect to EPA human health screening levels, as presented in Section 5 tables.
LUC = Land Use Controls
UPL = 95% Upper Prediction Limit
As = Arsenic
Co = Cobalt
Cr = Chromium
Fe = Iron
Mn = Manganese
Se = Selenium
Tl = Thallium
Vn = Vanadium

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