Draft

Remedial Investigation Report Addendum No. 1 for the RVAAP-49 Central Burn Pits

Ravenna Army Ammunition Plant
Ravenna, Ohio

April 17, 2008

GSA Contract No. GS-10F-0076J
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14. ABSTRACT

This addendum presents results of the Supplemental Phase II Remedial Investigation performed at the Central Burn Pits and evaluates necessary CERCLA requirements regarding chemical contamination in soil and dry sediment at the AOC.

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Human health risk, cleanup goals, remediation, ecological risk, nature and extent of contamination

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has completed the Draft Remedial Investigation Report Addendum No. 1 at RVAAP-49 Central Burn Pits at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Jed Thomas
Study/Design Team Leader

4/11/08
Date

Jennifer Loerch
Independent Technical Review Team Leader

4/11/08
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Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader.

As noted above, all concerns resulting from independent technical review of the project have been considered.

Principal w/ A-E firm

4/11/08
Date

Draft Remedial Investigation Report
Addendum No. 1 for the
RVAAP-49 Central Burn Pits

Volume One - Main Report and Appendices
Version 1.0

Ravenna Army Ammunition Plant
Ravenna, Ohio

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LIST OF ACRONYMS

amsl	Above mean sea level
AOC	Area of Concern
ARARs	Applicable and Relevant or Appropriate Requirements
BERA	Baseline Ecological Risk Assessment
BGS	below ground surface
BRAC	Base Realignment and Closure
CBP	Central Burn Pits
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	chemical of concern
CoC	Chain of Custody
COEC	Chemical of Ecological Concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
DoD	U. S. Department of Defense
DOT	U. S. Department of Transportation
DQO	Data quality objective
DQSR	Data Quality Summary Report
EE/CA	Engineering Evaluation/Cost Analysis
EPC	exposure point concentration
ESV	ecological screening value
FBQ	Fuze and Booster Quarry Landfill/Ponds
FS	Feasibility Study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IDW	Investigation derived waste
ILCR	incremental lifetime cancer risk
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
LOAEL	Lowest observed adverse effect level
MDC	maximum detected concentration
MEC	munitions and explosives of concern
MI	Multi-increment
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MS	matrix spike
MSD	matrix spike duplicate
NGB	National Guard Bureau
NOAEL	No observed adverse effect level
Non-TCRA	Non-Time Critical Removal Action

LIST OF ACRONYMS (CONTINUED)

NPL	National Priorities List
ODA2	Open Demolition Area #2
ODNR	Ohio Department of Natural Resources
OE	ordnance and explosives
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PCB	polychlorinated biphenyl
POL	Petroleum, oil, and lubricant
PRG	preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RAGS	Risk Assessment Guidance for Superfund
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RGO	Remedial goal option
RI	Remedial Investigation
RmAO	Removal Action Objective
RME	Reasonable maximum exposure
ROD	Record of Decision
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SERA	Screening Ecological Risk Assessment
SRC	site-related contaminant
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCLP	Toxicity characteristic leaching procedure
THI	target hazard index
TNT	2,4,6-trinitrotoluene
TR	target risk
TRV	Toxicity Reference Value
UCL	upper confidence limit
USACE	U. S. Army Corps of Engineers
USACHPPM	U. S. Army Center for Health Promotion and Preventative Medicine
USEPA	U. S. Environmental Protection Agency
USGS	U. S. Geological Society
WQS	Water Quality Standard
WWH	Warmwater habitat

ES.0 EXECUTIVE SUMMARY

Science Applications International Corporation (SAIC) has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to provide environmental services to remediate soil and dry sediment at Central Burn Pits (CBP) (RVAAP-49) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio.

The CBP Remedial Investigation (RI) Report (USACE 2005a) recommended characterization of debris piles and berms within CBP and additional sampling to define nature and extent of contaminants in soil. Supplemental Phase II RI (USACE 2005b) activities to address these recommendations were completed in November 2005. Debris piles and berms were previously addressed under a non-time critical removal action (non-TCRA) (USACE 2007a and 2007b). This addendum recommends no further action at CBP for soil and dry sediment in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The CBP RI phase is complete with submittal of this addendum to the RI Report.

ES.1 SCOPE

This addendum evaluates necessary CERCLA requirements regarding chemical contamination in soil and dry sediment at CBP. Assessment required to achieve cleanup of aqueous media (i.e., groundwater, surface water, and wet sediment) are not included in the scope of this addendum. Aqueous media will be addressed under future CERCLA decisions.

Munitions and explosives of concern (MEC) issues are addressed separately under the Military Munitions Response Program (MMRP) for RVAAP. If an area under the MMRP requires an MEC action, land use controls will be implemented. Under the MMRP, CBP is not categorized as an MEC response action site; therefore, future land use controls regarding MEC will not be required.

Removal actions for debris piles and berms at CBP were previously addressed separately from soil and dry sediment under an Engineering Evaluation/Cost Analysis (EE/CA) and non-TCRA. Based on process knowledge and visual inspection, debris piles and berms are small in size and contain a substantial percentage of material and residues from previous industrial operations. Therefore, debris piles and berms were considered as placed waste materials rather than conventional environmental media. Due to these two factors, the piles and berms were not considered as viable exposure units for risk characterization. However, a removal action took place for two of the 13 piles due to elevated levels of lead (Pile M) and hexavalent chromium (Pile N) in order to protect human health and the environment and minimize the potential for contaminant dispersal from the materials. This report presents the full results of debris pile and berm characterization, as previously summarized in the EE/CA.

Ohio Army National Guard (OHARNG) has established future land uses at CBP based on the anticipated training mission and utilization of the Ravenna Training and Logistics Site (RTLS) (USACE 2004). These anticipated future land uses, in conjunction with the evaluation of residential land use and associated receptors, form the basis for identifying and evaluating the need for future action for soil and dry sediment.

ES.2 SUPPLEMENTAL PHASE II RI EVALUATION

Supplemental Phase II RI field activities were conducted to further define nature and extent of soil and dry sediment contamination at CBP. The Supplemental Phase II RI also collected data from debris piles and berms to assess disposition requirements and options. The sampling strategy is presented in the Supplemental Phase II RI SAP (USACE 2005b).

Five additional surface [0-1 ft below ground surface (BGS)] and subsurface (1-3 ft BGS) discrete soil samples were collected to complete contaminant delineation from the initial RI. The results of the Supplemental Phase II RI identified one explosive (nitrobenzene) in surface and subsurface soil. The maximum detection was 0.05 mg/kg in CBP-036 and CBP-037 surface soil samples. These results are below the reporting limit for nitrobenzene. The extent of explosives in surface and subsurface soil at CBP has been defined to reporting limits with the additional data collected.

Two discrete surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil sample locations (CBP-035 and CBP-036) were collected to define the extent of manganese contamination which exceeded background at location SS-026. All four samples (two surface and two subsurface) were well below the facility-wide background values for manganese (1,450 mg/kg for surface soil and 3,030 mg/kg for subsurface soil). Therefore, the 51 discrete surface soil samples (0-1 ft BGS), 34 discrete subsurface soil samples (1-3 ft BGS), and 8 samples in excess of 3 ft BGS collected during the original RI and the Supplemental Phase II RI defined the extent of inorganic contamination in surface and subsurface soil at CBP.

Samples of debris pile and berm materials at CBP were collected using MI sampling techniques. The MI sample results from Piles M and N indicated they contained inorganic contaminants at much higher levels than surrounding soil. Supplemental Phase II sampling indicated Pile M had a lead concentration of 8,560 mg/kg and also a lead toxicity characteristic leaching procedure (TCLP) result of 15.4 mg/L. This TCLP result exceeded the maximum concentration of lead (5.0 mg/L) for toxicity characteristics and the debris pile material was classified as a potential characteristically hazardous waste. The MI sample for Pile N had a detected value of 25 mg/kg of hexavalent chromium. The result was highly elevated compared to RVAAP background values and concentrations in the surrounding soil at CBP. There is no TCLP criterion for hexavalent chromium.

ES.3 SUMMARY OF HUMAN HEALTH RISK ASSESSMENT

A baseline Human Health Risk Assessment (HHRA) was performed in the RI (USACE 2005a) to assess the potential current and future risks associated with human exposure to site-related

contaminants found at CBP. Current and future land use scenarios include ownership by the NGB for training purposes; use by recreational hunters and fishermen; and use as a residential farm. Risks were evaluated for a National Guard Trainee and a National Guard resident/trainer; a hunter/trapper; security maintenance worker; and a resident farmer (adult and child). Chemicals of concern (COCs) were selected and toxicological and exposure factors were applied to evaluate risk. HHRA results are summarized in Table ES-1. Subsequent to the baseline HHRA, the RVAAP Facility-Wide Risk Assessor Manual (USACE 2005c) was updated to include a trespasser scenario. This report presents the risk assessment for a trespasser scenario. Based on the exposure parameters, risks to a trespasser would be less than those predicted for the National Guard Trainee and Security Guard/Maintenance Worker.

Table ES-1. Summary of HHRA Risk Results for Direct Contact with Soil at the Central Burn Pits

Receptor	Total HI	Total ILCR	Potential COCs	Notes
National Guard Trainee (Representative Receptor)				
Deep Surface Soil[a]	4.1	1.6E-05	As, Cr, Mn	EPCs for As and Mn are ≤ background. Total Cr results evaluated as hexavalent chromium. Supplemental Phase II RI data confirm the majority of the chromium in deep surface soil is not hexavalent chromium.
Security Guard/Maintenance Worker				
Shallow Surface Soil[a]	0.10	8.1E-06	As, B(*a*)P	Total risk exceeds USEPA *deminimis* risk level of 1E-06, but is below Ohio EPA target risk level of 1E-05. EPC for As is ≤ background.
Hunter				
Shallow Surface Soil[a]	0.0010	8.9E-08	None	Total risk and hazard below USEPA and Ohio EPA target risk values.
National Guard Resident				
Shallow Surface Soil[a]	0.20	1.3E-05	As, B(*a*)P	EPC for As is ≤ subsurface background in a highly disturbed area. Risk from B(*a*)P is below Ohio EPA target risk level.
Subsurface Soil[a]	0.13	1.0E-05	As	EPC for As is ≤ background.
Resident Subsistence Farmer[b]				
Shallow Surface Soil[a]	1.7	6.0E-05	As, B(*a*)P	EPC for As is ≤ subsurface background in a highly disturbed area. Risk from B(*a*)P is below Ohio EPA target risk level.
Subsurface Soil[a]	1.2	4.8E-05	As	EPC for As is ≤ background.

As = arsenic
B(*a*)P = benzo(*a*)pyrene
COC = chemical of concern
Cr = chromium (evaluated as hexavalent chromium)
EPC = exposure point concentration
HI = hazard index
ILCR = incremental lifetime cancer risk
Mn = manganese
Ohio EPA = Ohio Environmental Protection Agency
RI = remedial investigation
USEPA = U.S. Environmental Protection Agency

[a]Shallow surface soil includes samples from 0-1 ft below ground surface (BGS); Deep surface soil includes samples from 0-4 ft BGS; subsurface soil includes samples from 1-30 ft BGS.
[b]Noncancer risks were calculated separately for Adult and Child Resident Subsistence Farmer scenarios. The maximum HI (for the child) are presented here. Cancer risks were calculated for a combined adult and child "Lifelong" Resident Subsistence Farmer scenario.

The Supplemental Phase II RI data were evaluated to determine if any changes to the conclusions of the baseline HHRA were required. The evaluation shows the new supplemental data require modification of the baseline HHRA conclusions only for chromium. The supplemental data confirm the majority of chromium in deep surface soil (0 to 4 ft BGS) is not hexavalent chromium; therefore, chromium is not a risk driver for the National Guard Trainee.

Calculated exposure point concentrations (EPCs) of the two potential inorganic COCs (arsenic and manganese) are below background concentrations of these metals. The calculated risk from benzo(*a*)pyrene is below the Ohio EPA target risk level of 1E-05; therefore, no COCs are identified for soil and dry sediment for evaluation of remedial alternatives for the National Guard or residential land use at CBP.

ES.4 SUMMARY OF SCREENING ECOLOGICAL RISK ASSESSMENT

The screening ecological risk assessment (SERA) performed for CBP is available in the RI Report (USACE 2005a). The SERA identifies a variety of ecological receptor populations that could be at risk and identifies chemicals of ecological concern (COECs) that could contribute to potential risks from exposure to contaminated media. The SERA also reported the ecological field work conducted at the site, including ecological reconnaissance of existing vegetation and animal life. The SERA showed soil hazard quotients (HQs) exceed 1 for some chemicals, but are generally not highly elevated and metal concentrations are similar to background for all COECs. Weight of evidence shows there are currently few observable adverse ecological effects and there is ample nearby habitat to maintain ecological communities at CBP and elsewhere on RVAAP. Sand Creek, which is at the western border of the AOC, has not received migrating contaminants from CBP and showed no negative ecological effects according to a Facility-Wide Biological and Surface Water Study (USACE 2005d). Eight Sand Creek locations evaluated in the SERA revealed very good to excellent stream habitats. Available data document the presence of healthy and functioning terrestrial and aquatic ecosystems. Based on the weight of evidence, quantitative ecological cleanup goals are not required for soil and dry sediment at CBP.

ES.5 PRELIMINARY CLEANUP GOALS

Preliminary cleanup goals are the chemical-specific numeric cleanup goals used to meet the remedial action objective for protection of human health. Information obtained during the RI shows that COC concentrations in soil and dry sediment at CBP are less than cleanup goals for restricted (National Guard Trainee) and unrestricted (residential) land use.

ES.6 RECOMMENDATIONS

Concentrations of COCs in soil and dry sediment at CBP are less than human health preliminary cleanup goals for the reasonable foreseeable land use, as well as unrestricted (residential) land use. Quantitative ecological cleanup goals are not required for CBP based on weight of evidence. Debris piles and berms were previously addressed under a non-TCRA. Piles M and N removal activities took place from October 2007 to March 2008 (USACE 2008). No further action for soil and dry sediment is recommended at CBP.

1.0 INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to provide environmental services to remediate soil and dry sediment at Central Burn Pits (CBP) (RVAAP-49) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio.

A Supplemental Phase II Remedial Investigation (RI) was conducted under the U.S. Department of Defense (DoD) Installation Restoration Program (IRP) by SAIC, under contract number GS-10F-0076J, Delivery Order No. W912QR-05-F-003, with USACE, Louisville District. The RI, completed in 2005 (USACE 2005a), and the supplemental investigation presented in this report, were conducted in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The work plans associated with these investigations were reviewed and commented on by the Ohio Environmental Protection Agency (Ohio EPA).

This addendum presents the results of the Supplemental Phase II RI of CBP, as well as updates to the human health risk assessment (HHRA) and screening ecological risk assessment (SERA). This addendum further addresses soil and dry sediment under the scope of this contract. Aqueous media (groundwater, surface water, and wet sediment) are not assessed in this addendum, but will be addressed under future remedial decisions.

This addendum summarizes the results of the Supplemental Phase II RI field activities conducted in November 2005 at CBP. These activities were conducted in accordance with the Supplemental Phase II RI Sampling and Analysis Plan (SAP) issued November 10, 2005 and approved by Ohio EPA (USACE 2005b). This report does not address the findings of the supplemental investigations at Fuze and Booster Quarry Landfill/Ponds (FBQ) and Open Demolition Area #2 (ODA2).

1.1 PURPOSE AND SCOPE

The purpose of the Supplemental Phase II RI was to complete the delineation of the nature and extent of contamination in soil and dry sediment. The original RI Report identified data gaps including some areas of soil contamination that were not fully delineated, lack of speciation data for chromium, and characterization of identified debris piles and berms. This addendum presents the following information:

- Preliminary cleanup goals and risk management considerations for the HHRA completed in the RI;

- Weight of evidence to show quantitative ecological cleanup goals are not required for CBP; and

- Conclusions to support whether CBP will require no further action for soil and dry sediment or if Feasibility Study (FS) is required to evaluate potential remedies and future actions using the results of both the original RI Report and this addendum.

Removal actions for debris piles and berms at CBP were addressed separately from soil and dry sediment under an Engineering Evaluation/Cost Analysis (EE/CA) (USACE 2007a) and non-time critical removal action (non-TCRA) (USACE 2007b). Based on known site history [presented in Section 1.2.2 of the CBP RI Report (USACE 2005a)] and visual inspection, debris piles and berms are small in size and contain a substantial percentage of material and residues from previous industrial operations. Therefore, debris piles and berms were considered as placed waste materials rather than conventional environmental media. Because the piles and berms were small and classified as placed waste material, they were not considered as viable exposure units for risk characterization. However, a removal action took place for two of the 13 debris piles and berms (Pile M and Pile N) due to elevated levels of lead and hexavalent chromium. This removal action was performed to protect human health and the environment and minimize the potential for contaminant dispersal from the materials. This report presents the full results of debris pile and berm characterization, as previously summarized in the EE/CA (USACE 2007a).

Ohio Army National Guard (OHARNG) has established future land uses at CBP based on the anticipated training mission and utilization of the Ravenna Training and Logistics Site (RTLS) (USACE 2005c). These anticipated future land uses, in conjunction with the evaluation of residential land use and associated receptors, form the basis for identifying and evaluating the need for remediation of soil and dry sediment. This basis is presented in Section 6.

1.2 RVAAP/RTLS GENERAL INFORMATION

1.2.1 General Facility Description

When the RVAAP IRP began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the OHARNG over a two year period (2002 and 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the National Guard Bureau (NGB) and subsequently licensed to the OHARNG for use as a military training site RTLS. The current RVAAP consists of 1,280 acres in various parcels throughout the OHARNG RTLS.

The RTLS is in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles (4.8 km) east-northeast of the city of Ravenna and approximately 1 mile (1.6 km) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. The RTLS is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1-1 and 1-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south.

The entire 21,683-acre parcel was an industrial facility that was government-owned and contractor-operated when the RVAAP was operational (the RTLS did not exist at that time). The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP; therefore, references to the RVAAP in this document indicate the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the waste water, containing TNT and Composition B, was known as "pink water" for its characteristic color. Pink water was collected in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include Areas of Concern (AOCs) that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

1.2.2 Demography and Land Use

RVAAP consists of 8,775 hectares (21,683 acres) and is located in northeastern Ohio, approximately 23 miles (37 km) east-northeast of Akron and 30 miles (48.3 km) west-northwest of Youngstown. RVAAP occupies east-central Portage County and southwestern Trumbull County. The 2001 populations (as estimated by the U.S. Census Bureau) for Portage County and Trumbull County are 152,743 and 223,982, respectively. Population centers closest to RVAAP are Ravenna, with a population of 12,100, and Newton Falls, with a population of 4,866.

The RVAAP facility is located in a rural area and is not close to any major industrial or developed areas. Approximately 55% of Portage County, in which the majority of RVAAP is located, consists of either woodland or farmland acreage. The closest major recreational area, the Michael J. Kirwan

Reservoir (also known as West Branch Reservoir), is located adjacent to the western half of RVAAP, south of State Route 5.

RVAAP, operated by the Base Realignment and Closure (BRAC) District, is in the process of environmental study and cleanup. The BRAC District administers cleanup of areas at RVAAP that were contaminated by historical operations. These areas are termed "environmental AOCs" for the purposes of this report. The NGB controls non-AOC areas and has licensed these areas to OHARNG for training purposes. Training and related activities at RTLS include field operations and bivouac training, convoy training, equipment maintenance, C-130 aircraft drop zone operations, helicopter operations, and storage of heavy equipment. The environmental AOCs will be transferred from the BRAC District to NGB once the AOCs are investigated and any required remedial actions are completed.

OHARNG has prepared a comprehensive Environmental Assessment and an Integrated Natural Resources Management Plan to address future use of RTLS property (OHARNG 2001). The perimeter of RVAAP is currently fenced and is patrolled intermittently by the facility caretaker contractor. Access to RVAAP is strictly controlled and any contractors, consultants, or visitors who wish to gain access to the facility must follow procedures established by RVAAP and the facility caretaker contractor.

1.3 CENTRAL BURN PITS DESCRIPTION

1.3.1 Operational History

CBP is located in the east-central area at the intersection of Paris-Windham Road and Lumber Yard Road, and is approximately 20 acres in size (Figure 1-3). The AOC is bordered by old railroad beds to the north (Track 39) and south (Track 33), and Sand Creek to the west-northwest. CBP was originally used as a lumber and building materials storage area. CBP was later used for open burning of non-explosive wastes, electrical components, wooden boxes, and scrap and the disposal of other non-hazardous waste material. Operation of the burn pits is believed to have started shortly after RVAAP began operations and continued until the mid-1970s, although actual dates are unknown. The burn pits are comprised of mounds of slag and debris; thirteen of which were sampled during the Supplemental Phase II RI. Additionally, three burn areas, characterized by debris, scrap materials, and distressed vegetation, were identified in the eastern portion of the AOC near Lumber Yard Road. Two burn areas had mounds of slag and debris, which were sampled during the Supplemental Phase II RI.

1.3.2 Previous Investigations and Activities

Figure 1-4 presents the previous, current, and anticipated future activities to complete remedial actions for soil and dry sediment at CBP. The following sections provide a summary of the previous investigations and activities performed to date. These previous investigations and activities provide information and data that factor into the findings of this RI Addendum.

1.3.2.1 Relative Risk Site Evaluation

An initial investigation was conducted at 13 AOCs as part of a relative risk site evaluation performed by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). The

relative risk site evaluation (USACHPPM 1998) assessed environmental data for metals, explosives, and organic constituents in surface and subsurface soil samples. Surface soil samples and one subsurface sample were collected within the main burn areas. The samples contained elevated levels of several metals including copper and lead. Groundwater was not sampled during this investigation and sediment was not evaluated as a human endpoint.

The results of the relative risk site evaluation provided the U.S. Army with qualitative and quantitative data to score these sites. The scores (high, medium, or low) provided the U.S. Army with a basis for prioritizing cleanups and allocating funds. Of the 13 sites evaluated, five sites (including CBP) were considered high-priority AOCs.

1.3.2.2 Phase I Remedial Investigation

The Phase I RI field activities for CBP were conducted in 2001. The field investigation consisted of sampling surface soil, subsurface soil, surface water, groundwater, and sediment. The Phase I RI sampled surface soil (0-1 ft below ground surface [BGS]) and subsurface soil (1-30 ft BGS). Data collected were used to support the development of the CBP RI Report (USACE 2005a).

Samples from the human health deep surface soil exposure unit (0 to 4 ft bgs), samples had occasional detections of polychlorinated biphenyl (PCBs), explosives, propellants and pesticides. Inorganics detected at the AOC above background and U.S. Environmental Protection Agency (USEPA) Region 9 preliminary remediation goal (PRGs) (residential) values include aluminum, arsenic, chromium, copper, lead, manganese, and vanadium.

1.3.2.3 Supplemental Phase II Remedial Investigation

Supplemental Phase II RI field activities were conducted in 2005 to further define nature and extent of soil contamination at CBP. In addition, samples were collected from the debris piles and berms to assess potential disposition requirements and options. The sampling strategy was presented in the Supplemental Phase II RI SAP (USACE 2005b). The results from the Supplemental Phase II RI are included in this addendum.

Results of the Supplemental Phase II RI indicated concentrations of lead and hexavalent chromium in two debris piles (M and N respectively) were sufficiently high that the materials were considered principal threat wastes. The U.S. Army and Ohio EPA elected to address these debris piles under a Non-TCRA as discussed in Sections 1.3.2.4 through 1.3.2.6 of this addendum. The remaining soil and dry sediment at CBP are addressed in this addendum and future documents.

1.3.2.4 Engineering Evaluation/Cost Analysis

Although RVAAP is not a National Priorities List (NPL) listed site, the U.S. Army and Ohio EPA agreed to proceed with a Non-Time Critical Removal Action (TCRA) for Piles M and N due to likelihood of contaminant dispersal and migration from the piles to surrounding environmental media. The removal action followed the guidelines of USEPA (USEPA 2000). Consequently, the EE/CA (USACE 2007a) was developed.

The purpose of the EE/CA was to evaluate alternatives for removing of Piles M and N. This evaluation included assessing the technologies available, identifying Applicable and Relevant or

Appropriate Requirements (ARARs); and comparing cost estimates. Two removal action alternatives were developed (No Action and Excavation of Waste Piles with Off-site Treatment and Disposal). At the completion of the analysis, the EE/CA recommended proceeding with Removal Action Alternative 2: Excavation of Waste Piles with Off-site Treatment and Disposal.

1.3.2.5 Action Memorandum

The CBP Action Memorandum (USACE 2007b) documents the selected removal action alternative to excavate Piles M and N with off-site treatment and disposal. This Action Memorandum also outlines the removal action objectives and cleanup goals. The Action Memorandum includes a Responsiveness Summary addressing public comments received during the public comment period held from March 7, 2007 to April 5, 2007. Following review and concurrence by the Ohio EPA, the Action Memorandum was signed by the U.S. Army on August 9, 2007.

1.3.2.6 Removal Action of Piles M and N

The CBP Removal Action Work Plan (USACE 2007c) was developed to detail implementation of the Pile M and N removal in accordance with the EE/CA (USACE 2007a) and Action Memorandum (USACE 2007b). Implementation of the removal action work plan began in October 2007. Removal activities continued until March 2008, when soil sample analyses confirmed the removal action cleanup goals were achieved. Details of the implementation of the removal action work plan are documented in the CBP Removal Action Report (USACE 2008).

1.3.3 Anticipated Future Land Use

CBP is currently licensed to the OHARNG and is part of the RTLS. OHARNG has prepared a comprehensive Environmental Assessment and an INRMP to address future use of RTLS property (OHARNG 2001). OHARNG has established future land use for CBP as Dismounted Training, No Digging based on anticipated training, mission, and utilization of the RTLS. Future land use will also include the development of small arms ranges. CBP is not included as a Military Munitions Response Program (MMRP) Munitions Response Site (MRS) at RVAAP based on available historical and operational information; therefore, no removal actions or land use controls are currently planned with respect munitions and explosives of concern (MEC).

1.4 REPORT ORGANIZATION

This addendum is organized in accordance with USEPA CERCLA Superfund and USACE guidance and meets Ohio EPA requirements. This addendum is organized as follows:

- Section 2 presents the environmental setting;
- Section 3 presents the study area field investigation and the methodologies used for data collection;
- Section 4 describes the updated nature and extent of soil contamination at CBP;
- Section 5 provides a qualitative risk evaluation of the Supplemental Phase II RI data;
- Section 6 presents the updated HHRA including calculation of preliminary cleanup goals and risk management considerations;
- Section 7 presents the updated SERA;
- Section 8 presents a summary of the report;
- Section 9 lists the recommendations for CBP; and
- Section 10 cites the references used in this report.

Appendices (A through H) contain information in support of the Supplemental Phase II RI field activities. These appendices are:

- Appendix A: Soil Sampling Logs;

- Appendix B: Investigation Derived Waste (IDW) Letter Report;

- Appendix C: Project Quality Assurance Summary Report;

- Appendix D: Data Quality Control Summary Report;

- Appendix E: Laboratory Analytical Results and chain-of-custody (CoC) records;

- Appendix F: Topographic Survey Data;

- Appendix G: MEC Avoidance Survey Report; and

- Appendix H: Risk Characterization for Trespasser Scenario.

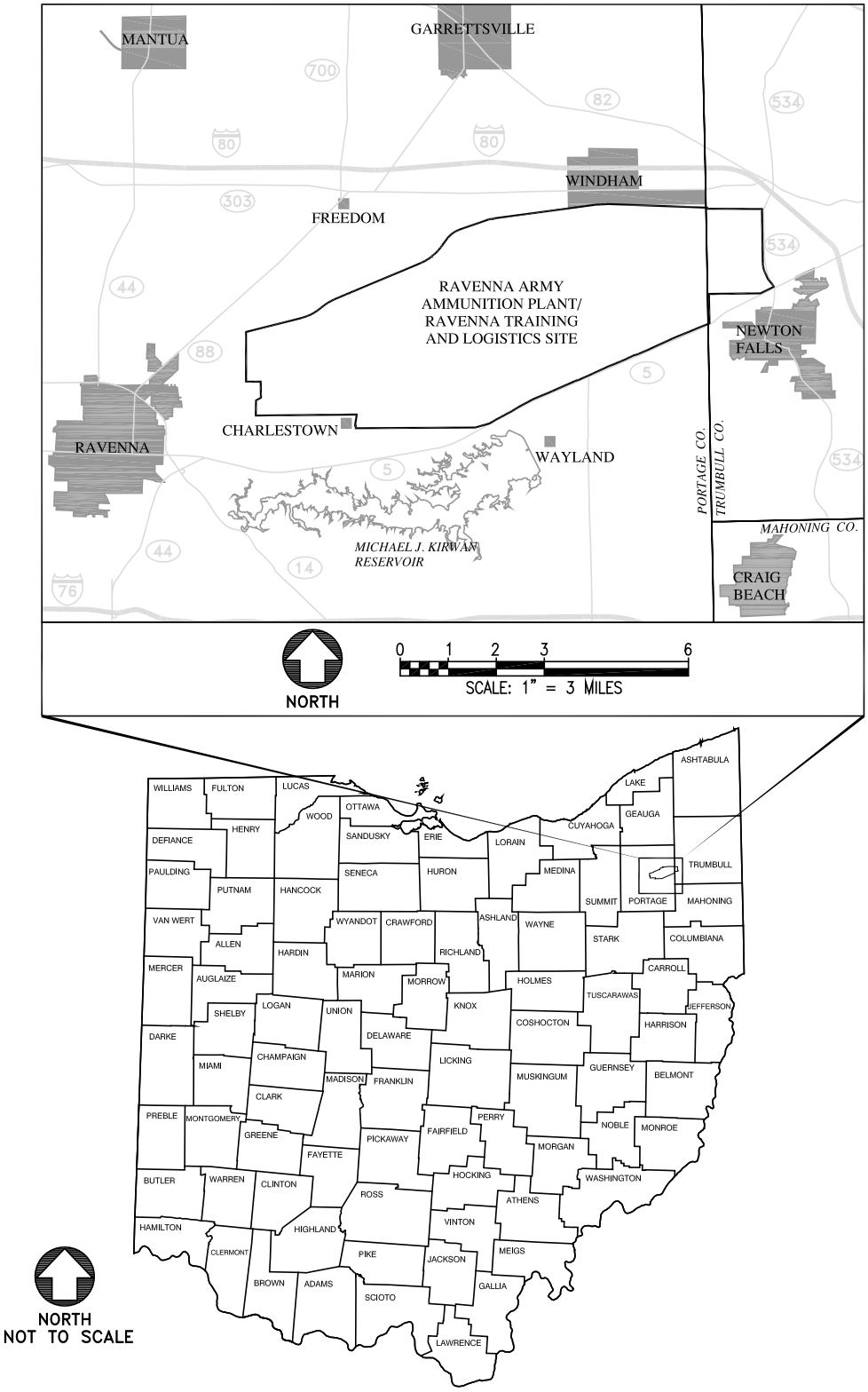

Figure 1-1. General Location and Orientation of RVAAP/RTLS

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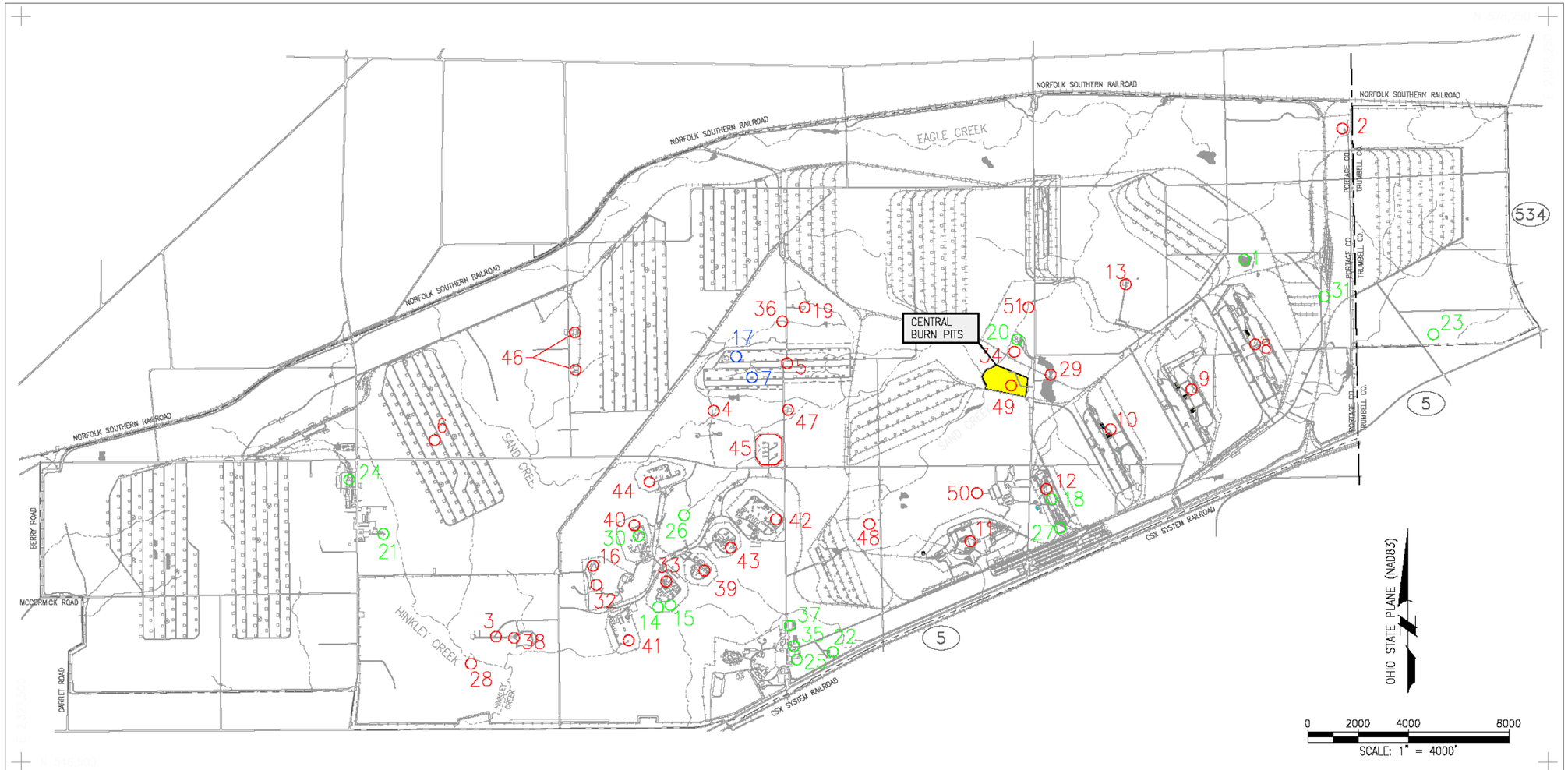

LEGEND:

1. RAMSDELL QUARRY LANDFILL
2. ERIE BURNING GROUNDS
3. DEMOLITIONS AREA #1
4. OPEN DEMOLITIONS AREA #2
5. WINKLEPECK BURNING GROUNDS
6. C BLOCK QUARRY
7. BUILDING 1601 HAZARDOUS WASTE STORAGE
8. LOAD LINE 1 AND DILUTION/SETTLING POND
9. LOAD LINE 2 AND DILUTION/SETTLING POND
10. LOAD LINE 3 AND DILUTION/SETTLING POND
11. LOAD LINE 4 AND DILUTION/SETTLING POND
12. LOAD LINE 12
13. BUILDING 1200 AND DILUTION/SETTLING POND
14. LOAD LINE 6, EVAPORATION UNIT
15. LOAD LINE 6, TREATMENT PLANT
16. FUZE AND BOOSTER QUARRY LANDFILL/PONDS
17. DEACTIVATION FURNACE
18. LOAD LINE 12 PINK WASTEWATER TREATMENT
19. LANDFILL NORTH OF WINKLEPECK BURNING GROUND
20. SAND CREEK SEWAGE TREATMENT PLANT
21. DEPOT SEWAGE TREATMENT PLANT
22. GEORGE ROAD SEWAGE TREATMENT PLANT
23. JUNIT TRAINING SITE WASTE OIL TANK
24. RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK
25. BUILDING 1034 MOTOR POOL WASTE OIL TANK
26. FUZE BOOSTER AREA SETTLING TANKS
27. BUILDING 854 PCB STORAGE
28. MUSTARD AGENT BURIAL SITE
29. UPPER AND LOWER COBB'S POND COMPLEX
30. LOAD LINE 7 PINK WASTEWATER TREATMENT PLANT
31. ORE PILE RETENTION POND
32. 40- AND 60-MM FIRING RANGE
33. FIRESTONE TEST FACILITY
34. SAND CREEK DISPOSAL ROAD LANDFILL
35. BUILDING 1037 LAUNDRY WASTEWATER SUMP
36. PISTOL RANGE
37. PESTICIDE STORAGE BUILDING T-4452
38. NACA TEST AREA
39. LOAD LINE 5/FUZE LINE 1
40. LOAD LINE 7/BOOSTER LINE 1
41. LOAD LINE 8/BOOSTER LINE 2
42. LOAD LINE 9/DETONATOR LINE
43. LOAD LINE 10/PERCUSSION ELEMENT
44. LOAD LINE 11/ARTILLERY PRIMER
45. WET STORAGE AREA
46. BUILDINGS F-15 AND F-16
47. BUILDING T-5301 DECONTAMINATION
48. ANCHOR TEST AREA
49. CENTRAL BURN PITS
50. ATLAS SCRAP YARD
51. DUMP ALONG PARIS-WINDHAM ROAD

CERCLA
RCRA
OTHER REGULATORY
RAILROAD TRACKS
FENCE LINE
PROPERTY BOUNDARY
STREAM OR CREEK

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RVAAP/RTLS
RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P.H. / S.D.	REV. 2 / 07-27-04	/0D064/DWGS/R7JSITE2

File: W:\CAD Cov\Ravenna\PBC 2005\Location Map\RVAAP Site.dwg Layout: Central Burn User: williamsbe Jun 20, 2007 - 10:01am

Figure 1-2. RVAAP/RTLS Installation Map

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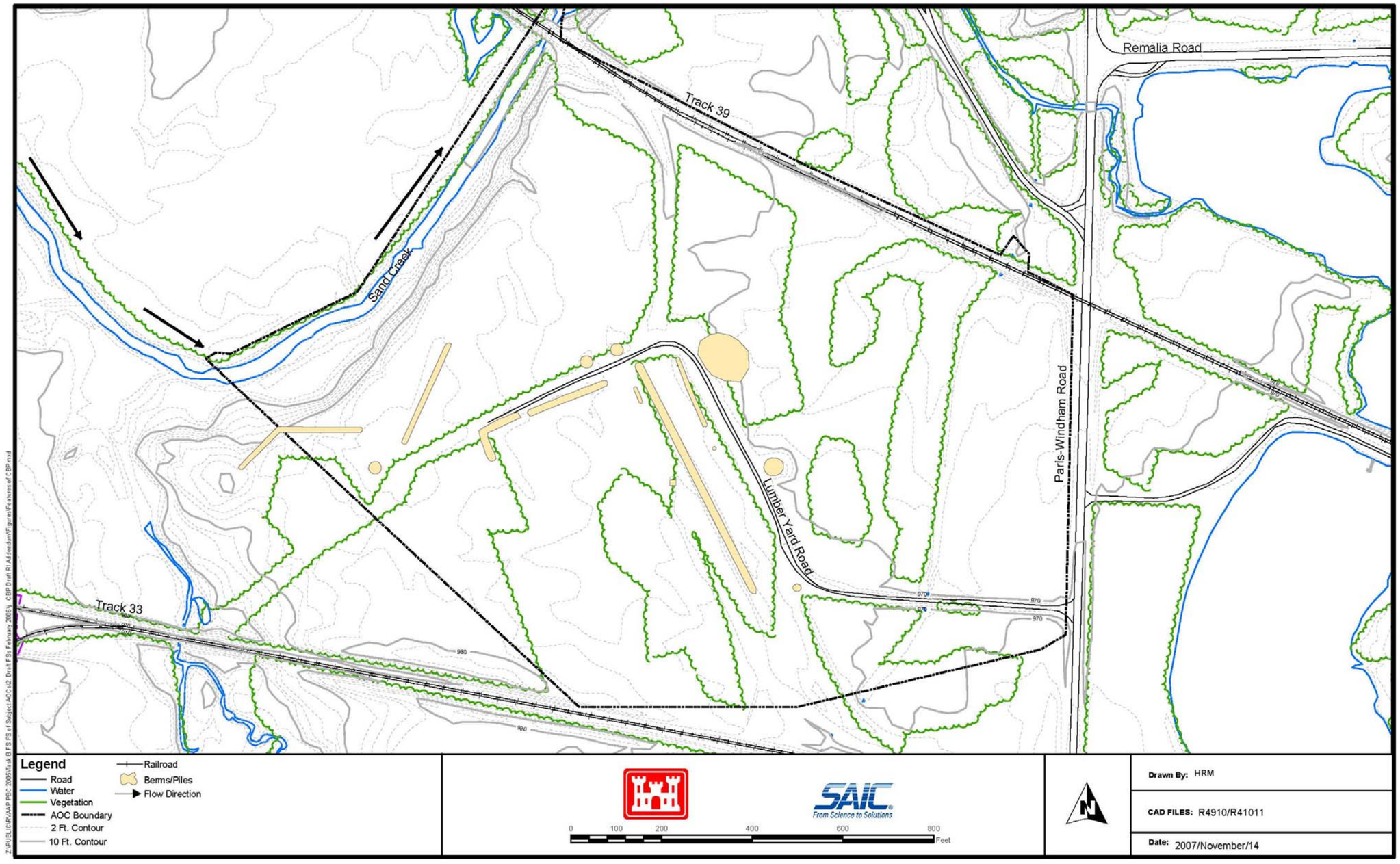

Figure 1-3. Features of CBP

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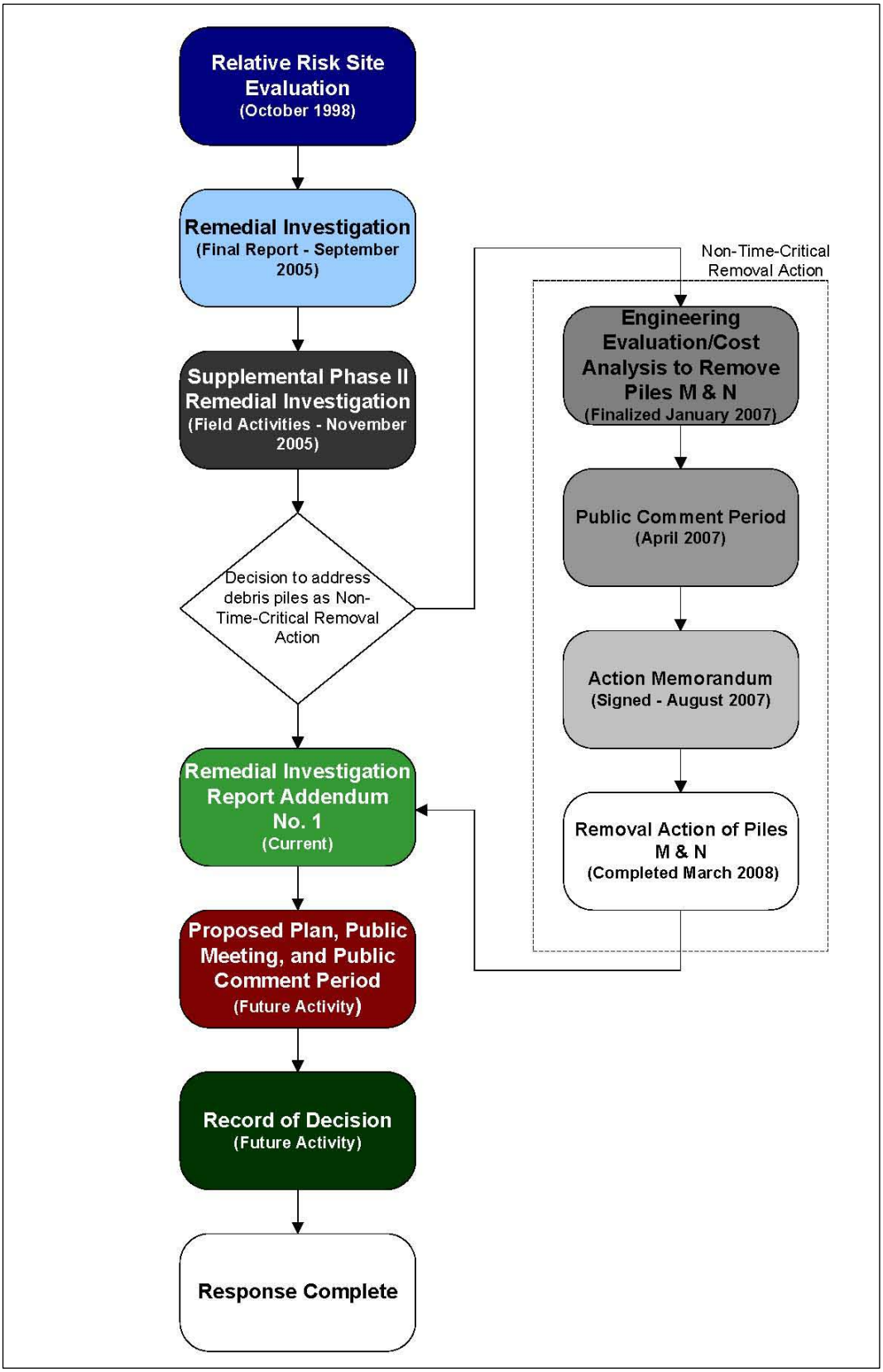

Figure 1-4. Central Burn Pits Activity Flowchart

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2.0 ENVIRONMENTAL SETTING

This section describes the physical characteristics of CBP and the surrounding environment that are factors in understanding potential contaminant transport pathways, receptors, and exposure scenarios for human health and ecological risks. Section 2 of the RI Report for CBP (USACE 2005a) described the physical characteristics of CBP in more detail.

2.1 RVAAP PHYSIOGRAPHIC SETTING

RVAAP is located within the Southern New York Section of the Appalachian Plateau physiographic province (USGS 1968). This province is characterized by elevated uplands underlain primarily by Mississippian- and Pennsylvanian-age bedrock units that are horizontal or gently dipping. The province is characterized by its rolling topography with incised streams having dendritic drainage patterns. The Southern New York Section has been modified by glaciation, which rounded ridges, filled major valleys, and blanketed many areas with glacially-derived unconsolidated deposits (i.e., sand, gravel, and finer-grained outwash deposits). Glacial activity in the Southern New York Section disrupted stream drainage patterns in many locales, which resulted in development of extensive wetland areas.

2.2 SURFACE FEATURES

The topography across the majority of CBP is relatively flat due to historical grading and fill activities performed to create a lumber and building materials storage area. Undisturbed topography is characterized by gently undulating contours. Sand Creek forms the western AOC boundary. Elevations vary from 960-980 ft above mean sea level (amsl). Structural features include former rail lines Track 39 and Track 33. Other features include debris piles and berms in the central portion and burn areas in the eastern portion of the AOC. These debris piles and berms are placed materials (many were dumped over a period of time from other areas of RVAAP) and are not conventional environmental media. Visual observations of the debris piles and berms show they consist primarily of gravel and excess fill dirt. Some piles and berms contain residues from former burning operations at CBP. Several berms and piles are shown in Photograph 2-1.

During a field reconnaissance in September 2005, field measurements of the approximate dimensions of these piles and berms were collected. The dimensions and estimated volumes are summarized in Table 2-1.

Miscellaneous construction/demolition materials were observed at CBP during the September 2005 field reconnaissance including glass, concrete, metal, ceramics, and railroad ties. There are no buildings at CBP. Soil in the area consists primarily of silty loams. Two drainage systems are present; one associated with Track 33, and the other drains water from the central portion of the AOC to the northeast corner of the site. All ditches discharge to the adjacent Sand Creek.

Table 2-1. CBP Debris Piles and Berms

Surface Features	Approximate Dimensions	Shape	Estimated Volume
Berm A[1]	Length = 570 ft, Width = 19 ft Height = 3 ft	Rectangular	32,500 cu ft 1,200 cu yards
Pile B	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu ft 47 cu yards
Pile C	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu ft 47 cu yards
Berm D[2]	Length = 340 ft, Width = 15 ft Height = 3 ft	Rectangular	15,300 cu ft 570 cu yards
Pile E	Length = 12 ft, Width = 8 ft Height = 4 ft	Rectangular	380 cu ft 14 cu yards
Pad F	Length = 6 ft, Width = 6 ft	Rectangular	NA
Berm H	Length = 245 ft, Width = 13 ft Height = 4 ft	Rectangular	12,740 cu ft 470 cu yards
Pile I[3]	Length = 304 ft, Width = 12 ft Height = 4 ft	Rectangular	14,600 cu ft 540 cu yards
Berm K	Length = 120 ft, Width = 9 ft Height = 1.5 ft	Rectangular	1,620 cu ft 60 cu yards
Pile L	Height = 8 ft, Radius = 5 ft	Pile	310 cu ft 11 cu yards
Pile M	Height = 3 ft, Radius = 19 ft	Pile	1,700 cu ft 63 cu yards
Pile N	Height = 4.5 ft, Radius = 10 ft	Pile	710 cu ft 26 cu yards
Pile P[4]	Height = 8 ft, Radius = 10 ft	Pile	1,260 cu ft 47 cu yards

[1] Berm A was re-surveyed after the Supplemental Phase II Remedial Investigation (RI) sampling and length was adjusted.
[2] Berm D encompasses Berm D and Berm G from the Supplemental Phase II RI Sampling and Analysis Plan.
[3] Pile I was re-surveyed after the Supplemental Phase II RI sampling and length was adjusted.
[4] Pile P identified during walkover with Ohio Environmental Protection Agency November 14, 2005.

Soil within CBP consists primarily of Mahoning silt loams, Trumbull silt loams, and Ellsworth silt loams. The Ellsworth silt loam is found near the southwestern boundary of the AOC. The Trumbull silt loam is found in the eastern portion of the AOC. The Mahoning silt loam covers the remainder of CBP (western and extreme eastern boundary).

The highest elevation within CBP is located near the southwestern portion of the AOC, which decreases towards the north. Sand Creek is located adjacent to the northwestern boundary of CBP. Surface water intermittently flows in several drainage ditches located within the AOC. Flow in the drainage ditches occurs during precipitation events and flow directions follow the general topographic slope toward Sand Creek. The ditches tend to hold water for extended periods due to the low permeability of most soil at CBP.

Photograph 2-1. Berms/Piles at CBP, April 2005

2.3 SUBSURFACE FEATURES

Subsurface lithology at CBP consists mostly of clay to sand-rich silt tills with interbedded sands scattered throughout. The till and sand deposits are generally firm, moderately plastic, and tend to hold water where encountered. Although bedrock was not encountered during the RI monitoring well installation, it is assumed bedrock is the Sharon Conglomerate bedrock based on available historical geologic and environmental surveys of the area.

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3.0 STUDY AREA INVESTIGATION

The scope of the Supplemental Phase II RI SAP (USACE 2005b) included collecting discrete surface (0-1 ft BGS) and discrete subsurface (1-3 ft BGS) soil samples throughout the AOC, and multi-increment soil samples at identified piles/berms. This section presents the rationale for samples collected during the field effort and provides a synopsis of the sampling methods employed during the investigation. Information regarding standard field decontamination procedures, sample container types, preservation techniques, sample labeling, chain-of-custody, and packaging and shipping requirements implemented during the field investigation are included in the Facility-Wide SAP (USACE 2001a) and the Supplemental Phase II RI SAP (USACE 2005b).

3.1 SURFACE AND SUBSURFACE SOIL LOCATIONS, DEVIATIONS, AND RATIONALE

The initial, proposed sample scheme and locations were presented in the Supplemental Phase II RI SAP (USACE 2005b). A site walkover with SAIC and Ohio EPA personnel was performed prior to sampling activities on November 14, 2005. From this site walkover, it was determined that all the proposed discrete sample locations at CBP were to be sampled as presented in the Supplemental Phase II RI SAP. Discrete soil samples for chemical analyses were collected from eight locations analyzed for explosives, inorganics, and/or hexavalent chromium.

Rationales for these sampling locations are as follows:

- Two discrete surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil samples were collected to define the manganese concentration, which exceeded background at location SS-026. One of the Supplemental Phase II RI sampling locations (CBP-035) is west-northwest of SS-026 and one location (CBP-036) is slightly southwest of SS-026.

- Three discrete surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil sample locations (CBP-CBP-037, CBP-038, and CBP-039) were planned to define a cluster of preliminary cleanup goal exceedances at the eastern portion of CBP. This cluster encompasses RI sample locations SS-004 to SS-021. This cluster of samples was bounded during RI sampling with the exception of the northeast.

- Three discrete surface (0-1 ft BGS) soil samples were collected for hexavalent chromium analysis. Hexavalent chromium analysis was not conducted during the original RI. Samples were collected from previous RI sample locations (CBPss-004, CBPss-018, and CBPss-033).

Adjustments were made to the proposed sampling scheme of CBP debris piles and berms. These adjustments were made with the approval of the Ohio EPA. Below are the adjustments made to the sampling scheme.

- Berms D and G were combined into one pile/berm and sampled as one location (Berm D, sample location identification number CBP-043) due to similar proximity and assumption that the berms were created from similar material and processes; and

- An additional Pile P was identified. Sample location CBP-045 was originally planned to represent Berm G. This sample location was changed to represent the newly identified Pile P.

Multi-increment samples were collected from the 12 identified debris piles and berms at CBP and analyzed for explosives and inorganics. In addition, samples were submitted for toxicity characteristic leaching procedure (TCLP) analyses to evaluate waste disposition options/requirements should remedial actions be deemed necessary.

The final sample locations were marked in the field based on site conditions, access considerations, visual survey of the area, and MEC considerations. Figure 3-1 illustrates these locations and Table 3-1 presents the sample location, rationale, and field notes.

Table 3-1. Soil Sample List and Rationales, CBP Supplemental Phase II RI

Area Description	Station ID	Sample Location/Rationale	Sample ID	Depth (ft)	Sample Collected (Yes/No)	Comments
CBP Discrete Sample Locations	CBP-035	AOC Boundary/Mn Exceedance	CBPss-035-0100-SO	0-1	Yes	--
	CBP-035		CBPso-035-0101-SO	1 to 3	Yes	--
	CBP-036		CBPss-036-0102-SO	0-1	Yes	--
	CBP-036	AOC Boundary/Preliminary Cleanup Goal Exceedances	CBPso-036-0103-SO	1 to 3	Yes	--
	CBP-037		CBPss-037-0104-SO	0-1	Yes	--
	CBP-037		CBPso-037-0105-SO	1 to 3	Yes	--
	CBP-038		CBPss-038-0106-SO	0-1	Yes	--
	CBP-038		CBPso-038-0107-SO	1 to 3	Yes	--
	CBP-039		CBPss-039-0108-SO	0-1	Yes	--
	CBP-039		CBPso-039-0109-SO	1 to 3	Yes	--
CBP Chromium Speciation	CBP-004	Chromium Speciation	CBPss-052-0122-SO	0-1	Yes	--
	CBP-018	Chromium Speciation	CBPss-053-0123-SO	0-1	Yes	--
	CBP-033	Chromium Speciation	CBPss-054-0124-SO	0-1	Yes	--
CBP Berms/Piles	CBP-040	Berm A Characterization	CBPss-040-0110M-SO	Top of berm to surrounding grade	Yes	--
	CBP-041	Pile B Characterization	CBPss-041-0111M-SO	Top of pile to surrounding grade	Yes	--
	CBP-042	Pile C Characterization	CBPss-042-0112M-SO	Top of pile to surrounding grade	Yes	--
	CBP-043	Berm D/G Characterization	CBPss-043-0113M-SO	Top of berm to surrounding grade	Yes	Berms D and G combined into one berm (Berm D)
	CBP-044	Pile E Characterization	CBPss-044-0114M-SO	Top of pile to surrounding grade	Yes	--
	CBP-045	Berm G Characterization	NA	Top of berm to surrounding grade	No	Berms D and G combined into one berm (Berm D)
	CBP-045	Pile P Characterization	CBPss-045-0115M-SO	Top of pile to surrounding grade	Yes	--
	CBP-046	Berm H Characterization	CBPss-046-0116M-SO	Top of berm to surrounding grade	Yes	--
	CBP-047	Pile I Characterization	CBPss-047-0117M-SO	Top of pile to surrounding grade	Yes	--
	CBP-048	Berm K Characterization	CBPss-048-0118M-SO	Top of berm to surrounding grade	Yes	--
	CBP-049	Pile L Characterization	CBPss-049-0119M-SO	Top of pile to surrounding grade	Yes	--
	CBP-050	Pile M Characterization	CBPss-050-0120M-SO	Top of pile to surrounding grade	Yes	--
	CBP-051	Pile N Characterization	CBPss-051-0121M-SO	Top of pile to surrounding grade	Yes	--

-- No Comment

3.2 FIELD SAMPLING METHODS

3.2.1 Discrete Surface Soil Field Sampling Method

The target depth interval for surface soil samples was 0-1 ft. One composite sample was collected for each discrete surface soil sample location. Because of the physical characteristics of explosives and propellant compounds (e.g., flakes, particles, and pellets) and the nature of munitions demolition operations, the distribution of these types of compounds in soil can be highly variable. Composite sampling has been shown to reduce statistical sampling error in surface soil at sites with a history of explosives contamination in surface soil (Jenkins et al. 1996) and to increase the likelihood of capturing detectable levels of explosives compounds over a given area. Composite sampling data are considered acceptable to the Ohio EPA for use in a risk assessment where concentrations are expected to vary spatially (USACE 2001a).

To collect composite samples for surface soil, three borings were hand augured in an equilateral triangle pattern measuring approximately 3 ft per side. Equal portions of soil from the three subsamples were collected as outlined in Section 3.2.4.1 and homogenized in as described in Section 3.2.4.2.

3.2.2 Discrete Subsurface Soil Field Sampling Method

To collect subsurface soil samples for chemical analyses, one of the three surface soil borings was deepened at each sample location over the required depth interval. Soil from the subsurface interval was collected as outlined in Section 3.2.4.1 and homogenized in as described in Section 3.2.4.2.

3.2.3 Multi-Increment Pile/Berm Field Sampling Method

Soil samples of berms and debris piles at CBP were collected using multi-increment sampling techniques. Multi-increment samples are composite samples collected from multiple stratified random points within each of the designated multi-increment sampling areas. The discrete samples discussed in the previous section were, in effect, composite samples, but collected from three (or four) points over a small discrete area (e.g., about 1 meter). MI samples are multiple-point (e.g., 30 minimum) composite samples collected over a much larger area. The sample aliquots comprising the sample were collected at random. Approximately equal sample aliquots were collected using a small-diameter push tube or hand auger. A sufficient number of aliquots were collected to provide statistical confidence that the average concentration of a particular chemical within a designated area is represented by the composite sample. Thirty aliquots were collected from each berm or pile to provide the requisite statistical confidence (95%).

Soil from each aliquot was placed into a stainless-steel bowl as outlined in Section 3.2.4.1 and the total soil was homogenized in as described in Section 3.2.4.2.

3.2.4 General Field Sampling Method

3.2.4.1 Soil Sample Collection

Each sample (discrete surface, discrete subsurface, and multi-increment) used decontaminated equipment to collect the soils. The collected soil samples (or combined sub-samples) were placed in a stainless-steel bowl, which was labeled with the Sample ID. Field descriptions and classifications for the soil samples were performed; the results were recorded in the project logbooks in accordance with Section 4.4.2.3 of the Facility-Wide SAP (USACE 2001a), as specified in the Supplemental Phase II RI SAP (USACE 2005b), with the exception that headspace gases in sample containers were not screened in the field for organic vapors. Organic vapor measurements were taken in the breathing zone during sampling and the results recorded on sample logs. Hand-auger borings were backfilled to the ground surface with dry bentonite chips.

3.2.4.2 Sample Homogenization

The samples were homogenized by MKM Engineers, Inc. using the approved procedure employed during the characterization of 14 AOCs (MKM 2005). The soil collected in the field were brought back to Building 1036 and logged for processing to ensure the chain-of-custody was maintained. The soil was spread and allowed to air dry overnight or up to two days. The air-dried soil was prepared for sieving by crushing and removing rocks and organic materials. The soil was then sieved using a #10 and #4 stainless-steel sieve. Any material not passing through the sieves was considered IDW. The remaining air-dried, sieved material was then ground using a decontaminated coffee grinder. The ground soil was incrementally placed into sample jars and submitted to the fixed-base laboratory for analysis

3.2.4.3 Disposal of Investigative-Derived Waste

Following preparation of the each sample, excess soil was designated as IDW and placed in lined 55-gallon open top drums staged at Building 1036. Details regarding the amount and final disposition of IDW are discussed in Appendix B.

3.3 ANALYTICAL PROGRAM OVERVIEW

3.3.1 Laboratory Analyses

All analytical procedures were completed in accordance with applicable professional standards, USEPA requirements, government regulations and guidelines, USACE Louisville District analytical quality assurance (QA) guidelines, and specific project goals and requirements. The sampling and analysis program conducted during the Supplemental Phase II RI for CBP involved the collection and analysis of surface soil, subsurface soil, and berm/pile materials. Specified samples were analyzed by an independent quality control (QC) laboratory under contract with the USACE Louisville District.

Samples were collected and analyzed according to the Facility-Wide SAP and the Supplemental Phase II RI SAP.

Samples collected during the investigation were analyzed by GPL Laboratories located in Gaithersburg, Maryland, a USACE Center of Excellence certified laboratory. The specified QC split samples were analyzed by USACE-contracted laboratory, Severn Trent Laboratories, located in North Canton, Ohio. Laboratories supporting this work have statements of qualifications including organizational structures, QA manuals, and standard operating procedures, which are available upon request.

The analytical data quality objectives (DQOs) for this project included analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data. Appendix C presents an assessment of those objectives as they apply to the analytical program.

QA/QC samples for this project included field blanks, QA field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, matrix spike/matrix spike duplicate (MS/MSD) samples, and QC field split samples (submitted to the independent USACE-contracted laboratory). Field blanks and equipment rinsate blanks were submitted for analysis along with field duplicate samples to provide a means to assess the quality of the data resulting from the field sampling program. The QC field split samples provide independent verification of the accuracy and precision of the principal analytical laboratory. The QC evaluation and the effect on project data quality are provided in Appendix D, Data Quality Summary Report (DQSR).

SAIC is the custodian of the project file and will maintain the contents of the file for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, and chain-of-custody forms. These files will remain in a secure area under the custody of the SAIC Program Manager until they are transferred to the USACE Louisville District and RVAAP. Analytical data reports from GPL Laboratories were forwarded to the USACE Louisville District laboratory data validation contractor (Lab Data Consultants, Inc.) for validation review and QA comparison. GPL Laboratories will retain all original raw data information (both hard and electronic formats) in a secure area under the custody of the laboratory project manager.

3.3.2 Sample Custody and Data Quality Assessment

Samples were properly packaged for shipment and dispatched to GPL Laboratories for analysis. A separate chain-of-custody record with sample numbers and locations listed was enclosed with each shipment. When transferring the possession of samples, the individuals who relinquished and received the samples signed, dated, and noted the time on the record. All shipments were in compliance with applicable U.S. Department of Transportation (DOT) regulations for environmental samples.

Data were produced, reviewed, and reported by the laboratory in accordance with specifications outlined in the Supplemental Phase II RI Quality Assurance Project Plan (QAPP) Addendum, the

USACE Louisville District analytical QA guidelines, and the laboratory's QA manual. Laboratory reports provide documentation that verifies analytical holding time was in compliance with QA guidelines.

GPL Laboratories performed in-house analytical data reduction under the direction of the laboratory project manager and QA officer. These individuals assessed data quality and informed SAIC of any data that were considered "unacceptable" or that required qualification as to their precision and accuracy. Data were reduced, reviewed, and reported as described in the laboratory QA manual and standard operating procedures, and were conducted as follows:

- Raw data produced by the analyst were turned over to the respective area supervisor.
- The area supervisor reviewed the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness.
- Upon acceptance of the raw data by the area supervisor, a report was generated and sent to the laboratory project manager.
- The laboratory project manager completed a thorough review of all reports.
- The laboratory project manager executed the final reports.

Data were then delivered to SAIC for data verification. GPL Laboratories prepared and retained full analytical and QC documentation for the project in both paper copy and electronic storage media (e.g., magnetic tape), as directed by the analytical methodologies employed. GPL Laboratories provided the following information to SAIC in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;
- Tabulated results of inorganic and organic compounds identified and quantified; and
- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, method blanks, and laboratory control sample information.

A systematic process for data verification was performed by SAIC to ensure that the precision and accuracy of the analytical data were adequate for their intended use. This verification also attempted to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach was consistent with DQOs for the project and with the analytical methods, and was appropriate for determining contaminants of concern and calculating risk. Analytical data were verified through the review process outlined in the SAP and are presented in Appendix E. Following

data verification, all data packages were forwarded to the USACE independent data validation contractor.

Independent data validation was performed by Lab Data Consultants, Inc. under a separate task with the USACE Louisville District. This review included a 1) comprehensive validation of 10 percent of the primary data set, 2) comprehensive validation of the QA split sample data set, and 3) comparison of primary sample, field duplicate sample, and field QA split sample information.

3.4 MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE

Although CBP is not included in the MMRP at RVAAP, MEC avoidance subcontractor support staff were present during all field operations. The ordnance and explosives (OE) Team Leader led an initial safety briefing to train all field personnel to recognize and avoid MEC. Daily tailgate safety briefings included reminders regarding MEC avoidance. Site visitors were briefed on MEC avoidance before they were allowed access to any of the AOCs addressed in the Supplemental Phase II RI SAP. Prior to beginning sampling activities, access routes into areas from which samples were to be collected were assessed for potential OE using visual surveys and hand-held magnetometers. At stations where subsurface soil samples were to be collected from 1-3 ft BGS, a magnetometer was lowered into the borehole to screen for subsurface magnetic anomalies at the top of the subsurface interval. Appendix G presents the MEC Survey Report.

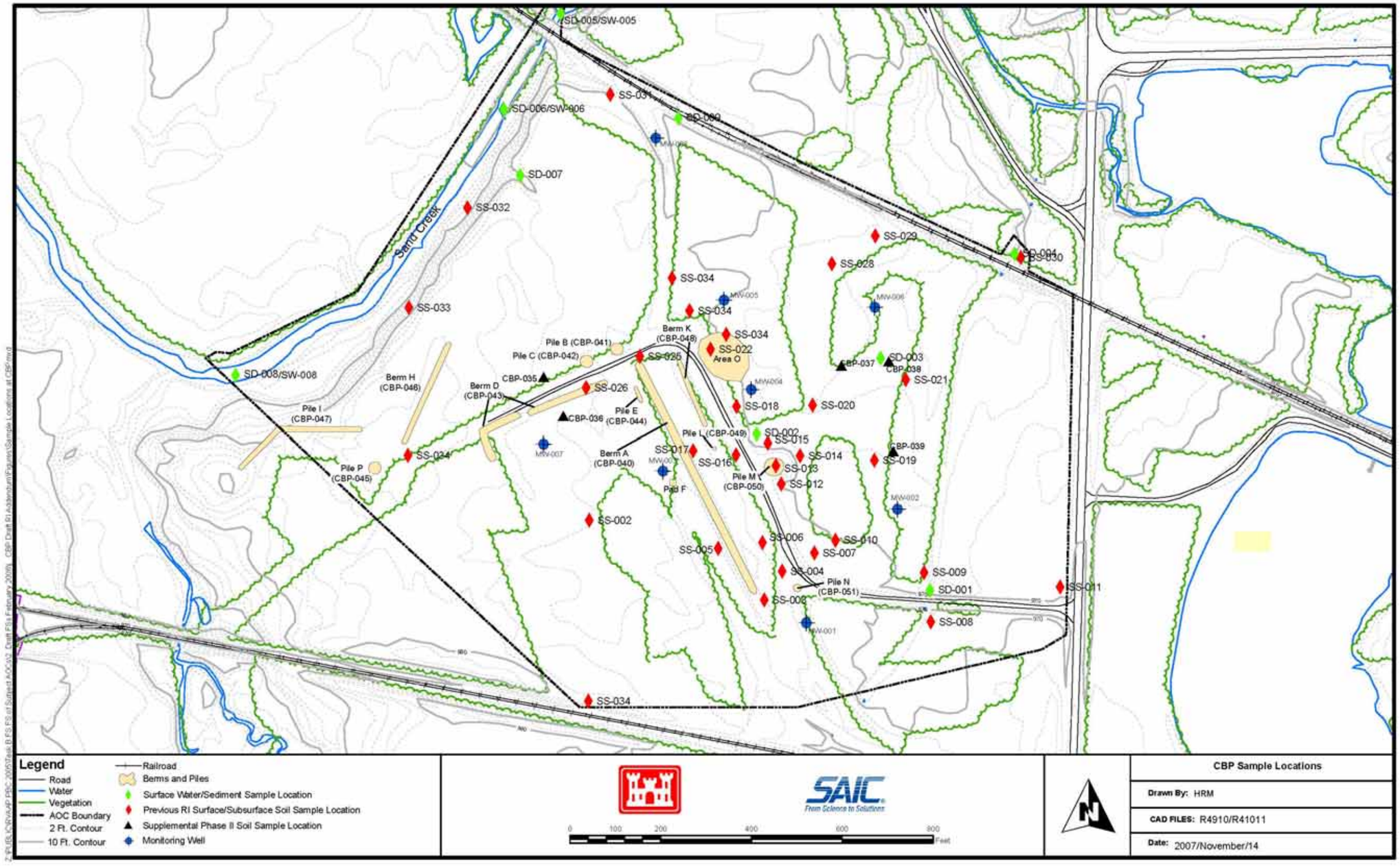

Figure 3-1. Sample Locations at CBP

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4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents results of the Supplemental Phase II RI. Chemicals that are deemed to be related to CBP operations are classified as site-related contaminant (SRCs). These SRCs are then evaluated to determine their occurrence and distribution in surface and subsurface soil at CBP. Section 4.1 presents the statistical methods and screening criteria used to reduce and display data and to distinguish naturally-occurring chemicals from SRCs indicative of historical site operations. Section 4.2 details the updated nature and extent of identified SRCs in surface and subsurface soil. Section 4.3 presents the findings of the multi-increment samples collected at the debris piles and berms. Section 4.4 updates the fate and transport assessment of chemicals of concern (COCs) in soil.

4.1 DATA EVALUATION METHODS

This Supplemental Phase II RI Report employed the established RVAAP data evaluation and screening processes used in the CBP RI Report (USACE 2005a) and other RIs for the facility, including: (1) defining data aggregates, (2) data reduction and screening, and (3) data presentation.

4.1.1 Data Aggregates

The CBP Supplemental Phase II RI soil data were grouped (aggregated) by environmental media as a single aggregate (soil) and then further aggregated on the basis of depth: surface soil from 0-1 ft (0-0.3 m) and subsurface soil greater than a depth of 1 ft. For the nature and extent section, only the Supplemental Phase II data are discussed.

Each pile or berm is evaluated on an individual basis. Berms/piles were not sampled in the CBP RI.

4.1.2 Data Reduction and Screening

Data reduction and screening steps to identify SRCs included the following: screening of inorganics against facility-wide background values and screening of essential human nutrients. A frequency of detection screening is not applicable as only five surface and five subsurface discrete samples were collected, in addition to the three samples for hexavalent chromium/total chromium analysis. The screening steps are summarized below.

- Facility-wide background values for inorganic chemicals in soil, sediment, surface water, and groundwater (bedrock and unconsolidated zones) were developed as part of a previous Phase II RI at the Winklepeck Burning Grounds at RVAAP (USACE 2001b). Any inorganic chemical exceeding its facility-wide background criterion for soil was considered to be an SRC. For inorganics not detected in the background data set, the background value is considered to be zero; thus, any detected value for these inorganics is considered to be above background.

- Chemicals considered to be essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) are not generally addressed as SRCs in the contaminant nature and extent evaluation and the HHRA (USEPA 1996) unless AOC-specific conditions indicate otherwise. For the CBP investigation, analyses were conducted for calcium, iron, magnesium, potassium, and sodium. These five chemicals were eliminated as SRCs for the nature and extent evaluation and HHRA.

4.1.3 Data Presentation

Data summary statistics and screening results for discrete surface and subsurface soil data are presented in Tables 4-1 and 4-2. Analytical results for selected SRCs are presented on maps to depict spatial distribution. Analytical results by sample location for classes of SRCs (e.g., explosive compounds or inorganics) are presented in Tables 4-3 through 4-6. Hexavalent chromium results and the results of the multi-increment sampling of debris piles and berms are presented separately in Sections 4.2.1.2 and 4.3, respectively. Complete analytical results are contained in Appendix E.

4.2 RESULTS OF DISCRETE SOIL SAMPLING AND ANALYSIS

Surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil samples were collected from five locations at CBP to further define the nature and extent of explosive and inorganic contamination. All discrete samples were analyzed for explosives and Target Analyte List (TAL) metals. Data summary statistics and screening results to identify SRCs are presented in Tables 4-1 and 4-2.

Table 4-1. Summary Statistics and Determination of Supplemental Phase II RI SRCs in CBP Surface Soil (0-1 ft BGS)

Analyte	CAS Number	Units	Results >Detection Limit	% Results >Detection Limit	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria	Max. > Bkg.?	Site Related?
Inorganics												
Aluminum	7429905	mg/kg	5/5	100	12200	9470	15500	14500	15500	17700	No	No
Antimony	7440360	mg/kg	4/5	80	0.398	0.39	0.56	0.548	0.56	0.96	No	No
Arsenic	7440382	mg/kg	5/5	100	12.2	10.2	16.5	14.7	16.5	15.4	Yes	Yes
Barium	7440393	mg/kg	5/5	100	74.9	53	92.7	89	92.7	88.4	Yes	Yes
Beryllium	7440417	mg/kg	5/5	100	0.593	0.43	0.84	0.745	0.84	0.88	No	No
Cadmium	7440439	mg/kg	2/5	40	0.09	0.08	0.34	0.226	0.34	0	Yes	Yes
Calcium	7440702	mg/kg	5/5	100	3390	475	10300	7170	10300	15800	No	No
Chromium	7440473	mg/kg	8/8	100	35	16.4	112	55.3	109	17.4	Yes	Yes
Chromium, hexavalent	18540299	mg/kg	1/3	33.3	1.36	3.6	3.6	4.63	3.6	--	--	Yes
Cobalt	7440484	mg/kg	5/5	100	9.24	7.7	11.1	10.5	11.1	10.4	Yes	Yes
Copper	7440508	mg/kg	5/5	100	12.4	7.6	22.2	17.9	22.2	17.7	Yes	Yes
Iron	7439896	mg/kg	5/5	100	22200	15400	31300	27700	31300	23100	Yes	No
Lead	7439921	mg/kg	5/5	100	25.2	17.9	30.1	29.9	30.1	26.1	Yes	Yes
Magnesium	7439954	mg/kg	5/5	100	2190	1390	3690	3030	3690	3030	Yes	No
Manganese	7439965	mg/kg	5/5	100	669	227	1260	1030	1260	1450	No	No
Mercury	7439976	mg/kg	5/5	100	0.059	0.03	0.1	0.0834	0.1	0.036	Yes	Yes
Nickel	7440020	mg/kg	5/5	100	16.9	9.6	26.4	23.2	26.4	21.1	Yes	Yes
Potassium	7440097	mg/kg	5/5	100	883	635	1250	1120	1250	927	Yes	No
Selenium	7782492	mg/kg	3/5	60	0.453	0.5	0.74	0.71	0.74	1.4	No	No
Sodium	7440235	mg/kg	1/5	20	57.6	100	100	80.3	100	123	No	No
Vanadium	7440622	mg/kg	5/5	100	24	16.6	29.5	28.4	29.5	31.1	No	No
Zinc	7440666	mg/kg	5/5	100	83.1	55.1	103	106	103	61.8	Yes	Yes
Organics-Explosives												
Nitrobenzene	98953	mg/kg	4/5	80	0.044	0.03	0.05	0.0525	0.05	--	--	Yes

-- Analysis not performed.

Table 4-2. Summary Statistics and Determination of Supplemental Phase II RI SRCs in CBP Subsurface Soil (1-3 ft BGS)

Analyte	CAS Number	Units	Results >Detection Limit	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria	Max. > Bkg.?	Site Related?
Inorganics											
Aluminum	7429905	mg/kg	5/5	12900	9840	14600	14700	14600	19500	No	No
Antimony	7440360	mg/kg	2/5	0.218	0.3	0.38	0.328	0.38	0.96	No	No
Arsenic	7440382	mg/kg	5/5	16.6	12	20.9	20.2	20.9	19.8	Yes	Yes
Barium	7440393	mg/kg	5/5	80.3	46.8	101	100	101	124	No	No
Beryllium	7440417	mg/kg	5/5	0.79	0.62	1	0.929	1	0.88	Yes	Yes
Calcium	7440702	mg/kg	5/5	1460	1170	1800	1760	1800	35500	No	No
Chromium	7440473	mg/kg	5/5	20.3	15.5	22.8	23.1	22.8	27.2	No	No
Cobalt	7440484	mg/kg	5/5	14.7	7.6	22.6	20	22.6	23.2	No	No
Copper	7440508	mg/kg	5/5	19.3	7.9	24.4	25.8	24.4	32.3	No	No
Iron	7439896	mg/kg	5/5	29500	25000	34300	33700	34300	35200	No	No
Lead	7439921	mg/kg	5/5	15.3	13.9	16.4	16.4	16.4	19.1	No	No
Magnesium	7439954	mg/kg	5/5	3230	1940	4700	4310	4700	8790	No	No
Manganese	7439965	mg/kg	5/5	598	237	1410	1040	1410	3030	No	No
Mercury	7439976	mg/kg	5/5	0.024	0.02	0.03	0.0292	0.03	0.044	No	No
Nickel	7440020	mg/kg	5/5	27.5	15.9	36.3	37.4	36.3	60.7	No	No
Potassium	7440097	mg/kg	5/5	1220	849	1530	1480	1530	3350	No	No
Selenium	7782492	mg/kg	1/5	0.27	0.54	0.54	0.414	0.54	1.5	No	No
Sodium	7440235	mg/kg	1/5	58.1	64	64	65.2	64	145	No	No
Thallium	7440280	mg/kg	1/5	0.339	0.47	0.47	0.462	0.47	0.91	No	No
Vanadium	7440622	mg/kg	5/5	23.9	22.1	29.1	26.7	29.1	37.6	No	No
Zinc	7440666	mg/kg	5/5	65.8	43.5	79.2	79.1	79.2	93.3	No	No
Organics-Explosives											
Nitrobenzene	98953	mg/kg	4/5	0.042	0.03	0.04	0.0524	0.04	--	--	Yes

-- Analysis not performed.

4.2.1 Surface Soil (0-1 ft)

4.2.1.1 Explosives

Nitrobenzene was detected in four of the five surface soil samples (Table 4-3). The maximum detection was 0.05 mg/kg (CBP-036 and CBP-037) (Figure 4-1). The detections of nitrobenzene in the Supplemental Phase II samples were all estimated values below reporting limits. No other explosives were detected. The extent of explosives is defined to below reporting limits at CBP.

Table 4-3. Explosive SRCs Detected in Surface Soil (0-1 ft BGS) at CBP

Analyte (mg/kg)	Station				
	CBP-035	CBP-036	CBP-037	CBP-038	CBP-039
Nitrobenzene	0.1 U	0.05 J	0.05 J	0.03 J	0.04 J

J - Estimated value less than reporting limits.
U - Not detected.

4.2.1.2 Hexavalent Chromium

Three previous RI sample locations (CBPSS-004, CBPSS-018, and CBPSS-033) were re-sampled and analyzed for hexavalent and total chromium in surface soil (0-1 ft BGS). The analytical results were evaluated to determine the percentage of hexavalent chromium at CBP (Supplemental Phase II Sample IDs CBP-052, CBP-053, and CBP-054). Two of the surface soil samples were collected from areas previously identified as having elevated total chromium (CBP-052 and CBP-053) and one was collected from an area that did not appear to have chromium elevated above background (CBP-054). Results for these three samples are included in the summary statistics for CBP (Table 4-1). The only detected concentration for hexavalent chromium was 3.6 mg/kg at location CBP-054 (Table 4-4). Hexavalent chromium comprised 11.1%, of the total chromium at this sample location. Figure 4-2 illustrates the chromium results collected in Supplemental Phase II RI surface soil samples.

Table 4-4. Chromium Results in Surface Soil (0-1 ft BGS) at CBP

Analyte (mg/kg)	Background Criteria	Station		
		CBP-052	CBP-053	CBP-054
Chromium, hexavalent	--	0.51 U	0.48 U	3.6 =
Chromium, total	17.4	105 =#	35 =#	32.3 =#
% Hexavalent Chromium	--	<0.49%	<1.4%	11.1%

U - Not detected
= - Analyte present and concentration accurate.
- Value above Facility-Wide background
-- Background criteria not defined at RVAAP.

4.2.1.3 Inorganics

Twenty-one inorganic compounds, with the exception of hexavalent chromium, were detected in surface soil samples (0-1 ft BGS) collected during the Supplemental Phase II RI (Table 4-1). Ten inorganic chemicals were identified as SRCs (Table 4-5).

Two discrete surface (0-1 ft BGS) soil sample locations (CBP-035 and CBP-036) were collected specifically to define the extent of manganese contamination exceeding background at location SS-026 (Figure 4-3). The Supplemental Phase II RI results were well below the facility-wide background values for manganese (1,450 mg/kg). The maximum concentration at these two locations was 619 mg/kg at CBP-035.

Table 4-5. Inorganic SRCs Detected in Surface Soil (0-1 ft BGS) at CBP

Analyte (mg/kg)	Background Criteria	Station				
		CBP-035	CBP-036	CBP-037	CBP-038	CBP-039
Arsenic	15.4	13.1 J	16.5 =#	10.5 =	10.4 =	10.5 =
Barium	88.4	82.1 J	68.6 J	53 J	92.7 J#	77.6 J
Cadmium	0	0.34 =#	0.02 U	0.02 U	0.08 =#	0.02 U
Chromium	17.4	25.8 =#	22.3 =#	21.3 =#	18.8 =#	18.3 =#
Cobalt	10.4	7.8 =	11.1 =#	8.9 =	9.9 =	9.1 =
Copper	17.7	12.4 =	22.2 J#	7.6 J	10.4 J	9.5 J
Lead	26.1	30.1 =#	25.3 =	23.5 =	29.3 =#	17.9 =
Mercury	0.036	0.1 =#	0.03 J	0.05 =#	0.05 =#	0.06 =#
Nickel	21.1	21 =	26.4 =#	12.1 =	14.7 =	11.4 =
Zinc	61.8	103 =#	98.9 =#	55.1 =	101 =#	57.4 =

J - Estimated value less than reporting limits.
U - Not detected.
= - Analyte present and concentration accurate.
- Value above Facility-Wide background.

4.2.2 Subsurface Soil (1-3 ft)

4.2.2.1 Explosives

Nitrobenzene was detected in four of the five subsurface soil samples (Table 4-6). The maximum detection was 0.04 mg/kg (CBP-036, CBP-037, and CBP-039) (Figure 4-4). The detections of nitrobenzene in the Supplemental Phase II samples were all estimated values below reporting limits. No other explosives were detected.

Table 4-6. Explosive SRCs Detected in Subsurface Soil (1-3 ft BGS) at CBP

Analyte (mg/kg)	Station				
	CBP-035	CBP-036	CBP-037	CBP-038	CBP-039
Nitrobenzene	0.12 U	0.04 J	0.04 J	0.03 J	0.04 J

J - Estimated value less than reporting limits.
U - Not detected.

4.2.2.2 Inorganics

Twenty-one inorganic compounds were detected in subsurface soil samples (1-3 ft BGS) collected during the Supplemental Phase II RI (Table 4-2). Only arsenic and beryllium were detected above

background and were identified as SRCs (Table 4-7). Figure 4-5 illustrates the results for inorganic SRCs in Supplemental Phase II RI subsurface soil samples.

Manganese was not detected above background in any of the Supplemental Phase II subsurface soil samples.

Table 4-7. Inorganic SRCs Detected in Subsurface Soil (1-3 ft BGS) at CBP

Analyte (mg/kg)	Background Criteria	Station				
		CBP-035	CBP-036	CBP-037	CBP-038	CBP-039
Arsenic	19.8	14.7 J	20.9 =#	20.2 =#	12 =	15 =
Beryllium	0.88	0.62 =	0.82 =	1 =#	0.69 =	0.82 =

J - Estimated value less than reporting limits.
= - Analyte present and concentration accurate.
- Value above Facility-Wide background.

4.3 MULTI-INCREMENT SAMPLES

MI samples were collected from the 12 identified debris piles and berms at CBP and analyzed for explosives and inorganics (including hexavalent chromium). These MI samples were collected to determine the disposition options and requirements for the debris piles and berms. One MI sample was collected for each pile and berm. The data are summarized in Tables 4-8 and 4-9. In addition, samples from the piles and berms were submitted to the analytical laboratory for TCLP analysis. Explosive and inorganic analytical results are presented in Sections 4.3.1 and 4.3.2, respectively. The analytical data for the MI samples are presented in Appendix E.

4.3.1 Explosives

Three explosives (2,6-dinitrotoluene, nitrobenzene, and tetryl) were detected in at least one MI sample (Table 4-8). All detections of the three explosives were estimated values below reporting limits. Figure 4-6 illustrates the results for explosives in the berms/piles.

Table 4-8. Explosives Detected in Multi-Increment Samples at CBP

Analyte (mg/kg)	Station											
	CBP-040	CBP-041	CBP-042	CBP-043	CBP-044	CBP-045	CBP-046	CBP-047	CBP-048	CBP-049	CBP-050	CBP-051
2,6-Dinitrotoluene	0.1 U	0.1 U	0.08 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nitrobenzene	0.02 J	0.03 J	0.1 U	0.1 U	0.03 J	0.1 U	0.05 J	0.1 U	0.04 J	0.1 U	0.1 U	0.1 UJ
Tetryl	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.02 J	0.06 J	0.03 J

J - Estimated value less than reporting limits.
U - Not detected.

4.3.2 Inorganics

Sixteen inorganics were identified in the piles/berms (Table 4-9). Figure 4-7 illustrates the inorganic detections at CBP piles/berms.

In addition to TAL metals, samples from the debris piles and berms were also analyzed for hexavalent chromium and results are presented in Table 4-9 and Figure 4-7. Samples collected at each pile and berm were analyzed for hexavalent chromium to determine the percentage of hexavalent chromium contributing to the measured total chromium. Hexavalent chromium was detected in 2 of 12 samples. Hexavalent chromium made up 4.3% of the total chromium at CBP-049 and 24% of the total chromium at CBP-051.

Table 4-9. Inorganics Detected in Multi-Increment Samples at CBP

Analyte (mg/kg)	Back-ground Criteria	Station											
		CBP-040	CBP-041	CBP-042	CBP-043	CBP-044	CBP-045	CBP-046	CBP-047	CBP-048	CBP-049	CBP-050	CBP-051
Chromium, hexavalent	--	0.42 U	0.47 U	0.4 U	0.48 U	0.43 U	0.49 U	0.53 U	0.42 U	0.49 U	1.2 =	0.42 U	25 =
Aluminum	17700	14500 =	15900 =	6960 =	18100 =#	12400 =	6190 =	16900 =	12500 =	32600 =#	22300 =#	12700 =	10200 =
Antimony	0.96	0.47 J	0.88 J	0.93 J	0.4 UJ	0.96 J	0.46 J	0.69 J	0.34 U	0.37 UJ	0.51 J	39.3 =#	6.5 =#
Arsenic	15.4	10 =	14.6 =	21.3/=#	8.8 =	15.6 =#	15 =	9.9 =	11.3 =	5.4 =	10.8 =	12 =	40.1 =#
Barium	88.4	121 J#	135 J#	87 J	329 J#	132 J#	73.1 J	222 J#	76.8 =	465 J#	264 =#	1560 =#	317 =#
Beryllium	0.88	1.1 =#	1.3 =#	0.67=	2.4 =#	1.2 =#	0.37 =	2.1 =#	0.6 =	3.6 =#	2.2 =#	1.6 U	1.1 =#
Cadmium	0	0.35 =#	0.68 =#	0.92 =#	0.69 =#	0.27 =#	0.43 =#	0.79 =#	0.36 =#	0.38 =#	0.27 =#	14.1 =#	6.2 =#
Chromium	17.4	51.6 J#	27.9 J#	19.2 J#	28.9 =#	28.3 =#	13.8 J	20.5 J#	18.8 =#	40.8 J#	27.8 =#	23.1 =#	105 =#
Copper	17.7	13.9 =	28.5 =#	113 =#	13.2 =	38.7 J#	9.9 =	16.4 =	15.7 =	14.8 =	18 =#	12800 =#	380 =#
Lead	26.1	20.7 =	75.1 =#	62.1 =#	57.9 =#	85.3 =#	29.8 =#	56.1 =#	37.3 =#	15.4 =	21.6 =	8560 =#	348 =#
Manganese	1450	1540 =#	1320 =	1050 =	2790 =#	3130 =#	690 =	1880 =#	733 =	5290 =#	2630 =#	668 =	745 =
Mercury	0.036	0.04 =#	0.05 =#	0.06 =#	0.04 =#	0.04 =#	0.06 =#	0.06 =#	0.06 =#	0.04 =#	0.13 =#	0.04 =#	28 =#
Nickel	21.1	24.6 =#	20.6 =	19.5=	17.1 =	24.9 =#	15.4 =	18.1 =	16.5 =	9 =	13.9 =	26.3 =#	30.7 =#
Selenium	1.4	1.8 J#	1.6 =#	1.4 J	1.6 J#	0.5 J	0.91 =	1 J	0.73 =	3.6 J#	2.3 J#	3.9 =#	2.7 =#
Silver	0	0.21 U	0.08 U	0.11 J#	0.24/U	0.04 U	0.05 U	0.22 U	0.04 U	0.9 J#	0.2 U	0.73 =#	98.2 =#
Thallium	0	1.4 U	0.54 U	0.57 U	1.6 U	2.4 U	0.3 U	1.5 U	0.27 U	2.9 U	1.3 U	0.84 J#	0.41 J#
Zinc	61.8	58.1 =	131 =#	151 =#	65.5 =#	151 =#	67.2 =#	75.1 =#	127 =#	34.3 =	72.9 =#	8780 =#	490 =#

J - Estimated value less than reporting limits.
U - Not detected.
= - Analyte present and concentration accurate.
- Value above Facility-Wide background.

4.4 FATE AND TRANSPORT ASSESSMENT OF COCS IN SOIL

The CBP RI Report (USACE 2005a) concluded no potential impact to groundwater from COCs in soil at this AOC. The addition of the Supplemental Phase II RI data does not change these conclusions. Actions to remediate soil to ensure protection of groundwater are not required. The primary contaminant migration pathways of concern for contaminants at CBP are overland runoff and

transport in surface drainage channels, including Sand Creek. Based on contamination concentrations found in soil, leaching from the soil is not a significant pathway. No organic chemicals were detected in the groundwater, indicating that leaching and migration within groundwater has not occurred to date.

4.5 SUMMARY OF CONTAMINANT NATURE AND EXTENT

The results of the Supplemental Phase II RI identified one explosive (nitrobenzene) in surface and subsurface soil. The maximum detection was 0.05 mg/kg in CBP-036 and CBP-037 surface soil samples. These results are below the reporting limit for nitrobenzene. The extent of explosives in surface and subsurface soil at CBP has been defined to reporting limits with the additional data collected.

Two discrete surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil samples (CBP-035 and CBP-036) were collected to define the extent of manganese contamination which exceeded background at location SS-026. All four samples (two surface and two subsurface) were well below the facility-wide background values for manganese (1,450 mg/kg for surface soil and 3,030 mg/kg for subsurface soil). Therefore, the extent of inorganic contamination in surface and subsurface soil at CBP has been defined with the additional data collected.

Samples of debris pile and berm materials at CBP were collected using MI sampling techniques. The MI sample results from Piles M and N indicated they contained inorganic contaminants at much higher levels than surrounding soil. Supplemental Phase II sampling indicated Pile M had a lead concentration of 8,560 mg/kg and also a lead TCLP result of 15.4 mg/L. This TCLP result exceeded the maximum concentration of lead (5.0 mg/L) for toxicity characteristics and the debris pile material was classified as a potential characteristically hazardous waste. The MI sample for Pile N had a detected value of 25 mg/kg of hexavalent chromium. There is no TCLP criterion for hexavalent chromium; however, the result was highly elevated compared to RVAAP background values and concentrations in the surrounding soil at CBP.

Although there are some slight exceedances of inorganic background values in the discrete soil samples, the RI and Supplemental Phase II RI investigations effectively determined the nature and extent of inorganic and explosives contamination at CBP. No data gaps have been identified following completion of the Supplemental Phase II RI. No additional soil characterization is recommended

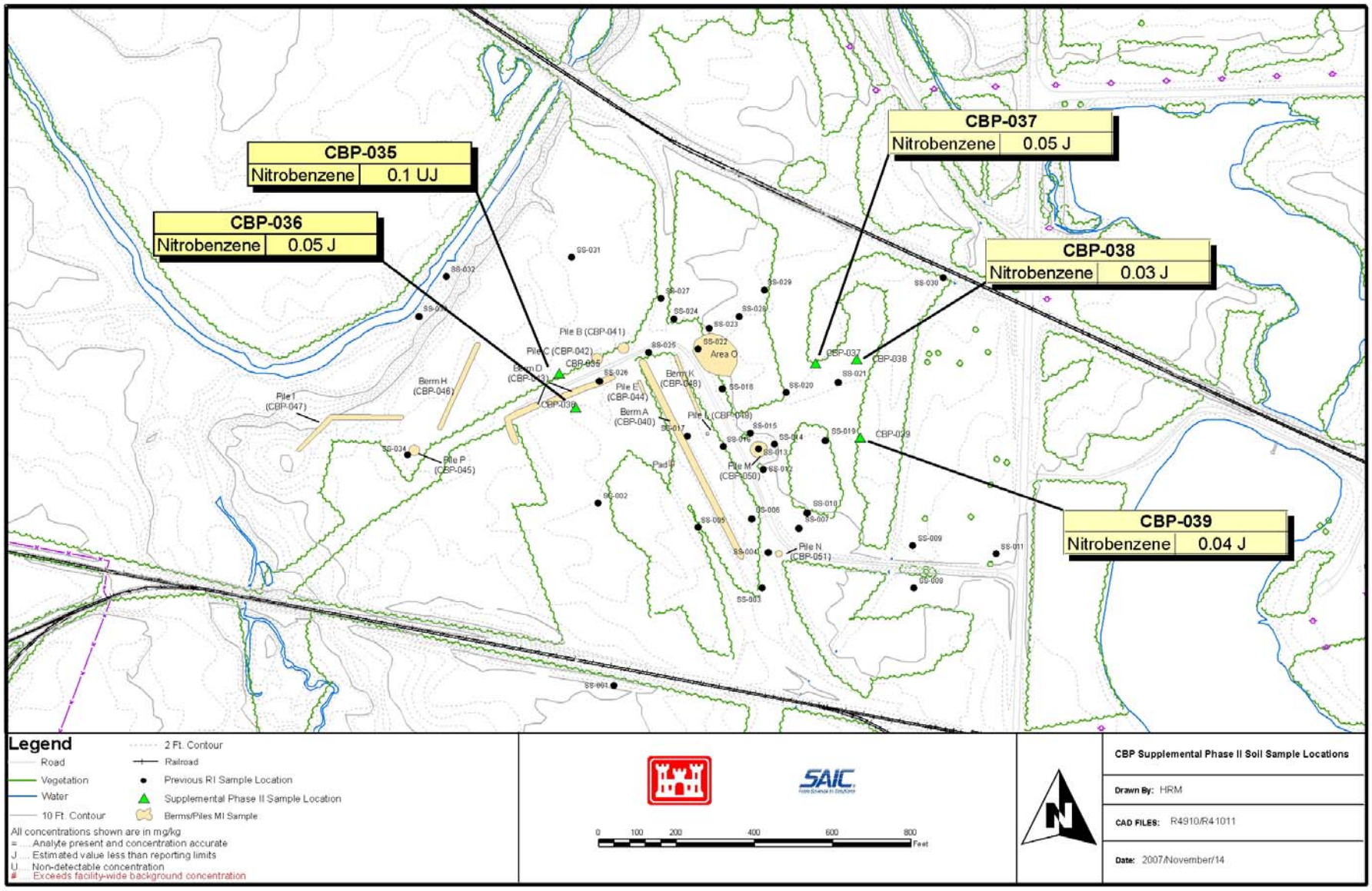

Figure 4-1. Occurrences of Detected Explosives in Surface Soil (0-1 ft), CBP Supplemental Phase II RI

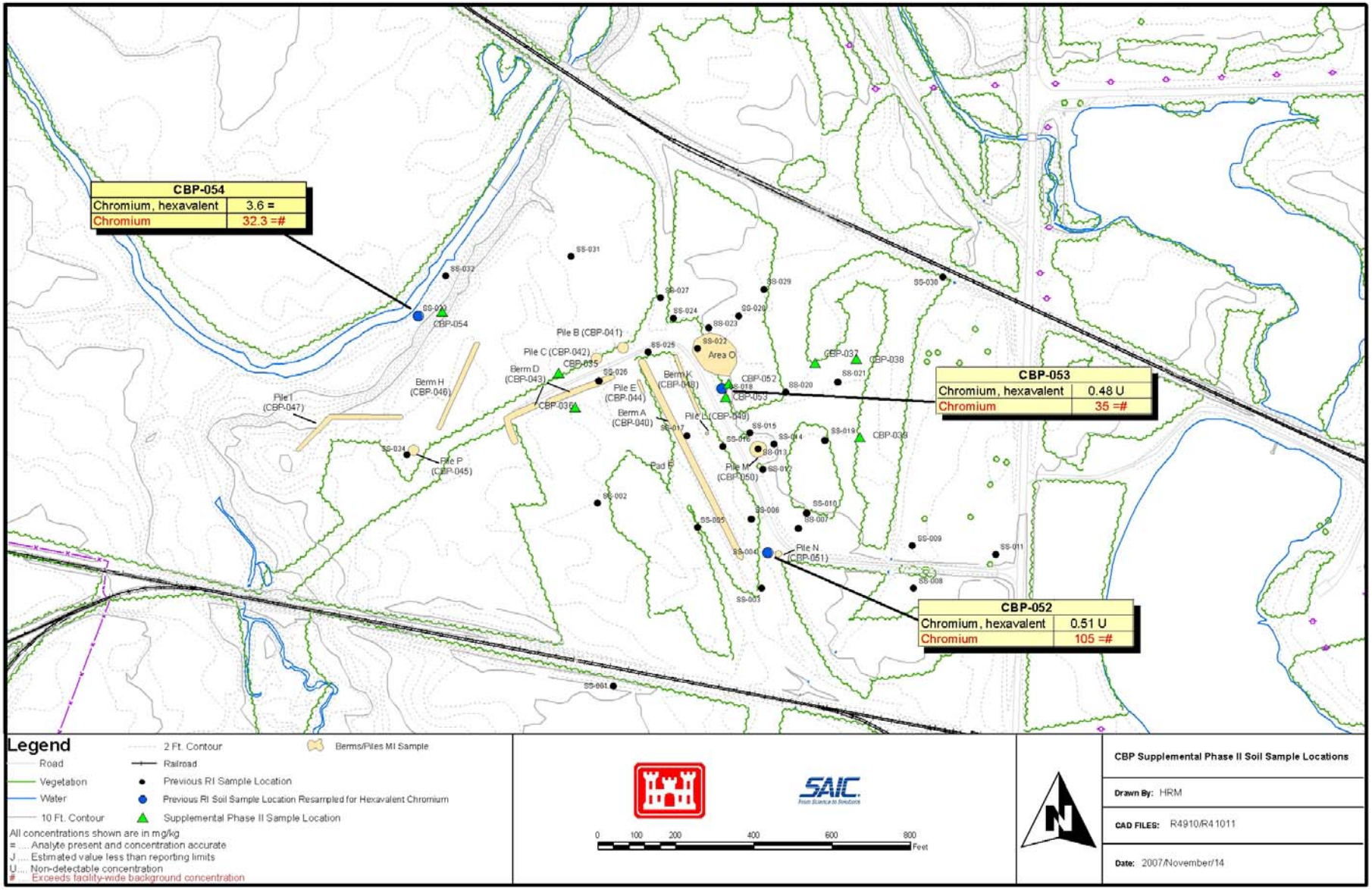

Figure 4-2. Occurrences of Hexavalent Chromium in Surface Soil (0-1 ft BGS) Samples, CBP Supplemental Phase II RI

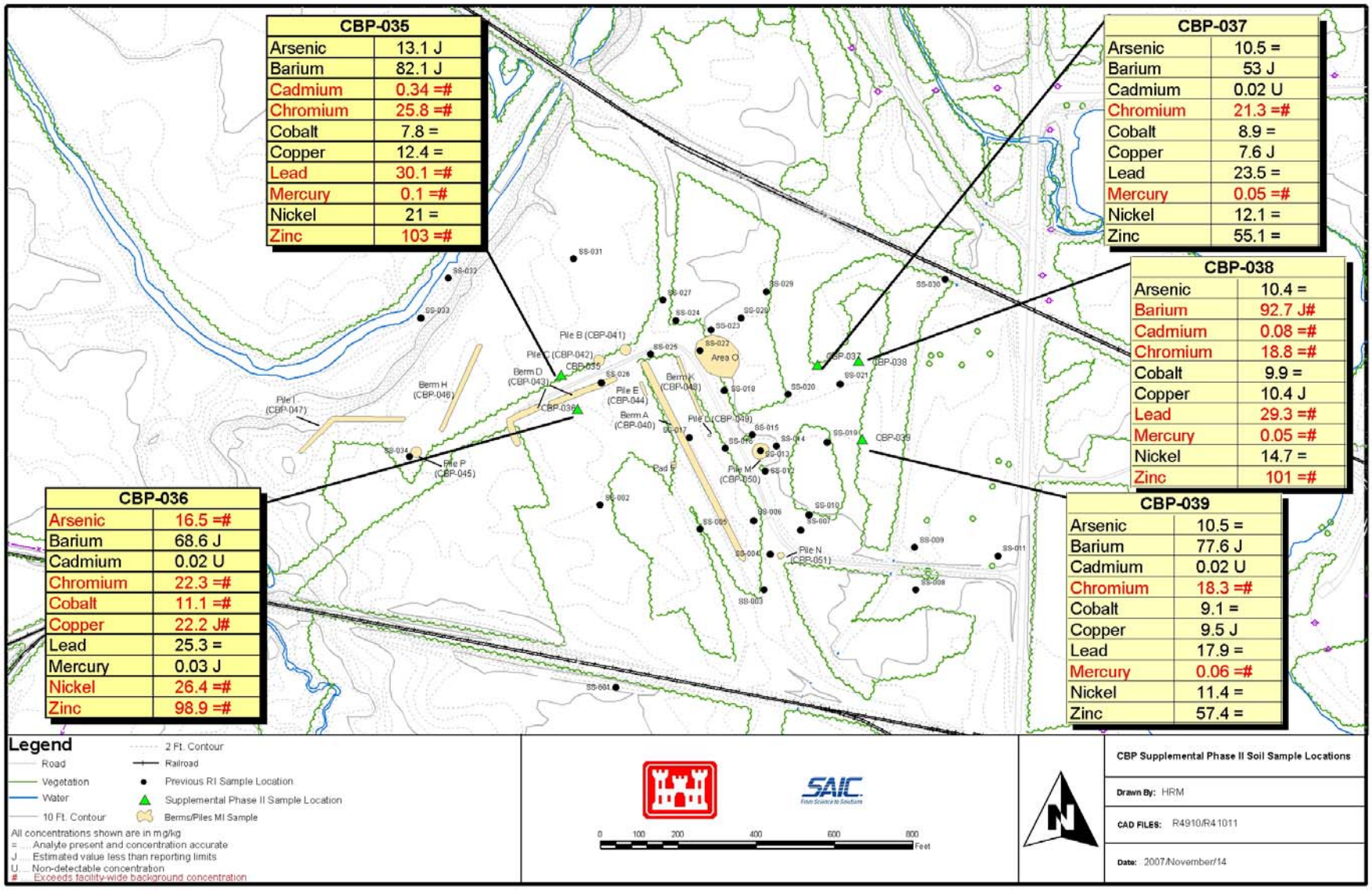

Figure 4-3. Occurrences of Detected Inorganic SRCs in Surface Soil (0-1 ft), CBP Supplemental Phase II RI

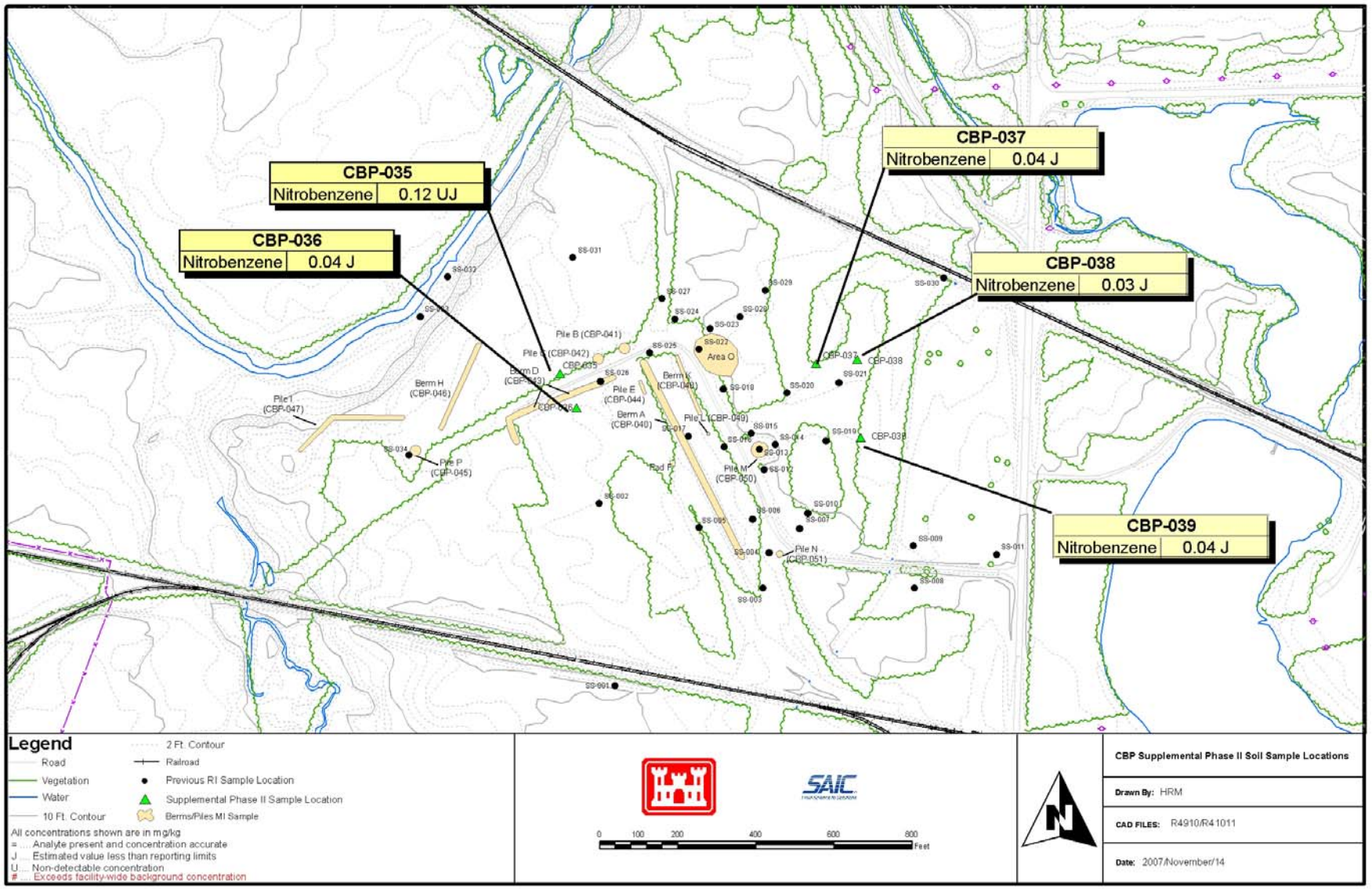

Figure 4-4. Occurrences of Detected Explosives in Subsurface Soil (1-3 ft), CBP Supplemental Phase II RI

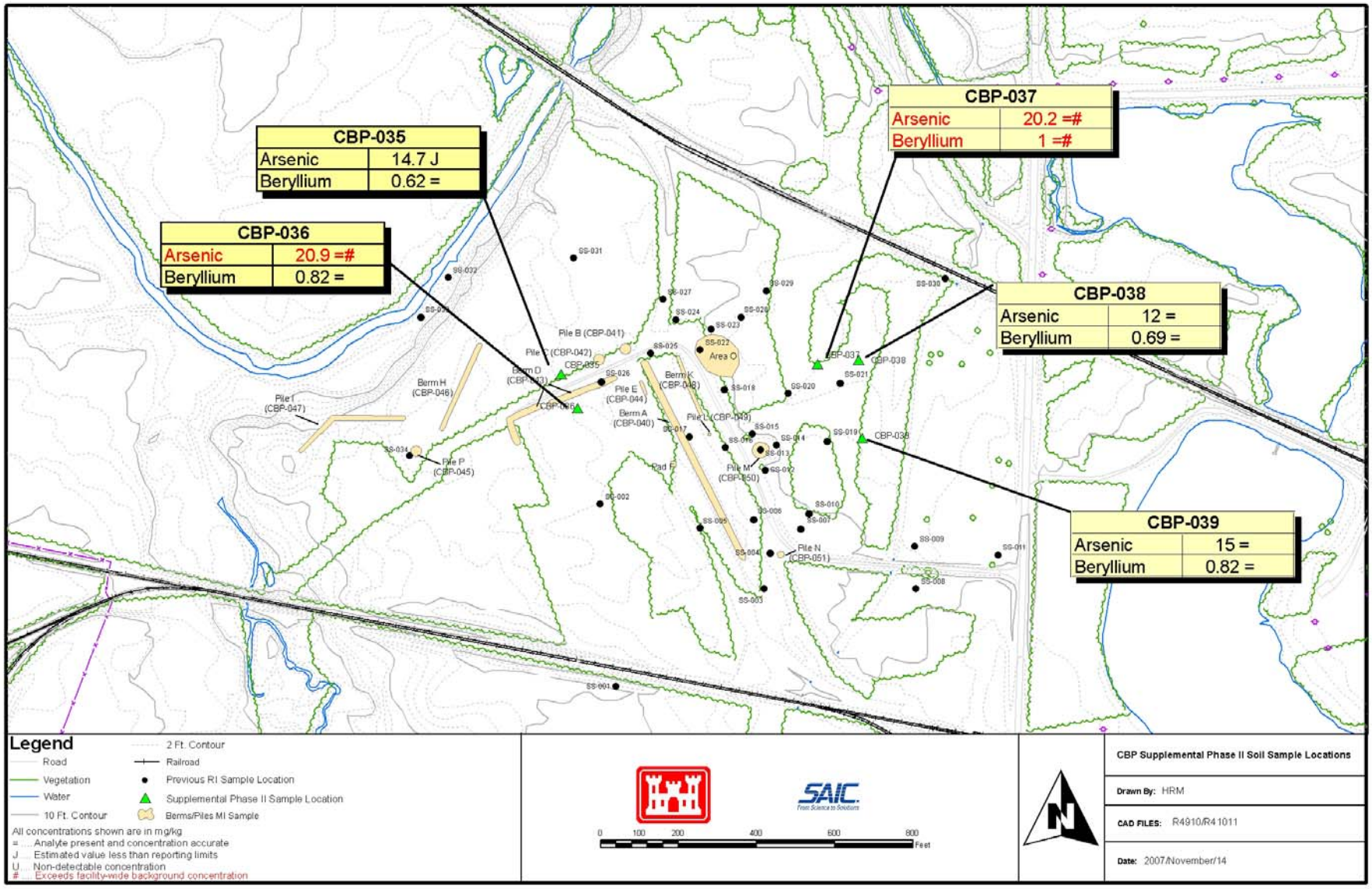

Figure 4-5. Occurrences of Detected Inorganic SRCs in Subsurface Soil (1-3 ft), CBP Supplemental Phase II RI

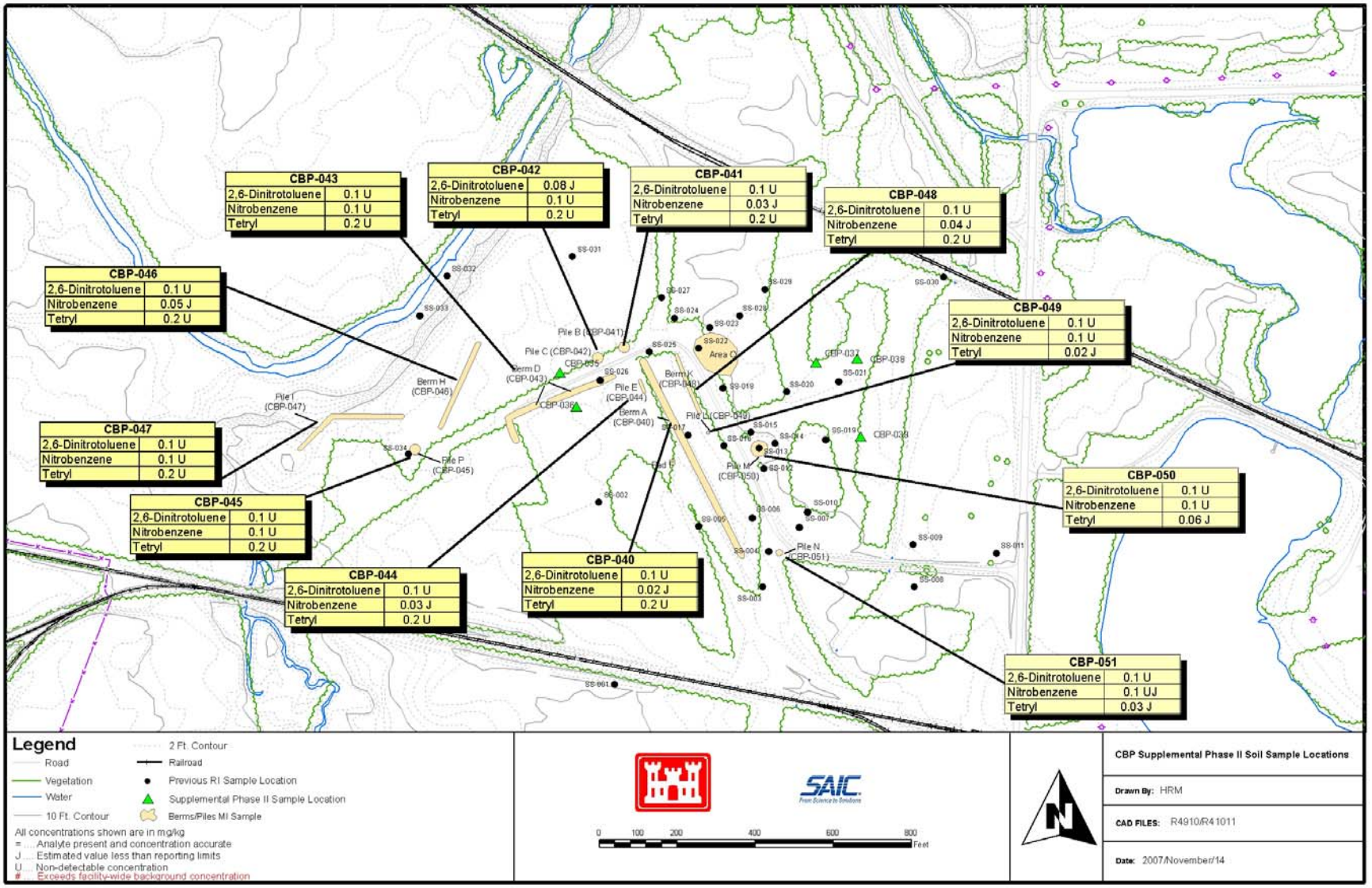

Figure 4-6. Occurrences of Detected Explosive SRCs in Multi-Increment Samples, CBP Supplemental Phase II RI

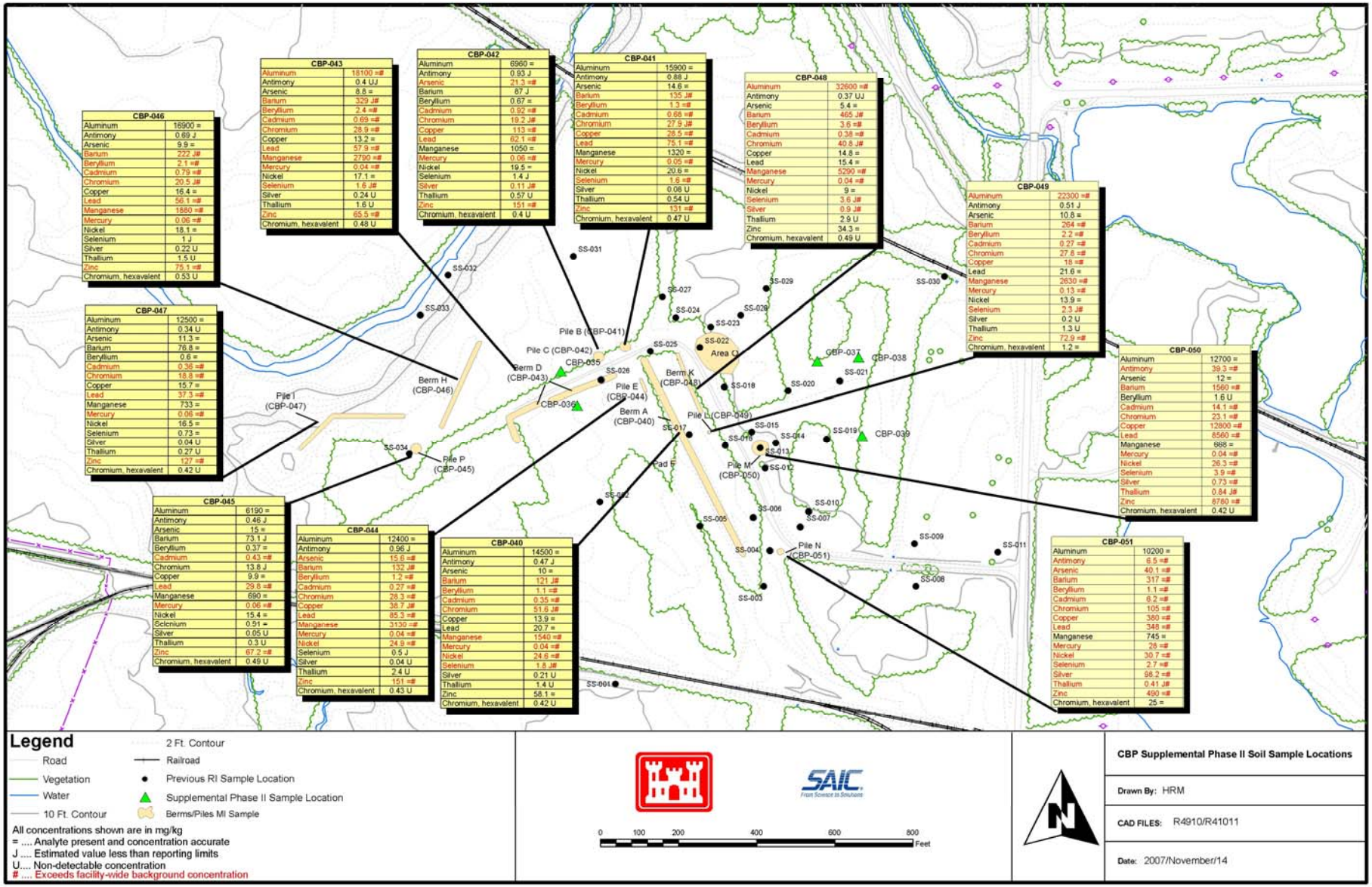

Figure 4-7. Occurrences of Detected Inorganic SRCs in Multi-Increment Samples, CBP Supplemental Phase II RI

5.0 QUALITATIVE RISK EVALUATION

This qualitative risk evaluation assesses whether the Supplemental Phase II RI soil (surface and subsurface discrete samples) data alters the conclusions of the HHRA and SERA presented in the original RI Report (USACE 2005a).

Tables 5-1 through 5-3 provide summary statistics and identification of SRCs and chemicals of potential concern (COPCs) for discrete soil samples for the soil data sets used in the original RI Report and revised soil data sets including both the original RI data and the Supplemental Phase II RI data collected in November 2005. The evaluation of the supplemental data falls into three categories:

1. Identifying chemicals where the addition of the Supplemental Phase II RI data does not alter the conclusions of the original RI risk assessment;

2. Identifying chemicals where the addition of the Supplemental Phase II RI data alters the conclusions of the oringial RI risk assessment; and

3. Identifying new chemicals (potentially new SRCs) detected in the supplemental data, but not detected or evaluated in the original RI Report data set.

Chemicals in each of these three categories are summarized below for shallow surface soil (0-1 ft BGS), deep surface soil (0-4 ft BGS), and subsurface soil (1-30 ft BGS).

5.1 SHALLOW SURFACE SOIL (0-1 FT BGS)

Summary statistics for shallow surface soil (0-1 ft BGS) data are provided in Table 5-1. The shallow surface soil statistics presented in the original RI Report were calculated by MKM Engineers, Inc. When SAIC calculated the same statistics, using the same data and the same rules, but using different software, the statistical results were the same (within rounding error) for all chemicals, except the 95% upper confidence limit (UCL) on the mean for cobalt. The 95% UCL for cobalt presented in the RI Report is 8.4 mg/kg. The 95% UCL calculated by SAIC is 13 mg/kg. Both values are well below the Region 9 residential PRG (140 mg/kg); therefore, this difference in statistical results does not alter the conclusions presented in the original RI Report.

The impact of inclusion of the Supplemental Phase II data on the conclusions of the HHRA and SERA is summarized in the following sections.

5.1.1 Chemicals for which Original HHRA Conclusions are Unchanged

Forty-four chemicals were detected in shallow surface soil (0-1 ft BGS) samples collected during the RI. For 43 of these chemicals, the determination whether or not they were SRCs/COPCs in the original RI HHRA does not change when including the Supplemental Phase II RI data. The remaining

chemical (chromium) was not identified as a COPC with inclusion of the Supplemental Phase II RI data and is discussed further in Section 5.1.2. For the remaining 43 chemicals, the exposure point concentration (EPC) (95% UCL or maximum detected concentration [MDC]) reported in the RI Report is very similar to the EPC calculated with the Supplemental Phase II RI data included (i.e., using two significant figures, the ratios of the revised EPC/original EPC range from 0.64 to 1.2). Chemicals with EPCs that decrease, increase, and stay the same are listed below:

- The EPCs for 11 chemicals (barium, beryllium, calcium, cobalt, copper, lead, magnesium, manganese, selenium, sodium, and zinc) are slightly lower with the Supplemental Phase II RI data included (revised EPC/original EPC range from 0.64 to 0.94). Eight of these chemicals (barium, beryllium, calcium, cobalt, magnesium, selenium, sodium, and zinc) were not COPCs in the RI Report and are not COPCs when the supplemental data are included. For the three that were COPCs (copper, lead, and manganese) in the RI Report, the maximum hazard quotient (HQ) for these chemicals (0.28) was below the acceptable level using the previous (higher) EPC; therefore, this reduction in the EPC does not change the conclusions of the HHRA.

- Seven of the 11 metals noted above (barium, cobalt, copper, lead, manganese, selenium, and zinc) were chemicals of ecological concern (COECs) in the RI Report SERA. The reduction in the EPCs for these metals is not enough to reduce HQs to below 1; therefore, the reduction in the EPCs does not change the conclusions of the SERA or the weight of evidence evaluation.

- The EPCs for three chemicals (cadmium, mercury, and nickel) are slightly larger with the supplemental data included (revised EPC/original EPC range from 1.1 to 1.2). These metals were not COPCs in the original RI Report and are not COPCs when the supplemental data are included.

- Cadmium, mercury, and nickel were also COECs in the SERA. The small increase in EPCs would result in a small increase in the HQs (which were already above 1) for these COECs, but does not change the conclusions of the SERA or the weight of evidence evaluation.

- The EPCs for the remaining 29 chemicals are unchanged (revised EPC/original EPC = 1.0).

The conclusions of the HHRA and SERA would be unchanged for these 43 chemicals.

5.1.2 Chemicals for which Original HHRA Conclusions Change

Chromium was identified as a COPC in the original RI data set; however, the classification changed with inclusion of the Supplemental Phase II RI data, as discussed below.

Chromium: In the absence of hexavalent chromium data, total chromium was conservatively evaluated as hexavalent chromium in the original RI Report. The supplemental data include

three samples analyzed for both hexavalent chromium and total chromium to evaluate what percentage of total chromium at CBP may be hexavalent chromium. Two samples were collected from areas previously identified as having elevated total chromium and one was collected from an area that did not appear to have chromium elevated above background. Hexavalent chromium was not detected in two of the samples. In the third sample (CBP-054), hexavalent chromium comprised 11.1% of the total chromium.

The PRG for total chromium is applicable to soil with hexavalent chromium to trivalent chromium ratio of 1:6 (i.e., 14% hexavalent chromium) or less (USEPA 2004b) . The supplemental data indicate that hexavalent chromium makes up less than 14% of the total chromium concentration at CBP; therefore, use of the PRG for total chromium is applicable. The maximum detected total chromium concentration in shallow surface soil (49 mg/kg) is less than the Region 9 residential PRG for total chromium (210 mg/kg); therefore, total chromium is not a COPC. Inclusion of the supplemental data does not change the conclusions of the HHRA for chromium because the maximum HQ (0.084) and maximum incremental lifetime cancer risk (ILCR) (8.8E-08) calculated for chromium in shallow surface soil were well below acceptable levels. Both total chromium and hexavalent chromium have the same ecological screening value (ESV); therefore, inclusion of the supplemental data does not change the conclusions of the SERA for chromium.

5.1.3 New chemicals detected in the Supplemental Data Only

Two chemicals, hexavalent chromium and nitrobenzene, were detected in the supplemental data but not in the original RI data.

Hexavalent chromium: This metal was not analyzed for in the original RI data but was analyzed for and detected in the supplemental data. No background concentration is available for hexavalent chromium in surface soil. The MDC (3.6 mg/kg) is below the Region 9 residential PRG (22 mg/kg). Hexavalent chromium is identified as an SRC but not a COPC; therefore, inclusion of the supplemental soil data does not change the conclusions of the HHRA with regard to hexavalent chromium. The MDC exceeds the ESV (0.4 mg/kg from Efroymson et al. 1997); therefore, hexavalent chromium is identified as a COPEC. Because chromium (which has the same ESV) was previously retained as COPEC, inclusion of the supplemental data does not change the conclusions of the SERA.

Nitrobenzene: This explosive was not detected in the RI Report data, but was detected in 4 of 5 supplemental samples. The MDC (0.05 mg/kg) is less than $1/10^{th}$ the Region 9 residential PRG (2.0 mg/kg); therefore, nitrobenzene is identified as an SRC but not a COPC. The MDC is also less than the ESV (40 mg/kg from Efroymson et al. 1997); therefore, nitrobenzene is not identified as a chemical of potential ecological concern (COPEC). Inclusion of the supplemental data does not change the conclusions of the HHRA or the SERA.

5.1.4 Risk Assessment Conclusions for Supplemental Shallow Surface Soil Data

Based on evaluation of the original and revised data sets, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for shallow surface soil (0-1 ft BGS) at CBP.

5.2 DEEP SURFACE SOIL (0-4 FT BGS)

Summary statistics for deep surface soil (0-4 ft BGS) data are provided in Table 5-2. The deep surface soil statistics presented in the RI Report were calculated by MKM Engineers, Inc. When SAIC calculated the same statistics, using the same data and the same rules, but using different software, the results were the same (within rounding error) for all chemicals except cobalt. The 95% UCL for cobalt presented in the RI Report is 8.4 mg/kg. The 95% UCL calculated by SAIC is 12 mg/kg. Both values are well below the Region 9 residential PRG (140 mg/kg); therefore, this difference in statistical results does not alter the conclusions of the RI Report.

The impact of inclusion of the Supplemental Phase II RI data on the conclusions of the HHRA is summarized in the following sections. The deep surface soil aggregate is not evaluated in the SERA.

5.2.1 Chemicals for which Original HHRA Conclusions are Unchanged

Forty-four chemicals were detected in deep surface soil samples collected during the RI. For 43 of these chemicals, the determination whether or not they were SRCs/COPCs in the original RI HHRA does not change when including the Supplemental Phase II RI data. For these 43 chemicals, the EPC (95% UCL or MDC) reported in the RI Report is very similar to the EPC calculated with the Supplemental Phase II RI data included (i.e., using two significant figures, the ratios of the revised EPC/original EPC range from 0.70-1.1). The remaining chemical (chromium) differed with inclusion of the Supplemental Phase II RI data and is discussed in Section 5.2.2. Chemicals with EPCs that decrease, increase, and stay the same are listed below:

- The EPCs for ten chemicals (barium, beryllium, calcium, copper, lead, magnesium, manganese, selenium, sodium, and zinc) are slightly lower with the supplemental data included (revised EPC/original EPC range from 0.70 to 0.94). Seven of these chemicals (barium, beryllium, calcium, magnesium, selenium, sodium, and zinc) were not COPCs in the RI Report and are not COPCs when the supplemental data is included. For the three chemicals that were COPCs: (1) copper had an HQ of 0.00010, below the acceptable level using the previous (higher) EPC; (2) lead is evaluated separately; and (3) manganese had an HQ of 3.5, above the acceptable level using the previous (higher) EPC. The reduction in the EPC for manganese is not enough to reduce its HQ to below 1; therefore, this reduction in the EPC does not change the conclusions of the HHRA.

- The EPCs for three chemicals (cadmium, mercury, and nickel) are slightly larger with the supplemental data included (revised EPC/original EPC is 1.1). These metals were not COPCs in the RI Report and are not COPCs when the Supplemental Phase II RI data are included.

- The EPCs for the remaining 30 chemicals are unchanged (revised EPC/original EPC = 1.0).

The conclusions of the HHRA would be unchanged for these 43 chemicals.

5.2.2 Chemicals for which Original HHRA Conclusions Change

Chromium was identified as a COPC in the original RI data set; however, the classification changed with inclusion of the Supplemental Phase II RI data, as discussed below.

Chromium: In the absence of hexavalent chromium data, total chromium was conservatively evaluated as hexavalent chromium in the RI Report. The supplemental data includes three samples analyzed for both hexavalent chromium and total chromium to evaluate what percentage of total chromium at CBP may be hexavalent chromium. Two samples were collected from areas previously identified as having elevated total chromium and one was collected from an area that did not appear to have chromium elevated above background. Hexavalent chromium was not detected in two of the samples. In the third sample (CBP-054), hexavalent chromium comprised 11.1% of the total chromium.

The PRG for total chromium is applicable to soil with hexavalent chromium to trivalent chromium ratio of 1:6 (i.e., 14% hexavalent chromium) or less (USEPA 2004b). The supplemental data indicate that hexavalent chromium makes up less than 14% of the total chromium concentration at CBP; therefore, use of the PRG for total chromium is applicable. The previously calculated HQ and ILCR for exposure of the National Guard Trainee to chromium was 0.027 (HQ) and 1.1E-05 (ILCR). The maximum detected total chromium concentration in deep surface soil (112 mg/kg) is less than the Region 9 residential PRG for total chromium (210 mg/kg); therefore, total chromium is not a COPC with inclusion of the Supplemental Phase II RI data. The Supplemental Phase II RI data change the conclusions of the HHRA and chromium is eliminated as a COC for the National Guard Trainee.

5.2.3 New chemicals detected in the Supplemental Data Only

Two chemicals, hexavalent chromium and nitrobenzene, were detected in the Supplemental Phase II RI data but not in the original RI data.

Hexavalent chromium: This metal was not analyzed for in the RI samples, but was analyzed for and detected in the Supplemental Phase II RI samples. No background concentration is available for hexavalent chromium. The MDC (3.6 mg/kg) is below the Region 9 residential PRG (22 mg/kg); therefore, hexavalent chromium is identified as an SRC but not a COPC; therefore, inclusion of the Supplemental Phase II RI soil data does not change the conclusions of the HHRA with regard to hexavalent chromium.

Nitrobenzene: This explosive was not detected in the RI samples, but was detected in 8 of 10 supplemental samples. The MDC (0.05 mg/kg) is less than $1/10^{th}$ the Region 9 residential PRG (2.0 mg/kg); therefore, nitrobenzene is identified as an SRC but not a COPC and inclusion of the supplemental soil data does not change the conclusions of the HHRA.

5.2.4 Risk Assessment Conclusions for Supplemental Deep Surface Soil Data

Based on evaluation of the original and revised data sets, inclusion of the supplemental data would not change the conclusions of the HHRA for deep surface soil (0-4 ft BGS) at CBP. Deep surface soil is not evaluated in the SERA.

5.3 SUBSURFACE SOIL (1-30 FT BGS)

Summary statistics for subsurface soil (1-30 ft BGS) data are provided in Table 5-3. The impact of inclusion of the supplemental data on the conclusions of the HHRA and SERA is summarized in the following sections.

5.3.1 Chemicals for which Original HHRA Conclusions are Unchanged

Twenty-five chemicals were detected in subsurface soil samples collected during the RI. For all 25 chemicals, the determination whether or not they were SRCs/COPCs in the original RI HHRA does not change when including the Supplemental Phase II RI data. For these 25 chemicals, the EPC (95% UCL or MDC) reported in the RI Report is very similar to the EPC calculated with the supplemental data included (i.e., using two significant figures, the ratios of the revised EPC/original EPC range from 0.72 to 1.1). Chemicals with EPCs that decrease, increase, and stay the same are listed below:

- The EPCs for four chemicals (calcium, magnesium, manganese, and sodium) are slightly lower with the supplemental data included (revised EPC/original EPC range from 0.72 to 0.95). Three of these metals (calcium, magnesium, and sodium) were not COPCs in the original RI Report and are not COPCs when the supplemental data are included. Manganese is a COPC for both data sets. The maximum HQ (0.18) for manganese is well below acceptable levels using the old (larger) EPC; therefore, this reduction in the EPC does not change the conclusions of the HHRA.

- The EPCs for two chemicals (cobalt and nickel) are slightly larger with the supplemental data included (revised EPC/original EPC of 1.1 for both chemicals). Neither of these metals were COPCs in the RI Report and neither are COPCs when the supplemental data are included; therefore, the slight increase in the EPC does not change the conclusions of the HHRA.

- The EPCs for the remaining 19 chemicals are unchanged (revised EPC/original EPC = 1.0).

5.3.2 Chemicals for which Original HHRA Conclusions Change

As noted above, no new SRCs/COPCs were identified among the 25 chemicals detected in the RI subsurface soil samples.

5.3.3 New chemicals detected in the Supplemental Data Only

One chemical, nitrobenzene, was detected in the supplemental data but not in the original RI data as shown in Table 5-3.

> **Nitrobenzene:** This explosive was not detected in the RI subsurface soil samples, but was detected in four of five supplemental samples. The MDC (0.04 mg/kg) is less than $1/10^{th}$ the Region 9 residential PRG (2.0 mg/kg); therefore, nitrobenzene is identified as an SRC but not a COPC. The MDC is also less than the ESV (40 mg/kg from Efroymson et al. 1997); therefore, nitrobenzene is not identified as a COPEC. The conclusions of the HHRA and SERA are unchanged by inclusion of nitrobenzene.

5.3.4 Risk Assessment Conclusions for Supplemental Subsurface Soil Data

Based on evaluation of the original and revised data sets, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for subsurface soil (1-30 ft BGS) at CBP.

5.4 SUMMARY OF THE QUALITATIVE RISK EVALUATION FOR SOIL

Based on evaluation of the original (as used in the RI Report [USACE 2005a]) and revised (including Supplemental Phase II samples) data sets, inclusion of the discrete soil samples from the Supplemental Phase II data does not change the conclusions of the HHRA or SERA for shallow surface soil (0-1 ft BGS), or subsurface soil (1-30 ft BGS) at CBP. Chromium (evaluated as hexavalent chromium) was identified as a COC in deep surface soil (0-4 ft BGS) in the RI Report for the National Guard Trainee. The conclusions of the HHRA for chromium are changed by inclusion of the Supplemental Phase RI II data. The calculated HQ and ILCR for exposure of the National Guard Trainee to chromium are reduced from 0.027 (HQ) and 1.1E-05 (ILCR) presented in the original RI Report to negligible because total chromium is eliminated as a COPC in deep surface soil based on the results of the Supplemental Phase II RI.

Results of the RI and Supplemental Phase II RI identify three COCs in shallow surface soil [arsenic and benzo(a)pyrene], deep surface soil (arsenic and manganese), and subsurface soil (arsenic). Further evaluation of the RI HHRA, including risk management considerations for these three COCs, and the SERA is discussed in Sections 6 and 7, respectively.

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Table 5-1. Summary of RI Report and Supplemental Phase II RI Shallow Surface Soil (0-1 ft BGS) Data: Central Burn Pits

Chemical	CAS Number	Site Backgrd Criteria[a]	Region 9 Res PRG[b]	Data included in RI Report (USACE 2005c)									Data included in RI report Plus Supplemental Data collected Nov 2005								Revised EPC/ RI Report EPC
				Freq of Detect	Measured Concentration			95% UCL	Calculated EPC[c]	EPC Reported in RIR[d]	SRC[e]	COPC[f]	Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[e]	COPC[f]	
					Min	Ave	Max							Min	Ave	Max					
Inorganics																					
Aluminum	7429905	17700	7600	43/ 43	3740	13200	29700	14900	14900	14876	Yes	Yes	48/ 48	3740	13100	29700	14600	14600	Yes	Yes	1.0
Antimony	7440360	0.96	3.1	17/ 43	0.20	0.22	1.8	0.29	1.8	1.8	Yes	No	21/ 48	0.20	0.24	1.8	0.30	1.8	Yes	No	1.0
Arsenic	7440382	15.4	0.39	42/ 43	1.7	12	33	16	16	16	Yes	Yes	47/ 48	1.7	12	33	16	16	Yes	Yes	1.0
Barium	7440393	88.4	540	43/ 43	37	126	417	152	152	151	Yes	No	48/ 48	37	121	417	142	142	Yes	No	0.93
Beryllium	7440417	0.88	15	43/ 43	0.39	0.98	3.9	1.2	1.2	1.1	Yes	No	48/ 48	0.39	0.94	3.9	1.1	1.1	Yes	No	0.94
Cadmium	7440439	0	3.7	27/ 43	0.11	0.34	2.2	0.59	0.59	0.58	Yes	No	29/ 48	0.08	0.32	2.2	0.63	0.63	Yes	No	1.1
Calcium	7440702	15800	NA	43/ 43	356	37200	205000	243000	194000	193500	No	No	48/ 48	356	33700	205000	137000	137000	No	No	0.71
Chromium	7440473	17.4	22/210[g]	43/ 43	4.4	16	49	18	18	18	Yes	Yes	51/ 51	4.4	19	112	21	21	Yes	No	1.2
Chromium, hexavalent	18540299	0	22	NA	NA	NA	NA	NA	NA	NA	No	No	1/ 3	3.6	1.4	3.6	4.6	3.6	Yes	No	NA
Cobalt	7440484	10.4	140	42/ 43	0.47	7.2	22	13	13	8.4	Yes	No	47/ 48	0.47	7.4	22	8.5	8.5	Yes	No	0.64
Copper	7440508	17.7	310	43/ 43	1.5	50	1260	40	40	39	Yes	Yes	48/ 48	1.5	46	1260	35	35	Yes	Yes	0.88
Cyanide	57125	0	120	19/ 43	0.24	2.9	99	6.5	92	92	Yes	No	19/ 43	0.24	2.9	99	6	92	Yes	No	1.0
Iron	7439896	23100	2300	43/ 43	1420	22000	107000	28500	28500	28544	No	No	48/ 48	1420	22000	107000	27800	27800	No	No	1.0
Lead	7439921	26.1	400	43/ 43	3.8	59	493	75	75	72	Yes	Yes	48/ 48	3.8	56	493	64	64	Yes	Yes	0.85
Magnesium	7439954	3030	NA	43/ 43	1370	4510	22900	5340	5340	5297	No	No	48/ 48	1370	4270	22900	4920	4920	No	No	0.92
Manganese	7439965	1450	180	43/ 43	107	1080	6150	1430	1430	1418	Yes	Yes	48/ 48	107	1040	6150	1320	1320	Yes	Yes	0.92
Mercury	7439976	0.036	2.3	42/ 43	0.0057	0.035	0.079	0.039	0.039	0.039	Yes	No	47/ 48	0.0057	0.038	0.1	0.049	0.049	Yes	No	1.2
Nickel	7440020	21.1	160	43/ 43	0.95	12	27	14	14	14	Yes	No	48/ 48	0.95	13	27	16	16	Yes	No	1.1
Potassium	7440097	927	NA	43/ 43	491	1160	2630	1300	1300	1295	No	No	48/ 48	491	1130	2630	1250	1250	No	No	1.0
Selenium	7782492	1.4	39	29/ 43	0.44	0.79	2.0	1.2	1.2	1.2	Yes	No	32/ 48	0.44	0.76	2	1.1	1.1	Yes	No	0.90
Silver	7440224	0	39	7/ 43	0.16	0.12	0.32	0.13	0.32	0.32	Yes	No	7/ 48	0.16	0.11	0.32	0.12	0.32	Yes	No	1.0
Sodium	7440235	123	NA	34/ 43	27	179	1160	259	259	251	No	No	35/ 48	27.2	166	1160	224	224	No	No	0.86
Thallium	7440280	0	0.52	2/ 43	0.18	0.30	0.24	0.43	0.23	0.23	No	No	2/ 48	0.18	0.30	0.24	0.42	0.23	No	No	1.0
Vanadium	7440622	31.1	7.8	43/ 43	2.5	20	37	22	22	22	Yes	Yes	48/ 48	2.5	20	37	22	22	Yes	Yes	1.0
Zinc	7440666	61.8	2300	43/ 43	8.2	142	1500	171	171	171	Yes	No	48/ 48	8.2	136	1500	158	158	Yes	No	0.92
Organics-Explosives																					
2,4,6-Trinitrotoluene	118967	NA	3.1	1/ 40	0.18	0.0209	0.18	0.0278	0.18	0.18	Yes	No	1/ 45	0.18	0.024	0.18	0.031	0.18	Yes	No	1.0
Nitrobenzene	98953	NA	2.0	0/ 40	NA	NA	NA	NA	NA	NA	No	No	4/ 45	0.030	0.015	0.050	0.017	0.050	Yes	No	NA
Nitrocellulose	9004700	NA	NA	7/ 9	0.76	1.1	1.8	1.3	1.5	1.5	Yes	Yes	7/ 9	0.76	1.1	1.8	1.3	1.5	Yes	Yes	1.0
Nitroguanidine	556887	NA	610	1/ 9	0.061	0.12	0.071	0.13	0.066	0.066	Yes	No	1/ 9	0.061	0.12	0.071	0.13	0.066	Yes	No	1.0
Organics-Pesticide/PCB																					
4,4'-DDE	72559	NA	1.7	1/ 9	0.0014	0.00086	0.0018	0.0013	0.0016	0.002	Yes	No	1/ 9	0.0014	0.00086	0.0018	0.0013	0.0016	Yes	No	1.0
4,4'-DDT	50293	NA	1.7	1/ 9	0.0027	0.00056	0.0027	0.00087	0.0016	0.002	Yes	No	1/ 9	0.0027	0.00056	0.0027	0.00087	0.0016	Yes	No	1.0
Endosulfan I	959988	NA	37	1/ 9	0.0010	0.00036	0.0010	0.00053	0.00061	0.0006	Yes	No	1/ 9	0.0010	0.00036	0.0010	0.00053	0.00061	Yes	No	1.0
Endosulfan II	33213659	NA	37	2/ 9	0.0018	0.00072	0.0034	0.0013	0.0030	0.003	Yes	No	2/ 9	0.0018	0.00072	0.0034	0.0013	0.0030	Yes	No	1.0
Endrin	72208	NA	1.8	1/ 9	0.0019	0.00071	0.0024	0.0011	0.0022	0.002	Yes	No	1/ 9	0.0019	0.00071	0.0024	0.0011	0.0022	Yes	No	1.0
Heptachlor epoxide	1024573	NA	0.053	1/ 9	0.00058	0.00019	0.00058	0.00028	0.00034	0.00030	Yes	No	1/ 9	0.00058	0.00019	0.00058	0.00028	0.00034	Yes	No	1.0
PCB-1254	11097691	NA	0.11	3/ 22	0.032	0.012	0.24	0.023	0.14	0.14	Yes	Yes	3/ 22	0.032	0.0119	0.24	0.023	0.14	Yes	Yes	1.0
gamma-Chlordane	5103742	NA	1.6	1/ 9	0.0045	0.00067	0.0047	0.0016	0.0046	0.005	Yes	No	1/ 9	0.0045	0.00067	0.0047	0.0016	0.0046	Yes	No	1.0

Table 5-1. Summary of RI Report and Supplemental Phase II RI Shallow Surface Soil (0-1 ft BGS) Data: Central Burn Pits (continued)

Chemical	CAS Number	Site Backgrd Criteria[a]	Region 9 Res PRG[b]	Data included in RI Report (USACE 2005a)									Data included in RI report Plus Supplemental Data collected Nov 2005								Revised EPC/ RI Report EPC
				Freq of Detect	Measured Concentration			95% UCL	Calculated EPC[c]	EPC Reported in RIR[d]	SRC[e]	COPC[f]	Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[e]	COPC[f]	
					Min	Ave	Max							Min	Ave	Max					
Organics-Semivolatile																					
Benz(a)anthracene	56553	NA	0.62	2/ 9	0.12	0.055	0.21	0.089	0.20	0.20	Yes	No	2/ 9	0.12	0.055	0.21	0.089	0.20	Yes	No	1.0
Benzo(a)pyrene	50328	NA	0.062	1/ 9	0.20	0.056	0.24	0.094	0.22	0.22	Yes	Yes	1/ 9	0.20	0.056	0.24	0.094	0.22	Yes	Yes	1.0
Benzo(b)fluoranthene	205992	NA	0.62	1/ 9	0.24	0.090	0.31	0.13	0.28	0.28	Yes	No	1/ 9	0.24	0.090	0.31	0.13	0.28	Yes	No	1.0
Benzo(k)fluoranthene	207089	NA	6.2	2/ 9	0.24	0.11	0.36	0.15	0.24	0.24	Yes	No	2/ 9	0.24	0.11	0.36	0.15	0.24	Yes	No	1.0
Chrysene	218019	NA	62	2/ 9	0.20	0.057	0.26	0.10	0.23	0.23	Yes	No	2/ 9	0.20	0.057	0.26	0.10	0.23	Yes	No	1.0
Fluoranthene	206440	NA	230	1/ 9	0.27	0.085	0.33	0.14	0.30	0.30	Yes	No	1/ 9	0.27	0.085	0.33	0.14	0.30	Yes	No	1.0
Indeno(1,2,3-cd)pyrene	193395	NA	0.62	1/ 9	0.13	0.077	0.16	0.094	0.15	0.15	Yes	No	1/ 9	0.13	0.077	0.16	0.094	0.15	Yes	No	1.0
Phenanthrene	85018	NA	230	1/ 9	0.093	0.045	0.093	0.051	0.065	0.065	Yes	No	1/ 9	0.093	0.045	0.093	0.051	0.065	Yes	No	1.0
Pyrene	129000	NA	230	1/ 9	0.23	0.11	0.30	0.15	0.27	0.27	Yes	No	1/ 9	0.23	0.11	0.30	0.15	0.27	Yes	No	1.0

Chemical was a COPC in the original RI Report data set but is not identified as a COPC with the Supplemental Phase II data included.

Chemical was not detected (nitrobenzene) or not analyzed for (hexavalent chromium) in the original RI Report data set but was detected in the Supplemental Phase II data.

EPC for this chemical was larger in the original RI Report data set and is reduced by the inclusion of the Supplemental Phase II data.

EPC for this chemical was smaller in the original RI Report data set and is increased by the inclusion of the Supplemental Phase II data.

All units are mg/kg
COPC = Chemical of potential concern
EPC = Exposure point concentration
PRG = Preliminary remediation goal
RI Report = Remedial investigation report
SRC = Site-related contaminant
UCL = Upper confidence limit on the mean
NA = not applicable or no data available

[a]Background criteria for surface soil from USACE 2001b. *Final Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[b]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to a carcinogenic risk of 1E-06 or hazard index of 0.1.

[c]For data sets with at least 50% detectable concentrations, EPC is the lesser of the 95% UCL calculated by SAIC using SAS or the maximum detected value. For data sets with < 50% detectable concentrations EPC is the maximum detected value.

[d]EPC reported in the RI Report as calculated by MKM Engineers Inc.

[e]Chemicals are identified as SRCs if (1) they are detected in any sample (high explosives) or they are detected in at least 5% of samples (all other chemical classes), and (2) they are not essential nutrients, and (3) the maximum detected concentration (MDC) is greater than background (inorganics).

[f]Chemicals are identified as COPCs if (1) they are SRCs and (2) the MDC is greater than the Region 9 residential PRG.

[g]In the absence of hexavalent chromium data, total chromium was conservatively evaluated as hexavalent chromium in the RI Report using the Region 9 residential PRG of 22 mg/kg. The supplemental data indicate that hexavalent chromium makes up less than 14% of the total chromium concentration at CBP: therefore, the Region 9 residential PRG (210 mg/kg) is used to evaluate total chromium with the supplemental data included.

Table 5-2. Summary of RI Report and Supplemental Phase II Deep Surface Soil (0-4 ft BGS) Data: Central Burn Pits

Chemical	CAS Number	Site Backgrd Criteria[a]	Region 9 Res PRG[b]	Data included in RI Report (USACE 2005a)									Data included in RI report Plus Supplemental Data collected Nov 2005								Revised EPC/ RI Report EPC
				Freq of Detect	Measured Concentration			95% UCL	Calculated EPC[c]	EPC Reported in RIR[d]	SRC[e]	COPC[f]	Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[e]	COPC[f]	
					Min	Ave	Max							Min	Ave	Max					
Inorganics																					
Aluminum	7429905	17700	7600	72/ 72	3730	13800	31100	15000	15000	15030	Yes	Yes	82/ 82	3730	13600	31100	14700	14700	Yes	Yes	1.0
Antimony	7440360	0.96	3.1	22/ 72	0.17	0.18	1.8	0.23	1.8	1.8	Yes	No	28/ 82	0.17	0.20	1.8	0.24	1.8	Yes	No	1.0
Arsenic	7440382	15.4	0.39	71/ 72	0.28	11.5	32.8	15.4	15.4	15.3	Yes	Yes	81/ 82	0.28	11.9	32.8	15.4	15.4	Yes	Yes	1.0
Barium	7440393	88.4	540	72/ 72	36.8	113	417	126	126	126	Yes	No	82/ 82	36.8	109	417	119	119	Yes	No	0.94
Beryllium	7440417	0.88	15	72/ 72	0.30	1	4.2	1.1	1.1	1.1	Yes	No	82/ 82	0.3	0.97	4.2	1.0	1.0	Yes	No	0.94
Cadmium	7440439	0	3.7	45/ 72	0.085	0.28	2.2	0.40	0.40	0.39	Yes	No	47/ 82	0.08	0.26	2.2	0.45	0.45	Yes	No	1.1
Calcium	7440702	15800	NA	72/ 72	356	32800	205000	94500	94500	93391	No	No	82/ 82	356	29100	205000	66300	66300	No	No	0.70
Chromium	7440473	17.4	22/210[e]	72/ 72	4.4	16.3	57.3	18	18	18	Yes	Yes	85/ 85	4.4	18.3	112	19.9	19.9	Yes	No	1.1
Chromium, hexavalent	18540299	--	22	NA	NA	NA	NA	NA	NA	NA	No	No	1/ 3	3.6	1.36	3.6	4.63	3.6	Yes	No	NA
Cobalt	7440484	10.4	140	70/ 72	0.47	7.52	22.3	11.7	11.7	8.4	Yes	No	80/ 82	0.47	8.1	22.6	12.2	12.2	Yes	No	1.0
Copper	7440508	17.7	310	72/ 72	1.5	35.4	1260	25.9	25.9	25.8	Yes	Yes	82/ 82	1.5	33.1	1260	24.4	24.4	Yes	Yes	0.94
Cyanide	57125	0	120	24/ 72	0.24	1.88	99	4.02	92.4	92.4	Yes	No	24/ 72	0.24	1.9	99	4.0	92.4	Yes	No	1.0
Iron	7439896	23100	2300	72/ 72	1420	21800	107000	26600	26600	26560	No	No	82/ 82	1420	22300	107000	26700	26700	No	No	1.0
Lead	7439921	26.1	400	72/ 72	3.8	43.4	493	44.1	44.1	44	Yes	Yes	82/ 82	3.8	40.6	493	40.1	40.1	Yes	Yes	0.91
Magnesium	7439954	3030	NA	72/ 72	1200	4580	22900	5090	5090	5063	No	No	82/ 82	1200	4350	22900	4720	4720	No	No	0.93
Manganese	7439965	1450	180	72/ 72	100	979	6150	1220	1220	1215	Yes	Yes	82/ 82	100	937	6150	1130	1130	Yes	Yes	0.93
Mercury	7439976	0.036	2.3	71/ 72	0.0057	0.033	0.079	0.035	0.035	0.035	Yes	No	81/ 82	0.0057	0.034	0.1	0.039	0.039	Yes	No	1.1
Nickel	7440020	21.1	160	72/ 72	0.95	13.6	33.7	16.4	16.4	16.3	Yes	No	82/ 82	0.95	14.6	36.3	17.4	17.4	Yes	No	1.1
Potassium	7440097	927	NA	72/ 72	491	1250	2630	1360	1360	1359	No	No	82/ 82	491	1230	2630	1320	1320	No	No	1.0
Selenium	7782492	1.4	39	40/ 72	0.16	0.69	2.7	0.95	0.95	0.95	Yes	No	44/ 82	0.16	0.65	2.7	0.85	0.85	Yes	No	0.90
Silver	7440224	0	39	7/ 72	0.16	0.108	0.32	0.12	0.32	0.32	Yes	No	7/ 82	0.16	0.097	0.32	0.11	0.32	Yes	No	1.0
Sodium	7440235	123	NA	56/ 72	27.2	175	1160	221	221	217	No	No	58/ 82	27.2	161	1160	190	190	No	No	0.86
Thallium	7440280	0	0.52	3/ 72	0.18	0.33	4.1	0.47	4.1	4.1	No	No	4/ 82	0.18	0.33	4.1	0.45	4.1	No	No	1.0
Vanadium	7440622	31.1	7.8	72/ 72	2.5	19.9	37	24.3	24.3	24.2	Yes	Yes	82/ 82	2.5	20.4	37	24.4	24.4	Yes	Yes	1.0
Zinc	7440666	61.8	2300	72/ 72	8.2	113	1500	118	118	117	Yes	No	82/ 82	8.2	108	1500	110	110	Yes	No	0.93
Organics-Explosives																					
2,4,6-Trinitrotoluene	118967	NA	3.1	2/ 69	0.066	0.020	0.18	0.024	0.18	0.18	Yes	No	2/ 79	0.066	0.024	0.18	0.028	0.18	Yes	No	1.0
Nitrobenzene	98953	NA	2.0	0/ 69	NA	NA	NA	NA	NA	NA	No	No	8/ 79	0.03	0.015	0.05	0.017	0.05	Yes	No	NA
Nitrocellulose	9004700	NA	NA	8/ 10	0.62	1.07	1.8	1.24	1.24	1.24	Yes	Yes	8/ 10	0.62	1.1	1.8	1.2	1.2	Yes	Yes	1.0
Nitroguanidine	556887	NA	610	1/ 10	0.061	0.12	0.071	0.13	0.066	0.066	Yes	No	1/ 10	0.061	0.12	0.071	0.13	0.066	Yes	No	1.0
Organics-Pesticide/PCB																					
4,4'-DDE	72559	NA	1.7	1/ 10	0.0014	0.000814	0.0018	0.00119	0.0016	0.002	Yes	No	1/ 10	0.0014	0.000814	0.0018	0.0012	0.0016	Yes	No	1.0
4,4'-DDT	50293	NA	1.7	1/ 10	0.0027	0.000523	0.0027	0.000806	0.0016	0.002	Yes	No	1/ 10	0.0027	0.000523	0.0027	0.00081	0.0016	Yes	No	1.0
Endosulfan I	959988	NA	37	1/ 10	0.001	0.000342	0.001	0.000494	0.00061	0.0006	Yes	No	1/ 10	0.001	0.000342	0.001	0.00049	0.000613	Yes	No	1.0
Endosulfan II	33213659	NA	37	2/ 10	0.0018	0.000669	0.0034	0.0012	0.0030	0.003	Yes	No	2/ 10	0.0018	0.000669	0.0034	0.0012	0.003	Yes	No	1.0
Endrin	72208	NA	1.8	1/ 10	0.0019	0.000663	0.0024	0.0010	0.0022	0.002	Yes	No	1/ 10	0.0019	0.000663	0.0024	0.00104	0.0022	Yes	No	1.0
Heptachlor epoxide	1024573	NA	0.053	1/ 10	0.00058	0.00018	0.00058	0.00026	0.00034	0.0003	Yes	No	1/ 10	0.00058	0.00018	0.00058	0.00026	0.000335	Yes	No	1.0
PCB-1254	11097691	NA	0.11	3/ 30	0.032	0.0090	0.24	0.017	0.14	0.14	Yes	Yes	3/ 30	0.032	0.0090	0.24	0.017	0.14	Yes	Yes	1.0
gamma-Chlordane	5103742	NA	1.6	1/ 10	0.0045	0.000616	0.0047	0.0014	0.0046	0.005	Yes	No	1/ 10	0.0045	0.000616	0.0047	0.0014	0.0046	Yes	No	1.0

Table 5-2. Summary of RI Report and Supplemental Phase II Deep Surface Soil (0-4 ft BGS) Data: Central Burn Pits (continued)

Chemical	CAS Number	Site Backgrd Criteria[a]	Region 9 Res PRG[b]	Data included in RI Report (USACE 2005a)									Data included in RI report Plus Supplemental Data collected Nov 2005								Revised EPC/ RI Report EPC
				Freq of Detect	Measured Concentration			95% UCL	Calculated EPC[c]	EPC Reported in RIR[d]	SRC[e]	COPC[f]	Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[e]	COPC[f]	
					Min	Ave	Max							Min	Ave	Max					
Organics-Semivolatile																					
Benz(a)anthracene	56553	NA	0.62	2/ 10	0.12	0.053	0.21	0.083	0.20	0.20	Yes	No	2/ 10	0.12	0.053	0.21	0.083	0.20	Yes	No	1.0
Benzo(a)pyrene	50328	NA	0.062	1/ 10	0.20	0.054	0.24	0.088	0.22	0.22	Yes	Yes	1/ 10	0.20	0.054	0.24	0.088	0.22	Yes	Yes	1.0
Benzo(b)fluoranthene	205992	NA	0.62	1/ 10	0.24	0.088	0.31	0.126	0.275	0.28	Yes	No	1/ 10	0.24	0.088	0.31	0.13	0.28	Yes	No	1.0
Benzo(k)fluoranthene	207089	NA	6.2	2/ 10	0.24	0.102	0.36	0.141	0.24	0.24	Yes	No	2/ 10	0.24	0.102	0.36	0.14	0.24	Yes	No	1.0
Chrysene	218019	NA	62	2/ 10	0.20	0.054	0.26	0.093	0.23	0.23	Yes	No	2/ 10	0.20	0.054	0.26	0.093	0.23	Yes	No	1.0
Fluoranthene	206440	NA	230	1/ 10	0.27	0.082	0.33	0.127	0.30	0.30	Yes	No	1/ 10	0.27	0.082	0.33	0.127	0.30	Yes	No	1.0
Indeno(1,2,3-cd)pyrene	193395	NA	0.62	1/ 10	0.13	0.076	0.16	0.091	0.15	0.15	Yes	No	1/ 10	0.13	0.076	0.16	0.091	0.15	Yes	No	1.0
Phenanthrene	85018	NA	230	1/ 10	0.093	0.045	0.093	0.050	0.065	0.065	Yes	No	1/ 10	0.093	0.045	0.093	0.050	0.065	Yes	No	1.0
Pyrene	129000	NA	230	1/ 10	0.23	0.11	0.30	0.14	0.27	0.27	Yes	No	1/ 10	0.23	0.11	0.30	0.14	0.27	Yes	No	1.0

Chemical was a COPC in the original RI Report data set but is not identified as a COPC with the Supplemental Phase II data included.

Chemical was not detected (nitrobenzene) or not analyzed for (hexavalent chromium) in the original RI Report data set but was detected in the Supplemental Phase II data.

EPC for this chemical was larger in the original RI Report data set and is reduced by the inclusion of the Supplemental Phase II data.

EPC for this chemical was smaller in the original RI Report data set and is increased by the inclusion of the Supplemental Phase II data.

All units are mg/kg
COPC = Chemical of potential concern
EPC = Exposure point concentration
PRG = Preliminary remediation goal
RI Report = Remedial investigation report
SRC = Site-related contaminant
UCL = Upper confidence limit on the mean
NA = not applicable or no data available

[a]Background criteria are the lesser of the values for surface soil (0-2 ft BGS) or subsurface soil (>2 ft BGS) for RVAAP from USACE 2001b *Final Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[b]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to a carcinogenic risk of 1E-06 or hazard index of 0.1.

[c]For data sets with at least 50% detectable concentrations, EPC is the lesser of the 95% UCL calculated by SAIC using SAS or the maximum detected value. For data sets with < 50% detectable concentrations EPC is the maximum detected value.

[d]EPC reported in the RI Report as calculated by MKM Engineers Inc.

[e]Chemicals are identified as SRCs if (1) they are detected in any sample (high explosives) or they are detected in at least 5% of samples (all other chemical classes), and (2) they are not essential nutrients, and (3) the maximum detected concentration (MDC) is greater than background (inorganics).

[f]Chemicals are identified as COPCs if (1) they are SRCs and (2) the MDC is greater than the Region 9 residential PRG.

[g]In the absence of hexavalent chromium data, total chromium was conservatively evaluated as hexavalent chromium in the RI Report using the Region 9 residential PRG of 22 mg/kg. The supplemental data indicate that hexavalent chromium makes up less than 14% of the total chromium concentration at CBP: therefore, the Region 9 residential PRG (210 mg/kg) is used to evaluate total chromium with the supplemental data included.

Table 5-3. Summary of RI Report and Supplemental Phase II Subsurface Soil (1-30 ft BGS) Data: Central Burn Pits

Chemical	CAS Number	Site Backgrd Criteria[a]	Region 9 Res PRG[b]	Data included in RI Report (USACE 2005a)									Data included in RI report Plus Supplemental Data collected Nov 2005								Revised EPC/ RI Report EPC
				Freq of Detect	Measured Concentration			95% UCL	Calculated EPC[c]	EPC Reported in RIR[d]	SRC[e]	COPC[f]	Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[e]	COPC[f]	
					Min	Ave	Max							Min	Ave	Max					
Inorganics																					
Aluminum	7429905	19500	7600	37/ 37	3730	13800	31100	15600	15600	15589	Yes	Yes	42/ 42	3730	13700	31100	15200	15200	Yes	Yes	1.0
Antimony	7440360	0.96	3.1	7/ 37	0.17	0.13	0.44	0.16	0.44	0.44	No	No	9/ 42	0.17	0.14	0.44	0.17	0.44	No	No	1.0
Arsenic	7440382	19.8	0.39	37/ 37	0.28	13	31	15	15	15	Yes	Yes	42/ 42	0.28	13	31	15	15	Yes	Yes	1.0
Barium	7440393	124	540	37/ 37	24	82	294	97	97	96	Yes	No	42/ 42	24	82	294	95	95	Yes	No	1.0
Beryllium	7440417	0.88	15	37/ 37	0.30	0.93	4.2	1.1	1.1	1.1	Yes	No	42/ 42	0.30	0.92	4.2	1.0	1.0	Yes	No	1.0
Cadmium	7440439	0	3.7	18/ 37	0.085	0.17	0.64	0.21	0.64	0.64	Yes	No	18/ 42	0.085	0.15	0.64	0.19	0.64	Yes	No	1.0
Calcium	7440702	35500		37/ 37	531	22600	166000	51900	51900	50126	No	No	42/ 42	531	20100	166000	37400	37400	No	No	0.72
Chromium	7440473	27.2	22	37/ 37	5.8	17	57	19	19	19	Yes	Yes	42/ 42	5.8	17	57	20	20	Yes	Yes	1.0
Cobalt	7440484	23.2	140	36/ 37	0.65	8.66	19.3	9.8	9.8	9.8	No	No	41/ 42	0.65	9.38	23	11	11	No	No	1.1
Copper	7440508	32.3	310	37/ 37	2.7	16	47	19	19	19	Yes	No	42/ 42	2.7	16	47	19	19	Yes	No	1.0
Cyanide	57125	0	120	6/ 37	0.62	0.36	3.1	0.55	3.1	3.1	Yes	No	6/ 37	0.62	0.36	3.1	0.55	3.1	Yes	No	1.0
Iron	7439896	35200	2300	37/ 37	3040	22800	37100	29000	29000	28956	No	No	42/ 42	3040	23600	37100	29300	29300	No	No	1.0
Lead	7439921	19.1	400	37/ 37	7.1	18	66	21	21	21	Yes	No	42/ 42	7.1	18	66	20	20	Yes	No	1.0
Magnesium	7439954	8790		37/ 37	1200	5170	21800	6420	6420	6415	No	No	42/ 42	1200	4940	21800	5960	5960	No	No	0.93
Manganese	7439965	3030	180	37/ 37	100	720	3340	937	937	928	Yes	Yes	42/ 42	100	705	3340	890	890	Yes	Yes	0.95
Mercury	7439976	0.044	2.3	34/ 37	0.0081	0.024	0.046	0.027	0.027	0.027	Yes	No	39/ 42	0.0081	0.024	0.046	0.027	0.027	Yes	No	1.0
Nickel	7440020	60.7	160	37/ 37	1.9	17.3	33.7	19.6	19.6	19.6	No	No	42/ 42	1.9	19	36	21	21	No	No	1.1
Potassium	7440097	3350		37/ 37	613	1610	3410	1850	1850	1843	No	No	42/ 42	613	1560	3410	1770	1770	No	No	1.0
Selenium	7782492	1.5	39	11/ 37	0.16	0.46	2.7	0.62	2.7	2.7	Yes	No	12/ 42	0.16	0.43	2.7	0.576	2.7	Yes	No	1.0
Sodium	7440235	145		30/ 37	29.5	168	946	257	257	247	No	No	31/ 42	30	155	946	208	208	No	No	0.81
Thallium	7440280	0.91	0.52	1/ 37	4.1	0.34	4.1	0.56	4.1	4.1	No	No	2/ 42	0.47	0.34	4.1	0.53	4.1	No	No	1.0
Vanadium	7440622	37.6	7.8	37/ 37	2.7	20	36	22	22	22	No	No	42/ 42	2.7	20	36	22	22	No	No	1.0
Zinc	7440666	93.3	2300	37/ 37	13	68	422	76	76	76	Yes	No	42/ 42	13	68	422	75	75	Yes	No	1.0
Organics-Explosives																					
2,4,6-Trinitrotoluene	118967	NA	3.1	1/ 37	0.066	0.018	0.066	0.020	0.066	0.066	Yes	No	1/ 42	0.066	0.022	0.066	0.025	0.066	Yes	No	1.0
Nitrobenzene	98953	NA	2	0/ 37	NA	NA	NA	NA	NA	NA	No	No	4/ 42	0.030	0.014	0.040	0.017	0.040	Yes	No	NA
Nitrocellulose	9004700	NA	NA	1/ 1	0.62	0.65	0.68	NA	0.65	0.65	Yes	Yes	1/ 1	0.62	0.65	0.68	NA	0.65	Yes	Yes	1.0

Chemical was not detected in the original RI Report data set but was detected with the Supplemental Phase II data.

EPC for this chemical was larger in the original RI Report data set and is reduced by the inclusion of the Supplemental Phase II data.

EPC for this chemical was smaller in the original RI Report data set and is increased by the inclusion of the Supplemental Phase II data.

All units are mg/kg
COPC = Chemical of potential concern
EPC = Exposure point concentration
PRG = Preliminary remediation goal
RI Report = Remedial investigation report
SRC = Site-related contaminant
UCL = Upper confidence limit on the mean. NA = not applicable or no data available.

[a]Background criteria for subsurface soil from USACE 2001b. *Final Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio.*

[b]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to a carcinogenic risk of 1E-06 or hazard index of 0.1.

[c]For data sets with at least 50% detectable concentrations, EPC is the lesser of the 95% UCL calculated by SAIC using SAS or the maximum detected value. For data sets with < 50% detectable concentrations EPC is the maximum detected value.

[d]EPC reported in the RI Report as calculated by MKM Engineers Inc.

[e]Chemicals are identified as SRCs if (1) they are detected in any sample (high explosives) or they are detected in at least 5% of samples (all other chemical classes), and (2) they are not essential nutrients, and (3) the maximum detected concentration (MDC) is greater than background (inorganics).

[f]Chemicals are identified as COPCs if (1) they are SRCs and (2) the MDC is greater than the Region 9 residential PRG.

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6.0 HUMAN HEALTH RISK ASSESSMENT

6.1 PREVIOUS BASELINE HUMAN HEALTH RISK ASSESSMENT

A baseline HHRA presented in the CBP RI Report (USACE 2005a) assessed the potential current and future risks associated with human exposure to site-related contaminants found at CBP. The baseline HHRA for exposure scenarios and technical requirements were specified at that time in the initial version of the Facility-Wide Human Health Risk Assessment Manual (USACE 2005c). This addendum includes a baseline HHRA for Trespasser scenario (Section 6.1, Appendix H), which was not in the initial version, but included in a later amendment to the Facility-Wide Human Health Risk Assessment Manual (USACE 2005b). This section briefly summarizes the results of the previous baseline HHRA and the Trespasser scenario, provides risk management considerations, and presents preliminary human health cleanup goals for identified COCs.

Future land use scenarios evaluated in the baseline HHRA include: ownership by the NGB for training purposes; use by recreational hunters and fishermen; and use as a residential farm. Risks were evaluated for a National Guard Trainee and a National Guard resident/trainer; a hunter/trapper; security maintenance worker; and a resident farmer (adult and child). COCs were selected and toxicological and exposure factors were applied to evaluate risk. The baseline HHRA indicates potential risks for some receptors under specific conditions (Table 6-1).

Discrete soil samples were collected from surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soil at CBP during the Supplemental Phase II RI to complete the analysis of nature and extent of contamination. These supplemental data are presented in Section 4. Evaluation of the Supplemental Phase II RI soil sample data shows that these new data do not change the conclusions of the HHRA at CBP for shallow (0-1 ft BGS) surface soil or subsurface (1-30 ft BGS) soil. The Supplemental Phase II RI data confirm the majority of the chromium in deep surface soil (0-4 ft BGS) is not hexavalent chromium. Therefore, chromium is not a risk driver for the National Guard Trainee. Thus, the only COCs for the National Guard Trainee exposed to deep surface soil are arsenic and manganese.

Multi-increment samples were collected from the berms/piles at CBP to assess disposition requirements/options and are not included in the HHRA.

Table 6-1. Summary of HHRA Risk Results for Direct Contact at the Central Burn Pits

Receptor	Total HI	Total ILCR	COCs	Notes
National Guard Trainee (Representative Receptor)				
Deep Surface Soil[a]	4.1	1.6E-05	As, Cr, Mn	HQ>1 for Mn inhalation. ILCR exceeds USEPA and Ohio EPA target risk. Primary risk driver is Cr evaluated as hexavalent chromium, risk from As is below Ohio EPA target risk.
Sediment	0.045	2.3E-06	As	Exceeds USEPA *deminimis* risk but below Ohio EPA target risk.
Surface Water	--	--	--	--
Groundwater	0.36	5.8E-05	As	Exceeds USEPA and Ohio EPA target risk.
Security Guard/Maintenance Worker				
Shallow Surface Soil[a]	0.10	8.1E-06	As, B(*a*)P	Exceeds USEPA *deminimis* risk but below Ohio EPA target risk.
Hunter				
Shallow Surface Soil[a]	0.0010	8.9E-08	None	Below USEPA and Ohio EPA target risk values for all media.
Sediment	0.0010	9.8E-08	None	None
National Guard Resident				
Shallow Surface Soil[a]	0.20	1.3E-05	As, B(*a*)P	Exceeds USEPA and Ohio EPA target risk. Primary risk driver is As, risk from B(*a*)P is below Ohio EPA target risk.
Subsurface Soil[a,c]	0.13	1.0E-05	As	Exceeds USEPA and Ohio EPA target risk.
Sediment	0.26	1.5E-05	As, B(*a*)P	Exceeds USEPA and Ohio EPA target risk. Primary risk driver is As, risk from B(*a*)P is below Ohio EPA target risk.
Surface Water	--	--	--	--
Groundwater	2.3	3.7E-04	As	Exceeds USEPA and Ohio EPA target risk.
Resident Subsistence Farmer[b]				
Shallow Surface Soil[a]	1.7	6.0E-05	As, Aroclor-1254, B(*a*)P	Exceeds USEPA and Ohio EPA target risk. Primary risk driver is As, risk from other COCs is below Ohio EPA target risk.
Subsurface Soil[a,c]	1.2	4.8E-05	As	Exceeds USEPA and Ohio EPA target risk.
Sediment	0.45	1.5E-05	As, B(*a*)P	Exceeds USEPA and Ohio EPA target risk. Primary risk driver is As, risk from B(*a*)P is below Ohio EPA target risk.
Surface Water	--	--	--	--
Groundwater	11		As	Exceeds USEPA and Ohio EPA target risk.

As = arsenic
B(*a*)P = benzo(*a*)pyrene
COC = Chemical of concern
Cr = chromium (evaluated as hexavalent chromium)
HI = Hazard index
ILCR = Incremental lifetime cancer risk
Mn = manganese
-- = no COPCs identified in surface water.

[a]Shallow surface soil includes samples from 0-1 ft below ground surface (BGS); Deep surface soil includes samples from 0-4 ft BGS; Subsurface soil includes samples from 1-30 ft BGS.
[b]Noncancer risks were calculated separately for Adult and Child Resident Subsistence Farmer scenarios. The maximum HI (for the child) are presented here. Cancer risks were calculated for a combined adult and child "Lifelong" Resident Subsistence Farmer scenario.
[c]The FWHRAM defines the subsurface soil exposure unit as 0 to 13 ft BGS; however, samples were collected to depths of 30 ft BGS during the RI and all data below below 1 ft BGS were incorporated into the risk evaluation.

6.2 SUPPLEMENTAL PHASE II RI RISK CHARACTERIZATION FOR TRESPASSER (ADULT AND JUVENILE) SCENARIO

The baseline HHRA provided in the RI Report for CBP evaluated the potential health risks to humans resulting from exposure to contamination at CBP. The HHRA presented in the CBP RI Report was based on the methods outlined at that time in the initial version of the Facility-Wide Human Health Risk Assessment Manual (USACE 2005c) which addressed five receptors to be evaluated at RVAAP

[National Guard Trainee, National Guard Resident/Trainer, Security Guard/Maintenance Worker, Hunter/Trapper, and Resident Subsistence Farmer (adult and child)].

This RI Addendum includes a risk characterization for an Adult and Juvenile Trespasser scenario per the more recent Facility-Wide Human Health Risk Assessment Manual Amendment #1 (USACE 2005c) to supplement the baseline HHRA provided in the original RI Report to provide risk managers with information relating to potential trespasser exposure. The risk characterization for the Trespasser Scenario is presented in Appendix H.

6.3 IDENTIFICATION HUMAN HEALTH PRELIMINARY CLEANUP GOALS FOR CBP

This section presents the proposed land use and corresponding preliminary cleanup goals to support the remedial alternative selection process for soil remediation at CBP. Preliminary cleanup goals are the chemical-specific numeric cleanup goals used to meet the remedial action objectives for protection of human health.

The HHRA identifies the COCs for all receptors indicated in Section 6.1 that could contribute to potential risks from exposure to contaminated media at CBP. In addition to the receptors in the HHRA, a Trespasser (Adult and Juvenile) is evaluated in Appendix H. The HHRA also documents the calculation of risk-based remedial goal options (RGOs) for human receptors for all media (i.e., soil, surface water, sediment, and groundwater), all COCs, and all receptor populations evaluated in the RI Report. These risk-based RGOs are referred to as risk-based cleanup goals in this addendum.

Chemical-specific preliminary cleanup goals are established for the National Guard Trainee (representative receptor under the most likely foreseeable future land use by OHARNG) and Resident Subsistence Farmer land use from these risk-based cleanup goals, background concentrations, and other information in this section. The preliminary cleanup goals for the National Guard Trainee are protective of other potential receptors with equal or lesser exposure assumptions than the representative receptor and; therefore, serve as surrogates for these other possible receptors (e.g., preliminary cleanup goals for the National Guard Trainee are also protective of a hunter or a security guard). The potential for the representative receptor to be protective of a trespasser to the site is also addressed. In addition to the representative receptor, preliminary cleanup goals are established for a Resident Subsistence Farmer (adult and child) to provide a baseline for evaluating whether this site may be eligible for unrestricted (i.e., residential) release.

The risk-based cleanup goals were calculated using the methodology presented in the Risk Assessment Guidance for Superfund (RAGS), Part B (USEPA 1991), while incorporating site-specific exposure parameters applicable to the five potential receptors outlined in the Facility-Wide Human Health Risk Assessment Manual. The process for calculating risk-based cleanup goals was a rearrangement of the cancer risk or non-cancer hazard equations, to solve for the concentration that will produce a specific risk or hazard level instead of calculating risk/hazard from a given concentration. For example, the risk-based cleanup goal for hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) at the cancer risk level of 1E-05 for the National Guard Trainee is the concentration of RDX

that produces a risk of 1E-05 when using the exposure parameters specific to the National Guard Trainee receptor and the cancer slope factor for RDX. Equations, exposure parameters, and toxicity values (cancer slope factors and non-cancer reference doses) are provided in the HHRA and were taken from the Facility-Wide Human Health Risk Assessment Manual (USACE 2005c).

The Facility-Wide Human Health Risk Assessment Manual (USACE 2005c) identifies 1E-05 as a target for cumulative incremental lifetime cancer risk (ILCR) (target risk [TR]) for carcinogens and an acceptable target hazard index (THI) of 1 for non-carcinogens consistent with Ohio EPA guidance (Ohio EPA 2004), with the caveat that exposure to multiple COCs might require these targets to be decreased for chemical-specific risks. The chemical-specific TR and THI are dependent on several factors, including the number of carcinogenic and non-carcinogenic COCs and the target organs and toxic endpoints of these COCs. For example, if numerous (i.e., more than ten) non-carcinogenic COCs with similar toxic endpoints are present, it might be appropriate to select chemical-specific preliminary cleanup goals with a THI of 0.1 to account for exposure to multiple contaminants.

The calculations for risk-based cleanup goals included assumptions for combined exposure through ingestion, inhalation of vapors and fugitive dust, and dermal contact with contaminated media. For chemicals having both a cancer and non-cancer endpoint, risk-based cleanup goals were calculated for both cancer risk and non-cancer hazard at the appropriate TR and THI. The preliminary cleanup goals are selected as the lower of the risk-based cleanup goal for cancer risk and non-cancer hazard. For the Resident Subsistence Farmer, an additional selection criterion is the lower of the risk-based cleanup goal for the adult and child. If the applicable risk-based cleanup goal concentration is less than background, the background concentration is selected as the preliminary cleanup goal.

The list of human health COCs for evaluation of remedial alternatives are identified for CBP based on risk management considerations including:

- Comparison of EPC to preliminary cleanup goal concentrations (including background concentrations);
- Consideration of soil as the primary source of contamination (i.e., if soil concentrations are below background at an AOC, that AOC is not contributing to contamination in other media); and
- Other site-specific and receptor-specific considerations.

The remainder of this section provides the following detailed information:

- Land use and potential receptors at CBP (Section 6.3.1);
- A summary of COCs identified in the HHRA (Section 6.3.2);

- Identification of the appropriate TR level and THI for establishing preliminary cleanup goals based on the number and type of COCs identified in the HHRA (Section 6.3.3);

- Chemical-specific preliminary cleanup goals (Section 6.3.4); and

- Risk management considerations and the identification of COCs for further evaluation (Section 6.3.5).

6.3.1 Land Use and Potential Receptors at CBP

The intended future land use for CBP is for National Guard training. Specifically, this area will be used for dismounted training. This future use could include the three National Guard receptor types (Trainee, Security Guard/Maintenance Worker, and Fire/Dust Suppression Worker). The receptors are exposed to soil through incidental ingestion, dermal contact, and inhalation of vapors and fugitive dust for durations specified in Table 6-2. Based on these parameter values, the National Guard Trainee has the largest risks among the three National Guard receptors. Therefore, preliminary cleanup goals established for this receptor will also be protective of other National Guard receptors. The National Guard Trainee is also protective of a Juvenile Trespasser and an Adult Trespasser. The National Guard Trainee is used as the representative receptor for the intended land use and preliminary cleanup goals for the National Guard Trainee are presented here as the primary preliminary cleanup goals applicable to soil at CBP.

Table 6-2. Central Burn Pits Receptor Exposure Durations

Receptor	Exposure Durations			
	Hours/Day	Days/Year	Hours/Year	Total Years
National Guard Trainee	24	39	936	25
National Guard Fire/Dust Suppression Worker	4	15	60	25
National Guard Security Guard/Maintenance Worker	1	250	250	25
Juvenile Trespasser	2	50	100	10
Adult Trespasser	2	75	150	30
Recreational Receptor	4.57	7	32	30

While the intended future land use for CBP does not include recreational use or commercial/industrial development, preliminary cleanup goals established for the National Guard Trainee will be protective of both. A recreational receptor exposed to contaminants in soil during hunting, trapping, and fishing because these recreational activities assume less exposure than the National Guard Trainee. The National Guard Trainee has similarities to a commercial/industrial receptor (e.g., 25-year adult exposure). The total exposure time for an industrial worker (2,000 hours/year) is approximately double that of the National Guard Trainee; however, exposure to airborne contaminants (i.e., fugitive dust) is greater for the National Guard Trainee because of high dust generation by tracked vehicles used in training. Based on this analysis, the National Guard Trainee would produce larger risks than the commercial/industrial receptor when assessing human health risks via inhalation and; therefore,

the National Guard Trainee would be protective of the commercial/industrial receptor exposed via the inhalation pathway. However, if commercial/industrial development is proposed in future land use planning, it will be necessary to reevaluate potential receptors.

In addition to the National Guard Trainee described above, the Resident Subsistence Farmer (adult and child) provides a baseline for evaluating whether this site may be eligible for unrestricted release. The Resident Subsistence Farmer is considered a "worst-case" exposure scenario and cleanup goals developed for this scenario are considered to be protective for all other potential land uses.
As indicated above, National Guard Training is the most likely foreseeable land use at CBP; therefore, the Trainee is considered as the representative receptor. A summary of the preliminary cleanup goals for the COCs identified for evaluation of remedial alternatives is provided below for the representative receptor (National Guard Trainee) and the Resident Subsistence Farmer (adult and child).

6.3.2 Chemicals of Concern

COCs are defined under EPA guidelines as chemicals with an ILCR greater than 1E-06 and/or a hazard index (HI) greater than 1 for a given receptor. COCs for soil for the National Guard Trainee and Resident Subsistence Farmer (adult and child) are summarized below.

- Two COCs were identified in deep surface soil (0-4 ft BGS) for the National Guard Trainee in the HHRA presented in the CBP RI Report (USACE 2005a) and the Supplemental Phase II RI of Central Burn Pits. These COCs include one non-carcinogen (manganese) and one carcinogen (arsenic). Chromium was identified as a COC in the HHRA because it was evaluated as hexavalent chromium (the most toxic form of chromium) in the absence of measured hexavalent chromium data. Subsequent to the HHRA, additional soil samples were collected at CBP and analyzed for both total chromium and hexavalent chromium. These data and their impact on the conclusions of the HHRA are provided in Chapter 5. Evaluation of these data results in both total chromium and hexavalent chromium being eliminated as COPCs in soil at CBP; therefore, chromium is not a COC for this medium.

- No non-carcinogenic COCs were identified for the Resident Subsistence Farmer. Two carcinogenic COCs were identified for this receptor including one metal (arsenic) and one semi-volatile organic compound (SVOC) [benzo(*a*)pyrene]. Arsenic was also identified as a subsurface soil (1-30 ft BGS) COC for this receptor.

A Trespasser (Adult and Juvenile) is evaluated in Appendix H in addition to the National Guard Trainee and residential land use. No soil COCs are identified for the Juvenile Trespasser; arsenic is identified as a COC in shallow surface soil (0-1 ft BGS) for the Adult Trespasser because assumed exposure is higher than for the Juvenile.

6.3.3 Target Risk for Preliminary Cleanup Goals

The Facility-Wide Human Health Risk Assessment Manual (USACE 2005c) identifies a 1E-05 target for cumulative ILCR (TR) for carcinogens and an acceptable THI of 1 for non-carcinogens consistent with Ohio EPA guidance, with the caveat that exposure to multiple COCs might require these targets to be decreased. For example, if numerous (i.e., more than 10) non-carcinogenic or carcinogenic COCs with similar toxic endpoints are present, it might be appropriate to select chemical-specific preliminary cleanup goals with a TR of 1E-06 or a THI of 0.1 to account for exposure to multiple contaminants. The TR and THI selected for CBP are dependent on several factors, including the number of carcinogenic and non-carcinogenic COCs and the target organs and toxic endpoints of these COCs.

A chemical-specific TR of 1E-05 and THI of 1.0 are identified as appropriate for establishing preliminary cleanup goals for soil at CBP based on the small number of COCs present and the types of COCs (carcinogenic or non-carcinogenic). The National Guard Trainee is the representative receptor for CBP. Only two soil COCs were identified for this receptor; one non-carcinogen (manganese) and one carcinogen (arsenic). Two soil COCs (both carcinogens) were identified for the residential receptors.

6.3.4 Preliminary Cleanup Goals

Risk-based cleanup goals calculated in the HHRA for COCs in soil, background concentrations for inorganics, and preliminary cleanup goals are presented for the National Guard Trainee in Table 6-3.

Table 6-3. Soil Preliminary Cleanup Goals for National Guard Trainee Scenario at CBP[a]

COC	EPC (mg/kg)	Risk-Based cleanup goal from HHRA (mg/kg)		Background[b] (mg/kg)	Preliminary Cleanup Goal (mg/kg)
		HI = 1.0	ILCR = 1E-05		
Inorganics					
Arsenic	15	1500	31	15.4	31
Manganese	1200	350	--	1450	1800[c]

[a] Deep (0-4 ft below ground surface) surface soil is used for the National Guard Trainee due to the nature of ground training activities that may result in tank depressions and soil disturbance to 4 feet bgs.

[b] Final facility-wide background values for the Ravenna Army Ammunition Plant from the Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 2001b). Background values for soil are available for two soil depths: surface (0-1 ft BGS) and subsurface (1-12 ft BGS); the minimum value for these two aggregates is reported.

[c] Value is USEPA Region 9 residential PRG (http://www.epa.gov/region09/waste/ sfund/prg/index.html)

-- = Toxic endpoint not evaluated for this COC.

Estimated EPCs of arsenic and manganese are less than the preliminary cleanup goals established for these COCs for the National Guard Trainee Scenario.

Risk-based cleanup goals calculated in the HHRA for COCs in soil, background concentrations for inorganics, and preliminary cleanup goals for the Resident Subsistence Farmer are presented in Table 6-4.

Table 6-4. Soil Preliminary Cleanup Goals for Resident Subsistence Farmer Scenario at CBP

COC	EPC[a] (mg/kg)	Risk-Based Cleanup Goal from HHRA (mg/kg)				Background[b]		Preliminary Cleanup Goal	
		Adult		Child					
		HI = 1.0	ILCR = 1E-05	HI = 1.0	ILCR = 1E-05	Surface	Sub surface	Surface	Sub surface
Inorganics									
Arsenic	15 (15)	130	3.1	22	NC	15.4	19.8	15.4	19.8
Semivolatiles									
Benzo(a)pyrene	0.22	--	0.37	--	NC	NA	NA	0.37	NA

[a] Shallow (0-1 ft BGS) surface soil and subsurface soil (1-30 ft BGS) are used for Resident Subsistence Farmer. The FWHHRAM (USACE 2005b) defines the subsurface soil exposure unit as 0 to 13ft BGS; however, samples were collected to depths of 30 ft BGS during the RI and all data below 1 ft BGS were incorporated into the risk evaluation. EPCs are presented for surface soil. EPCs for subsurface soil are in (parentheses).

[b] Final facility-wide background values for the Ravenna Army Ammunition Plant from the Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 2001b).

-- = Toxic endpoint not evaluated for this COC.

NA = Not applicable. Background concentrations are used for inorganic COCs only and benzo(a)pyrene is not identified as a COC in subsurface soil (1-30 ft BGS).

NC = Not calculated.

Estimated EPCs of both arsenic and benzo(a)pyrene are less than the preliminary cleanup goals for these COCs for the Resident Subsistence Farmer Scenario in shallow surface (0-1 ft BGS) and subsurface soil (1-30 ft BGS).

6.3.5 Risk Management Considerations

For representative land use (i.e., for the National Guard Trainee receptor), two soil COCs are identified. Neither of the soil COCs identified in the HHRA for the National Guard Trainee are recommended for further evaluation for the following reason:

- The EPCs for arsenic and manganese in deep surface soil (0-4 ft BGS) are less than the background and preliminary cleanup goals established for the National Guard Trainee (Table 6-5). Furthermore, only one individual concentration (out of 72 sample results) is above the preliminary cleanup goal for arsenic. The 11 individual samples having detected concentrations (out of 72 total sample results) above the preliminary cleanup goal for manganese are randomly located throughout CBP. It is unlikely that a National Guard Trainee would be exposed to concentrations at a single location over the entire exposure period for this representative receptor (936 hours per year for 25 years).

For Resident Subsistence Farmer (adult and child) land use, two shallow surface soils COCs and one subsurface COC were identified. These COCs for residential land use are not identified for further evaluation for the following reasons:

- The EPC for arsenic in shallow surface soil (0-1 ft BGS) (16 mg/kg) exceeds the background concentration (15 mg/kg) for surface soil (0-1 ft BGS) and is below the background concentration (20 mg/kg) for subsurface soil (1-30 ft BGS). CBP is a highly disturbed area making it difficult to distinguish between original surface and subsurface soil. Further, any residential development would require excavation resulting in exposure of subsurface soil. Because residential development would result in exposure to subsurface soil (with a background of 20 mg/kg), and the EPC for arsenic in surface soil is only 16 mg/kg, arsenic is not recommended for evaluation of remedial alternatives. Also note that the nine individual samples having detected concentrations (out of 43 total sample results) above the preliminary cleanup goal for arsenic are randomly located throughout CBP. It is unlikely that a resident would be exposed to concentrations at a single location over the entire exposure period (e.g., 24 hours per day for 350 days per year for 30 years for an Adult Resident Subsistence Farmer).

- The EPC for arsenic in subsurface soil (1-30 ft BGS) is less than the preliminary cleanup goal established for the Resident Subsistence Farmer (Table 6-6). Furthermore, the five individual samples having detected concentrations (out of 37 total sample results) above the preliminary cleanup goal for arsenic are randomly located throughout CBP and, as noted above, it is unlikely that a resident would be exposed to concentrations at any single location over the entire exposure period (e.g., 24 hours per day for 350 days per year for 30 years for an Adult Resident Subsistence Farmer).

- Benzo(a)pyrene was detected only once in shallow surface soil (0-1 ft BGS) and the detected concentration is less than the preliminary cleanup goal for the Resident Subsistence Farmer Scenario (Table 6-6).

Table 6-5. Soil COCs for Representative Receptor (National Guard Trainee) at CBP

COC[a]	Freq. of Detect	Measured Concentration (mg/kg)			Bkg[d] (mg/kg)	Detects > Bkg[e]	Preliminary Cleanup Goal[f] (mg/kg)	Detects > Preliminary Cleanup Goal[e]	Risk Management Considerations	Rec[g]
		Avg.	Max[b]	EPC[c]						
Deep Surface Soil (0-4 ft BGS)										
Arsenic	71/ 72	12	33	15	15	12	31	1	EPC less than background and preliminary cleanup goal	NC
Manganese	72/ 72	980	5780	1220	1450	13	1800	11	EPC less than background and preliminary cleanup goal	NC

[a]Chemical of concern (COC) identified in the HHRA.

[b]Maximum detected concentration.

[c]Exposure point concentration (EPC) is 95 percent upper confidence limit (UCL) of the mean or maximum detected concentration depending on number of samples and data distribution.

[d] Final facility-wide background values for the Ravenna Army Ammunition Plant from the *Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001b).

[e]Number of detected concentrations exceeding the background criterion or preliminary cleanup goal. The one deep surface soil locations with arsenic detected > its preliminary cleanup goals is SS-004-0001-SO from 0-1 ft BGS (32.8 mg/kg).

The following manganese concentrations were detected above its preliminary cleanup goal: SS-004 from 0-1 ft BGS (32.8 mg/kg), SS-006 from 0-1 ft BGS (5,410 mg/kg), SS-007 from 0-1 ft BGS (2,860 mg/kg), SS-019 from 0-1 ft BGS (2,720 mg/kg), SS-022 from 0-1 ft BGS (2,550 mg/kg), SS-026 from 0-1 ft BGS (2,420 mg/kg), SS-004 from 1 to3 ft BGS (2,670 mg/kg), SS-007 from 1 to 3 ft BGS (2,390 mg/kg), SS-010 from 1-3 ft BGS (3,340 mg/kg), SS-026 from 0-1 ft BGS (2,180 mg/kg), and SS-027- from 0-1 ft BGS (2,090 mg/kg).

[f]Preliminary cleanup goal from Table 6-3.

[g]Recommendation for COCs for evaluation of remedial alternatives.

NC = Not recommended as a COC for further evaluation.

Table 6-6. Soil COCs for Residential Land Use at CBP

COC[a]	Freq. of Detect	Measured Concentration (mg/kg)			Bkg[d] (mg/kg)	Detects > Bkg[e]	Preliminary Cleanup Goal[f] (mg/kg)	Detects > Preliminary Cleanup Goal[e]	Risk Management Considerations	Rec[g]
		Avg.	Max[b]	EPC[c]						
Shallow Surface Soil (0-1 ft BGS)										
Arsenic	42/ 43	12	33	16	15	9	15	9	EPC less than subsurface background and preliminary cleanup goal	NC
Benzo(a)pyrene	1/ 9	0.056	0.22	0.22	NA	NA	0.37	0	EPC less than preliminary cleanup goal	NC
Subsurface Soil (1-30 ft BGS)										
Arsenic	37/ 37	13	31	15	20	5	20	5	EPC less than background/preliminary cleanup goal	NC

[a]Chemical of concern (COC) identified in the HHRA.

[b]Maximum detected concentration.

[c]Exposure point concentration (EPC) is 95 percent upper confidence limit (UCL) of the mean or maximum detected concentration depending on number of samples and data distribution.

[d] Final facility-wide background values for the Ravenna Army Ammunition Plant from the *Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001b).

[e]Number of detected concentrations exceeding the background criterion or preliminary cleanup goal.

The nine shallow surface soil locations (0-1 ft BGS) with arsenic exceeding preliminary cleanup goals are: SS-001 (19.7 mg/kg), SS-002 (25.2 mg/kg), SS-004 (32.8 mg/kg), SS-008 (25.5 mg/kg), SS-009 (19.5 mg/kg), SS-014 (17.2 mg/kg), SS-018 (19.3 mg/kg), SS-031 (19.6 mg/kg), and SS-036 (16.5 mg/kg).

The five subsurface soil locations with arsenic detected > its preliminary cleanup goals are: SS-008 from 1-3 ft BGS (27.5 mg/kg), SB-003A from 21-23 ft BGS (25 mg/kg), SB-005 from 17 to18 ft BGS (22.3 mg/kg), SB-007 from 22-24 ft BGS (26.2 mg/kg), CBP-036 from 0 to 3 ft BGS (20.9 mg/kg).

The one sediment sample with arsenic exceeding the preliminary cleanup goal is SD-009 (20.1 mg/kg):

[f]Preliminary cleanup goal from Table 6-4.

[g]Recommendation for COCs for evaluation of remedial alternatives.

NA = Not applicable. Background criteria are used only for naturally occurring inorganic chemicals.

NC = Not recommended as a COC for further evaluation.

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7.0 ECOLOGICAL RISK ASSESSMENT

The SERA for CBP is available in the original RI Report (USACE 2005a). The SERA evaluates the potential risk to ecological receptors. The SERA was based on the available data following the RI. Additional discrete soil sample data collected during the Supplemental Phase II RI was evaluated to determine if the conclusions of the SERA change as a result of the new data (Chapter 5). Evaluation of the supplemental soil data showed that no changes to the conclusions of the SERA at CBP are required for either surface soil (0-1 ft BGS) or subsurface soil (1-30 ft BGS).

7.1 SUMMARY OF ECOLOGICAL RISK ASSESSMENT

The BERA (Level III Baseline) identified multiple COECs in surface soil (0-1 ft BGS) from the CBP (Table 7-1). There were two scenarios evaluated in the RI Report (USACE 2005a): a conservative scenario and an average scenario. The conservative scenario entailed using reasonable maximum exposure (RME) concentrations (i.e., lower of the maximum detected concentration and the 95% UCL of the mean) and no-observed-adverse-effect level (NOAEL) toxicity reference values (TRVs) for wildlife receptors. The COECs were called COPCs in the RI Report but the COPC designation was comparable to Ohio EPA's designation of COEC.

The SERA for CBP included an additional screening step in the conservative scenario by comparing against lowest-observed-adverse-effect level (LOAEL) TRVs, and also included an average scenario in which mean concentrations for calculating exposures were compared against both NOAEL and LOAEL TRVs, consistent with USEPA guidance for re-evaluation of COPCs (USEPA 1997). The Ohio EPA guidance for SERA (Ohio EPA 2003) does not describe the use of either the conservative scenario comparison using LOAEL TRVs or the average scenarios using either NOAEL or LOAEL TRVs, but they may be related to SERA levels II or III in Ohio EPA Guidance. In this report, soil COECs were identified as chemicals having an HQ > 1.0 for one or more of the ecological terrestrial receptors when compared to NOAEL TRVs, or chemicals for which there were no TRVs associated with an expected level of effect. Surface soil (0-1 ft BGS) COECs have the potential to pose a hazard or risk to plants and animals.

Based on the conservative scenario (RME concentrations and NOAEL TRVs for wildlife receptors), surface soil had 27 total COECs, including 18 based on having HQs > 1 for multiple ecological receptors and 10 COECs based on having no TRV for one or more receptors. Aluminum had the largest HQ for plants (622), followed by the HQ for iron for earthworms (535). Based on the average scenario that used mean concentrations and LOAEL TRVs for wildlife, the total number of COECs decreased to 14, which included just one based on an HQ >1.

Table 7-1. Overview of Surface Soil (0-1 ft BGS) COECs at CBP - BERA (Level III)

COECs[a] with 3 Highest HQs[a]		Other COECs with HQs[a] > 1	
COEC	**HQ**	**COEC**	**Range of HQs**
Aluminum	622	Mercury	155
Iron	535	Chromium	3 to 143
Zinc	176	Cyanide	74
		Manganese	62
		Lead	12 to 49
		Copper	21
		Vanadium	19
		Selenium	13
		Arsenic	3 to 8
		Arochlor-1254	3 to 6
		Thallium	4
		Barium	2
		Cadmium	1 to 2
		Cobalt	1
		Nickel	1

COECs = Chemicals of ecological concern.
[a]Note: These HQs are based on Lowest Observed Adverse Effect Levels for plants and invertebrates, but No Observed Adverse Effect Levels for wildlife, and RME concentrations.
RME = Reasonable maximum exposure (lower of maximum detect or 95% UCL of the mean).
HQ = Hazard quotient.

The SERA (Level III screen) was also performed to find any COECs in surface water and sediment for the CBP location. No COPECs or COECs were identified in the surface water samples. For sediment, there were five COEPCs retained due to risks to benthic invertebrates. Additional evaluation criteria were applied to these five COECs: (1) the magnitude of exceedance, (2) frequency of chemical detection and spatial distribution, (3) contaminant bioavailability, (4) habitat, and (5) alternative benchmarks. In every case, there was no reason to do any further analyses; the five COECs did not exhibit much ecological risk (e.g., they had low HQs) once the additional five evaluation criteria were applied. In addition, the facility-wide biology and surface water study (USACE 2005d) looked at various parameters in nearby Sand Creek (downstream and upstream stretches) and at both locations the stream was reported as being healthy and functioning and that use attainment was being met according to Ohio EPA guidance. In short, there is no, to little, ecological risk from the sediment and surface water at CBP.

7.2 ECOLOGICAL PROTECTION

The SERA performed for CBP is available in the RI Report (USACE 2005a). Ohio EPA Levels I, II, and III were performed for CBP. The SERA identifies a variety of ecological receptor populations that could be at risk and identifies the COPECs and COECs that could contribute to potential risks from exposure to contaminated media.

Table 7-2. Summary of CBP SERA Potential Risks

Type of Species	Screening Results	Notes
Terrestrial plants and soil invertebrates	Copper, lead and zinc retained as COPECs.	Several COPECs, though not retained, are potentially bioaccumulative, so they were evaluated further in wildlife.
Sediment Invertebrates	No COPECs retained.	None of the COPECs were bioaccumulative, so no further evaluation was conducted.
Aquatic Organisms	No COPECs retained.	None of the COPECs were bioaccumulative, so no further evaluation was conducted.
Terrestrial Wildlife - Carnivores	"Conservative scenario" and NOAEL resulted in no chemicals having an HQ >1. No COPECs retained.	Because conservative scenario and NOAEL did not result in HQ >1, the empirical data were not different from background.
Terrestrial Wildlife - Insectivores/ Herbivores	"Average scenario" and NOAEL resulted in HQ>1 for: arsenic (vole and shrew); lead (robin and shrew), cadmium, chromium, and zinc (robin only).	Because conservative bioavailability assumptions were made, few LOAEL exceedances, lack of habitat in areas with greatest chemical concentrations, and similarity of site average concentrations to background concentrations, risks were determined to be acceptable.

The RI Report also reported the findings of the ecological field work (ecological reconnaissance of existing vegetation and animal life) conducted at the AOC. A facility-wide biology and surface water study provides further information for consideration at CBP. Available data document the presence of healthy and functioning terrestrial and aquatic ecosystems. If contaminants related to CBP are present in surface water and sediment in adjacent reaches of Sand Creek, they occur at levels such that detrimental effects are not observed.

The SERA results, field observations conducted at CBP, and results from studies of the adjacent reaches of Sand Creek are key risk management considerations for whether remediation is necessary to protect ecological resources at CBP. This combination of information shows that: (1) while TRV exceedance and HQs being greater than one suggest risk to plants and selected animals, and (2) the field observations reveal the ecological system with the plants and animals is functioning well and organisms appear to be healthy. Further, where surface water is involved, the use attainments are being met per Ohio guidance. The ecological systems were found healthy, therefore ecological preliminary cleanup goals are not recommended and remediation for ecological risks is not justified at CBP.

7.2.1 Ecological Preliminary Cleanup Goals for CBP

Ohio EPA guidance (Ohio EPA 2003) allows decisions regarding the need for remediation to be made at the completion of each level of the SERA process. The remedial alternatives evaluation process includes the development of preliminary cleanup goals or COEC concentrations used to define areas where remediation is needed to achieve protectiveness for ecological resources. A decision whether it is necessary to remediate because of potential harm to ecological receptors and whether it is necessary to set preliminary cleanup goals for ecological receptors at CBP is not included in the RI Report. The

following weight-of-evidence discussions provide input for that decision. A Level II SERA and a Level III BERA was conducted at CBP.

Stewardship of the environment will be a major consideration in the phases of planning, design, and implementation of the military mission of the National Guard trainee. Presently, ecological risk is possible albeit the HQs are mostly under 1 and, if not, mostly under 150 for exposure scenarios considered to be protective of the ecological receptors at CBP (zinc at 180 and aluminum excluded). Biological measurements (healthy stream ecology downgradient of site) near CBP corroborate the generally low HQs (i.e., low ecological risk). The OHARNG will manage and protect natural resources at CBP through implementation of the Integrated Natural Resources Management Plan (INRMP) (AMEC 2001). However, a small amount of habitat alteration from training exercises (dismounted training and no digging) could occur and result in vegetation cut-back (simpler or different habitats), less available food sources in those patches (simpler habitat), and fewer organisms to be exposed. These few changes would be minor compared to the existing habitat disturbance (cut-over areas, roads, and piles). These observations, along with the low concentrations of various COECs, support the recommended decision no remediation for ecological resources at CBP. The following sections provide the detailed rationale for the recommendation.

7.2.2 Ecological Cleanup Goal Development Weight of Evidence

This section provides the detailed rationale for why remediation for protection of ecological receptors is not warranted for ecological risks at this time. The rationale includes:

- Onsite or near-site field observations (Level I of Ohio EPA protocol and Facility-wide Biological and Surface Water Study) show relatively healthy terrestrial and aquatic ecosystems and full attainment status (USACE 2005a) according to Ohio EPA guidance, despite the identification of COECs with HQs greater than 1.

- Chemical HQs in soil are generally not highly elevated and metal concentrations are similar to background for all COECs.

- Land use at the AOC (military training) may impact ecological habitats, and military mission overrides the results of the HQ.

- No unique ecological resources are found at CBP and there is attractive high-quality habitat adjacent to CBP.

- Contaminant fate and transport evaluation in the RI report show that migration is not expected to occur from soil to nearby aquatic environments.

- Mitigation trade-off is of two types (chemical and physical) where removal of impacted soil or sediment (i.e., chemical) would lower the exposure and ecological risk, but where attendant physical removal, such as vegetation, would cause damage to the habitat.

Each element is explained below regarding the need for ecological preliminary cleanup goals or remediation to protect ecological receptors and a recommendation follows.

7.2.2.1 Ecological Reconnaissance and USEPA/USACE Biology and Surface Water Study Shows Functioning Ecological System

Level IV of the SERA process (Ohio EPA 2003) is an evaluation of exposures and any observable adverse ecological effects at the site. Observation of a healthy ecological community can mitigate the conclusions resulting from risk calculations based on theoretical exposure models. Although a Level IV risk assessment was not done, some field observations have been made at CBP. These observations indicate that despite the presence of COPECs, little adverse ecological effect has occurred at the site.

A facility-wide biological and surface water investigation was completed by USACE with cooperation of Ohio EPA (USACE 2005d). In the investigation, water and sediment samples were taken from locations along major stream and tributaries, ponds, and wetlands throughout RVAAP at locations that could have been impacted by former facility activities and sites where the streams entered RVAAP. Fish were caught, identified, and released in the sampling locations corresponding to the water and sediment sample locations. Invertebrate biota were collected by Hester-Dendy samplers set in the same locations and by qualitative sampling of organic debris and rocks in the stream reach. Funnel traps were additionally placed in ponds and wetlands for further invertebrate sampling. Sand Creek, which borders CBP on the west, was among the sampled water bodies. The details of the study, locations, techniques, and results from this study are published in the Ravenna Facility-wide Surface Water Study: Streams and Ponds (USACE 2005d).

By way of summary of surface water quality, for all eight of the Sand Creek sampling locations, including the one near CBP, there were no exceedances of the Ohio Water Quality Standard (WQS) aquatic life maximum or average water quality criteria. None of the chemicals measured in this study exceeded criteria protective of the Warmwater Habitat (WWH) aquatic life use. For the sediment summary, sediment collected from all eight locations in Sand Creek reflected non-contaminated conditions. All eight Sand Creek sites evaluated in this survey revealed very good to excellent stream habitats. Macroinvertebrate communities were very good to exceptional in Sand Creek. Fish communities ranged from marginally good to good in Sand Creek, one sampling location of which is near CBP.

7.2.2.2 Anticipated Habitat Alteration

The OHARNG will implement environmental stewardship and sustainable resource practices through the INRMP (AMEC 2001) to ensure that natural resources at CBP are protected. However, under the future land use, minor potential habitat disturbance because of National Guard dismounted training activities may occur at any one acre (i.e., size of home range of small wildlife species). Some small areas at the CBP may be cleared of vegetation, but much stress to vegetation already exists at CBP (i.e., CBP is a previously disturbed area). Thus, any additional disturbance of vegetation would not

necessarily add more stress. Other places may have soil compaction and potentially disturbed vegetation, but there is already stress of that type too. Minor impacts on surface soil (0-1 ft BGS) may involve small petroleum, oil, and lubricant (POL) leaks and exhaust from vehicles. Subsurface disturbance activities are not planned; digging and occupying fighting positions that extend below ground will be prohibited. Thus, any habitat disturbance at CBP would be limited.

The amount of minor future potential habitat disturbance is not known at this time and therefore, a scenario has been developed to predict what could happen. It is assumed that up to 50% (worst case scenario) of the area may be disturbed. Mostly, the vegetation may potentially be disturbed, while the soil would be disturbed to a lesser extent. CBP consists of about 20 acres of habitat. Thus, the potential disturbance area could be up to 10 acres. The potential acreage to be disturbed is small compared to the total facility acreage. For example, CBP is part of a facility that is approximately 22,000 acres; therefore, this area represents 20 acres out of 22,000 acres or about 0.1% of the total area. Potential disturbance to this small area would be insignificant to ecological function and sustainability.

Any potential habitat disturbance from military training may involve only a few acres within thousands of acres of adjacent habitats at RVAAP. For example, most of CBP (approximately 20 acres) consists of old field and cutover forest communities including corridors and patches of trees (see next Section 7.2.2.3 on nearby habitats). There are hundreds of acres of these types of habitats at RVAAP. The other habitats at CBP are also part of the great diversity of habitat types near CBP and across thousands of acres at RVAAP.

In summary, impacts to habitat at CBP would be minimal due to an already disturbed habitat, the diversity of habitat in adjacent areas and elsewhere on the facility, and the continuation of environmental stewardship.

7.2.2.3 Habitat

Vegetation and animals are found at CBP. The vegetation consists of many old-field communities with corridors and patches of forest vegetation. Animals consist of soil invertebrates, many species of insects, mammals (e.g., mice, deer, and foxes), and birds (e.g., sparrows, cardinals, and warblers). Therefore, National Guard training would be carried out in an environment in which the impact would be limited to typical RVAAP ecological resources. A more detailed description is contained in the original RI Report (USACE 2005a).

As stated above, ecological resources are present and nearby habitat is available to receive wildlife that leaves the training area. Some vegetation, especially bushes and old-field vegetation, as well as some trees, may be removed from within CBP. Old-field vegetation could be mowed or cleared in another way. Wildlife may be disturbed by the movement and noise of training equipment as well as trainees. Wildlife species, such as small mammals and small birds with limited home ranges, can leave and enter adjacent old fields and forest patches and vegetative corridors.

7.2.2.4 Low Levels of Soil Contamination

A total of 17 of the 18 COECs identified in surface soil (0-1 ft BGS) at CBP are metals. The EPCs for six of the metals are less than their background criteria (Table 7-3) and the EPCs for eight of the metals are less than three times their background criteria. The remaining three metals have no background criteria for comparison. The only organic COEC is Arochlor-1254 (detected in 3 of 20 surface soil samples).

Table 7-3. Background Concentrations of Surface Soil (0-1 ft BGS) COECs at CBP

Analyte	Detected Results/Total Samples	Average Result	Maximum Detect	Exposure Concentration	Background	Number of Detects>Bkg.
Aluminum	43/43	13200	29700	14900	17700	5
Arsenic	42/43	12	33	16	15	9
Barium	43/43	126	417	153	88	21
Cadmium	27/43	0.34	2.2	0.59	0	27
Chromium	43/43	16	49	18	17	12
Cobalt	42/43	7.2	22	13	10	11
Copper	43/43	50	1260	40	18	9
Cyanide, Total	19/43	2.9	92	2.1	0	19
Iron	43/43	22000	107000	28500	23100	17
Lead	43/43	59	493	74	26	18
Manganese	43/43	1090	5780	1430	1450	8
Mercury	42/43	0.0362	0.071	0.040	0.040	16
Nickel	43/43	12	27	14	21	4
Selenium	29/43	0.79	2.0	1.2	1.4	7
Thallium	2/43	0.30	0.22	0.22	0	2
Vanadium	43/43	20	37	22	31	3
Zinc	43/43	142	1500	172	62	20

7.2.2.5 No to Low Contaminant Migration

The facility-wide surface water sampling and assessment revealed that, in general, surface water quality in the streams at RVAAP was good to excellent with few exceedances of Ohio Water Quality Standards (WQS). Intact riparian buffers around the streams contributed to good habitat and absence of substantial silt deposits. Evidence suggests that an additional remedial investigation effort, on an installation-wide basis, of the streams included in that report is not warranted. Contamination is not currently present in the sediment in the sampled reaches, and the surface water appears to be similarly free of contaminants. However, this does not preclude investigating surface water and sediment on an individual basis as required by Ohio EPA.

At CBP, offsite migration is possible via a conveyance in the northwestern portion of the AOC towards Sand Creek. Sand Creek is up to 1,000 ft from the AOC boundary. Migration is not likely for three reasons: First, site conditions (slope, soil type, plant cover) are only slightly conducive to

erosion. Second, the RI contaminant fate and transport assessment concluded that leaching of contaminants from soil was not a significant transport pathway. Third, and more importantly, site conditions are unlikely to change in a way that would lead to increases in surface water or sediment concentrations as a result of erosion or leaching from the soil. Thus, it is expected that exposure and risk to aquatic receptors will not change. If contamination has reached Sand Creek, there is little to no evidence of it.

7.2.2.6 Mitigation Trade-off of Reducing Chemical Risk but Harming Environment

There is a trade-off of two kinds of risk: physical alterations and residual contamination. The localized ecosystem can either have clean soil because of removal and replacement but have a highly disturbed habitat as a result, or have exposure to contaminants in the soil in a habitat that is minimally disturbed. In some cases, it can be appropriate to allow plants and animals low in the food chain to be exposed to potentially toxic concentrations, sparing important habitat, if animals higher in the food chain (especially top carnivores) are not receiving toxic exposures. In other cases, especially when human health is threatened, it is necessary to alter or destroy habitat to prevent exposure to soil contaminants (Suter et al. 1995). In the case of CBP activities, the military training mission requires activities that will alter some already disturbed habitat and could create some intermittent noise. Wildlife is expected to respond by moving away from the noise and likely returning to their cover and food when the noise abates.

There may be little benefit to removing contaminated soil or sediment because COPEC concentrations are not necessarily at harmful levels. For example, of 14 metal COPECs with stated background criteria, 10 had average concentrations below the background criteria, and the remaining 4 had average concentrations less than twice background. This small factor means that concentrations are not likely to be an exposure and risk issue.

7.3 Ecological Risk Assessment Conclusions and Recommendations

Based on the Supplemental Phase II RI results and weight of evidence evaluation, it is recommended that no quantitative ecological preliminary cleanup goals to protect ecological receptors be developed at CBP. This recommendation is based principally on four major conclusions from the evaluations detailed in Section 7.2:

- Field observations published in the RI (USACE 2005f) indicated there are currently few adverse ecological effects, and there is ample nearby habitat to maintain ecological communities at CBP and elsewhere on RVAAP. Further, the Facility-wide Biological and Surface Water Study (USACE 2005d) showed no evidence of negative ecological impacts in adjacent reaches of Sand Creek due to any migrating contaminants from CBP. If contaminants have migrated from CBP into these reaches of Sand Creek, they occur at concentrations such that detrimental effects are not observed.

- Soil HQs are generally not greatly elevated and, for inorganic COECs (Table 7-1), concentrations are similar to RVAAP background values.

- The OHARNG will manage and protect natural resources at CBP through implementation of the INRMP. However, a few ecological effects from military training activities (dismounted training and no digging) may occur; for example, clearing of some vegetation in an already altered and disturbed habitat may occur in the future. Any remediation of habitat would tend to be re-disturbed by repeated military training activities and; thus, reduce the benefits of remediation.

- Beneficial reduction of ecological risk would be provided by any human health risk-driven remediation.

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8.0 SUMMARY AND CONCLUSIONS

This section presents the summary and conclusions of this addendum.

8.1 CONTAMINANT NATURE AND EXTENT

Contaminant nature and extent has been fully defined with the collection and analysis of the Supplemental Phase II RI data. The areas exhibiting the greatest numbers and concentrations of explosives and inorganics have been identified and delineated, as recommended by the original RI Report (USACE 2005a). Adequate data has been collected and the uncertainties of the RI have been addressed.

Based on evaluation of the original RI data set and updated data set that includes Supplemental Phase II results, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for shallow surface soil (0-1 ft BGS) or subsurface soil (1-3 ft BGS) at CBP.

Chapters 5, 6, and 7 conclude that there is no soil or dry sediment COCs for the representative receptor that requires remediation at CBP. Soil removal is not warranted under a restricted land use scenario. As stated in Section 6, only one COC (arsenic) was identified for the Security Guard/Maintenance Worker in surface soil (0-1 ft BGS). However, the EPC is smaller than background and zero soil sample concentrations exceed the preliminary cleanup goal of 26 mg/kg. Terrestrial and aquatic ecological resources do not exhibit high HQs for soil. These points and other weight-of-evidence elements were considered when making the recommendation showing that no preliminary cleanup goals for soil and dry sediment are required for ecological protection. No preliminary cleanup goals for soil and dry sediment are required for ecological protection. No further action is warranted for soil and dry sediment at CBP.

8.2 DEBRIS PILES AND BERMS

Soil samples of berm and pile materials at CBP were collected using MI sampling techniques. The MI samples were composite samples collected from multiple, stratified random points within each of the designated MI sampling areas. The MI sample results from Piles M and N indicate they contain inorganic contaminants at much higher levels than surrounding soil. Process knowledge and visual characteristics indicate Piles M and N contain a substantial percentage of residues from previous burning activities and, on this basis, are considered waste material rather than conventional environmental media. The MI sample result from Pile M contained a total lead concentration of 8,560 mg/kg. The lead concentration in the TCLP sample from Pile M was 15.4 mg/L. This TCLP result exceeds the maximum lead concentration (5.0 mg/L) for toxicity characteristics per 40 *Code of Federal Regulations* (*CFR*) 261.24. Therefore, debris pile M was classified as a characteristically hazardous waste.

The MI sample result for Pile N had a detected value of 25 mg/kg of hexavalent chromium, which, although not characteristically hazardous, is highly elevated compared to the surrounding soil. All TCLP sample results from Pile N were below laboratory reporting limits.

The U.S. Army and Ohio EPA agreed to proceed with a non-TCRA for Piles M and N due to likelihood of contaminant dispersal and migration from the piles to surrounding environmental media. The EE/CA (USACE 2007a) developed removal action objectives (RmAOs) and evaluated alternatives for removal of Piles M and N consistent with the intended future land use at CBP.

The CBP Action Memorandum (USACE 2007b) documents the non-TCRA recommended in the EE/CA. Piles M and N were excavated and material was transported for off-site treatment and disposal. The CBP Removal Action Report documents the removal of Piles M and N, completed in March 2008, and includes the results of confirmation sampling performed to verify attainment of cleanup goals.

9.0 RECOMMENDATIONS

No further action (NFA) is recommended for chemical contaminants in CBP soil and dry sediment. No preliminary cleanup goals for ecological resources are recommended because of the several combined elements in the weight-of-evidence assessment. No human health COCs are identified for remediation under either the most likely foreseeable land use (National Guard dismounted training - no digging) or residential land use. Recommendations regarding wet sediment, surface water, and groundwater are not within the scope of this report and any necessary action for these media will be established in future decisions.

The next step in the CERCLA process is to prepare a Proposed Plan to solicit public input with respect to no further action (NFA) for soil and dry sediment at CBP. The Record of Decision (ROD) will document the final remedy for soil and dry sediment at CBP. Comments on the Proposed Plan received from state and federal agencies and the public will be considered in drafting the ROD for CBP. The ROD will provide a brief summary of the history, characteristics, risks, and the basis for the final remedy at CBP under representative land use. The ROD also will include a responsiveness summary, addressing comments received on the Proposed Plan.

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APPENDIX A

SOIL SAMPLING LOGS

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APPENDIX A
SOIL SAMPLING LOGS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

MULTI-INCREMENT SAMPLES

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DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

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HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-018 BW
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Martha Clough	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in) S.S. Bowl & Spoon BW	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: N/A 0915
	10. DRILL DATE/TIME STARTED: ~~0920~~ BW COMPLETED: ~~0940~~ 0935 BW
	15. DEPTH GROUNDWATER ENCOUNTERED: 0.2 inches BGS
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 1 ft.	

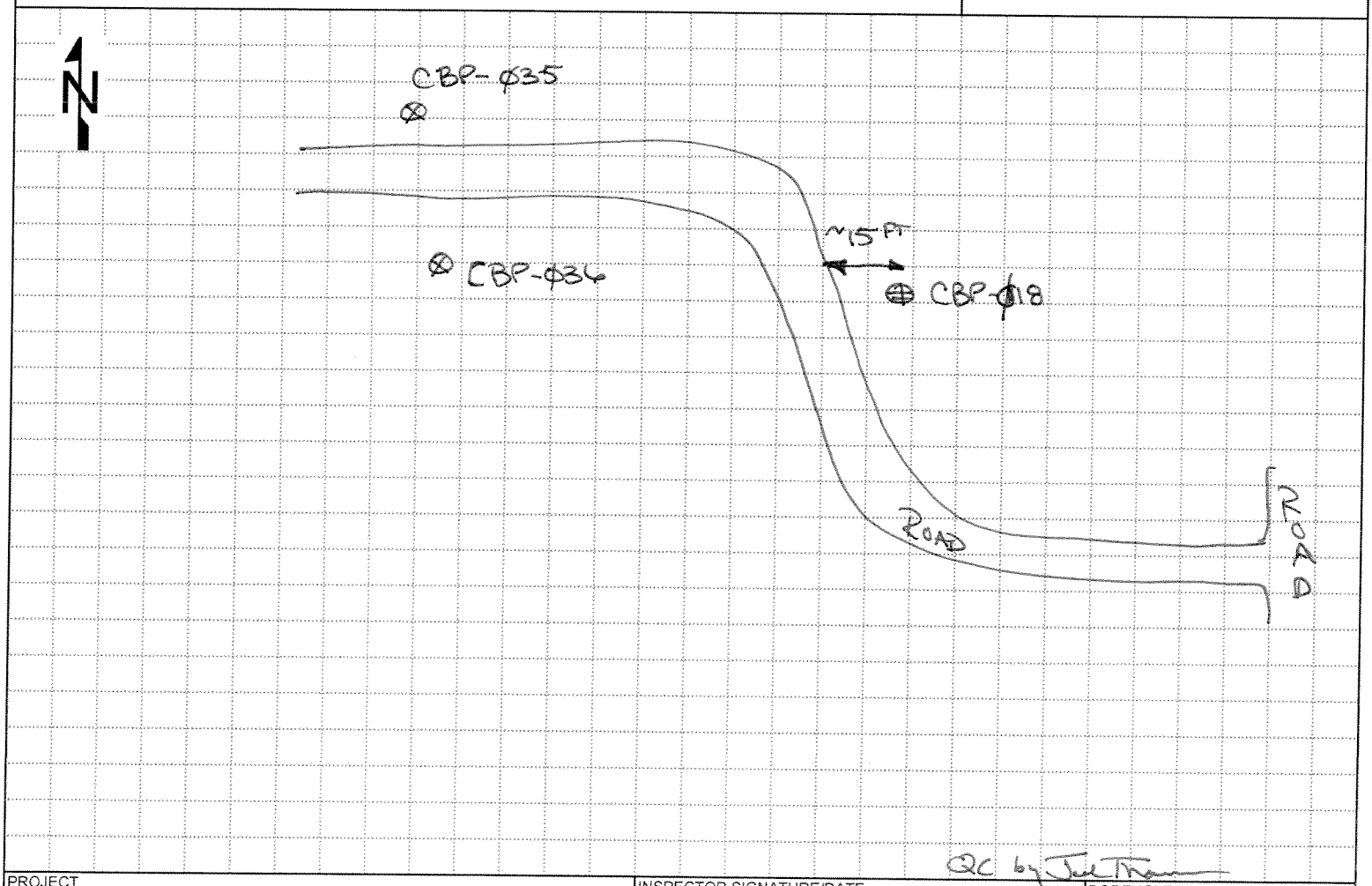
18. GEOTECHNICAL SAMPLES: N/A — UNDISTURBED: — DISTURBED: — | 19. TOTAL NUMBER OF CORE BOXES: N/A

20. CHEMICAL SAMPLES: ~~METALS~~ ~~EXPL~~ (OTHER: Total Chromium) | 21. TOTAL CORE RECOVERY %: N/A

22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/05 | DATE COMPLETED/ABANDONED: 11/16/05

BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by JT

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05	CBP-018 BW

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-018
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED DEGREES	
7. NOTES: PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KR 303		

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	BW 0.5	SM*	SAND AND SILT 2.5Y 3/1 Very dark gray; BURN DEBRIS: Burnt wood, 1/8 inch thick chips of black press board-like material (1-1.5 inches wides), bentonite from previous soil boring, metal, gravel, & roots; wet	CBP-SS-0053-0123-50 BW	0.0	FORMER LOCATION FOUND; *Primarily burn debris; Martha Clough; Water in hole
	0.8					
	BW 1.0		1.0 ft			
			Bottom of borehole			
	BW 3					
	BW 4					
	BW 5					
	BW 6					
	BW 7					
	BW 8					
	BW 9					
	BW 10					

BW 11/16/05

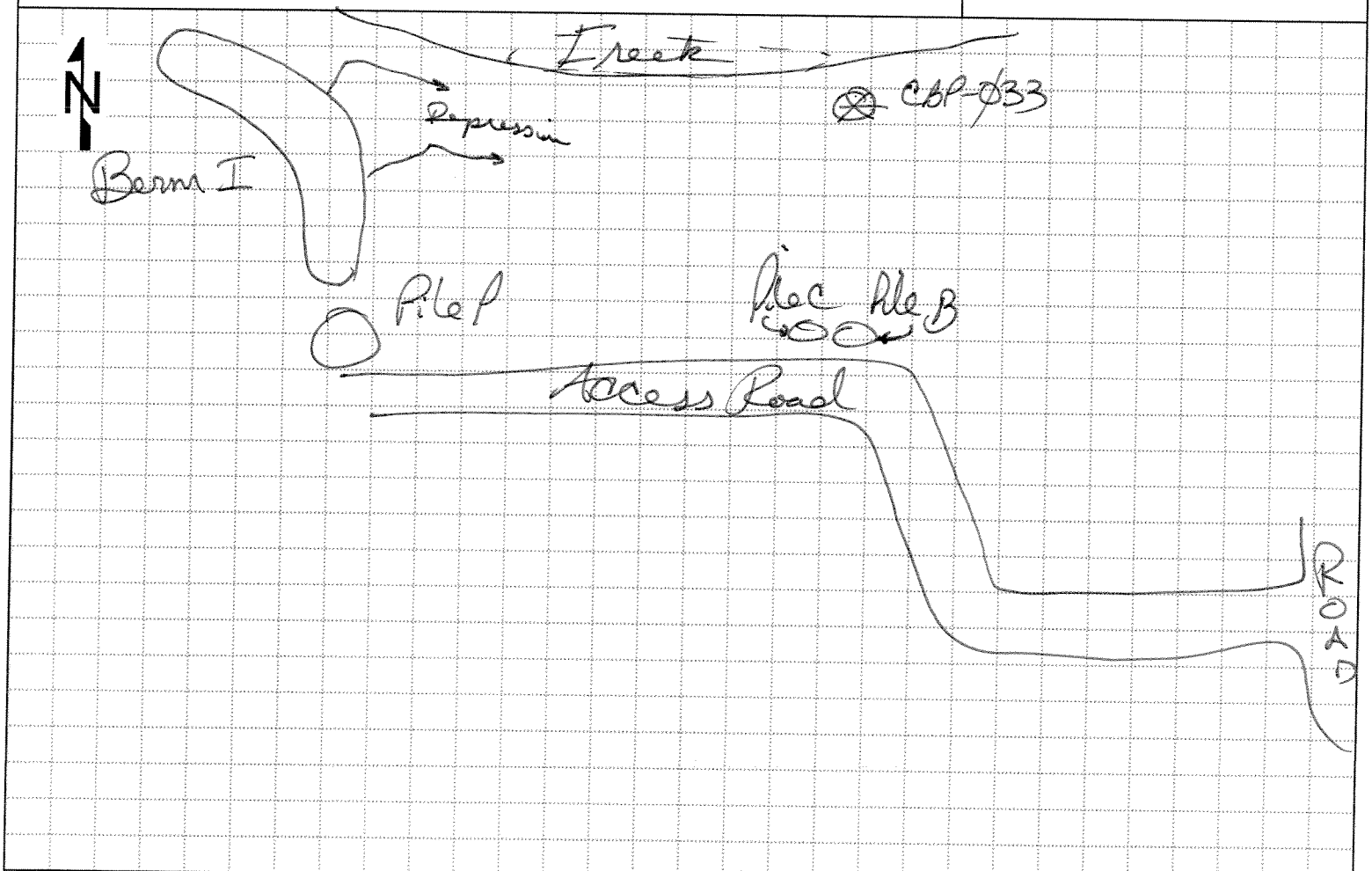
QC by [illegible]

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05	CBP-018

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-033
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3. in) SS. Bowl & Spoon SW	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 0950 COMPLETED:	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
12. OVERBURDEN THICKNESS: N/A		
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 0-1 ft		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: DISTURBED:	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: METALS EXPL OTHER:	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED:	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/17/05	BOREHOLE NUMBER: CBP-033

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-033
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

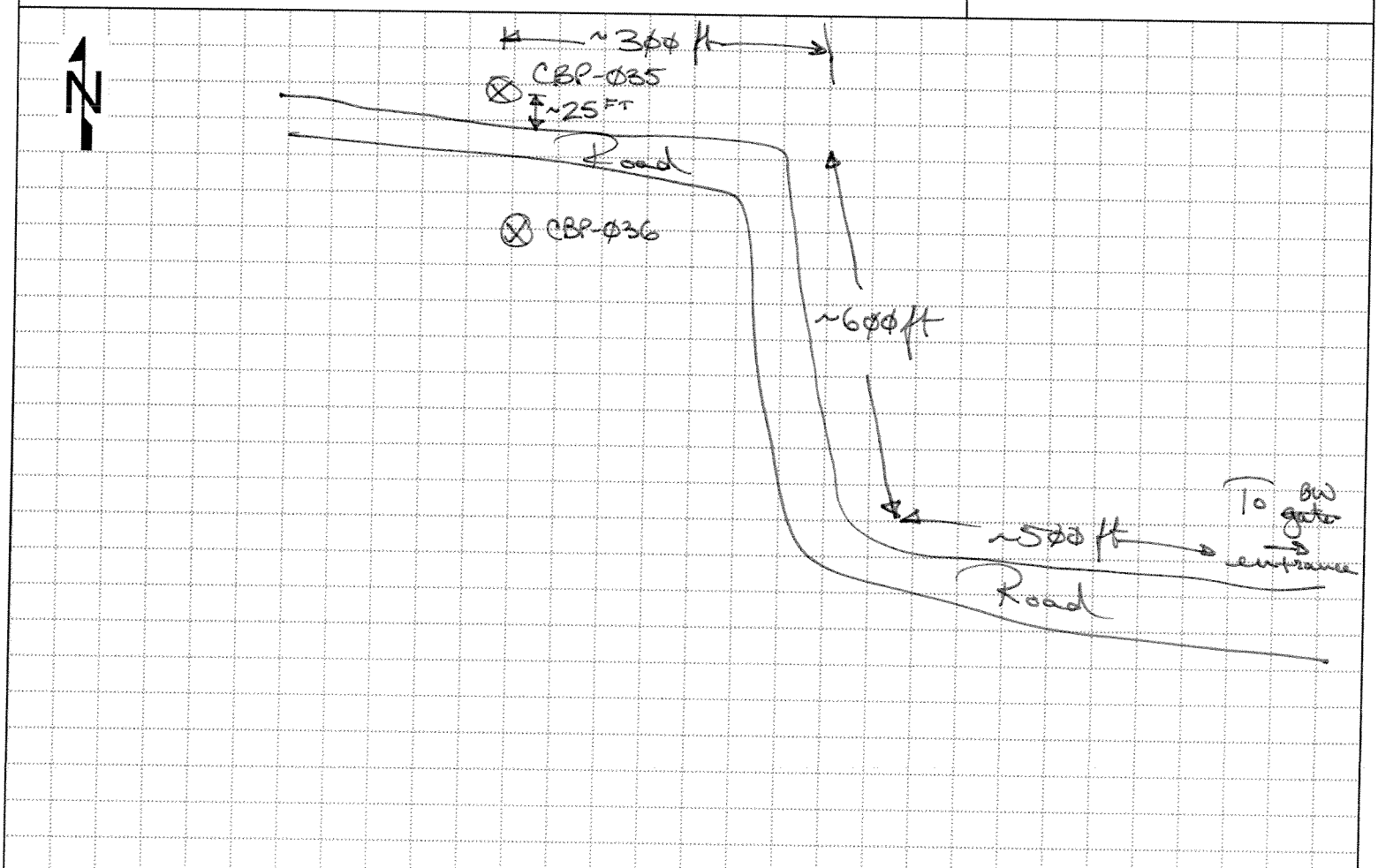
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	CL	2.5Y 3/2 very dark grayish brown; lean clay with fine sand; moist; ~10% fine angular stones; roots.	CBPss-033-0054-0124-SO	0.0	BW
	2					
	3					
	4					
	5		BW 11/18/05			
	6					
	7					
	8					
	9					
	10					

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	D. Will 11/7/05	CBP-033

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: BW CBP-SS-CBP-035
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. AUGER (HAND) (3-IN) SS. BOWL & SPOON (BW)	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1410 COMPLETED: 1445	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3FT		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/14/05	DATE COMPLETED/ABANDONED:	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/14/05	BOREHOLE NUMBER: CBP-035

HTRW DRILLING LOG (continued)

1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	DISTRICT: USACE - Louisville
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	BOREHOLE NUMBER: CBP-035
5. NAME OF DRILLER: SAIC - Martha Clough	6. DIRECTION OF BOREHOLE: ☒ VERTICAL ☐ INCLINED ____ DEGREES	SHEET 2 OF 2
7. NOTES PID MAKE/MODEL: Perkins Elmer Photorae 2000	PID SERIAL#: ED KR 383	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.7		2.5Y 3/1 very dark gray silt with sand (medium to course) poorly sorted angular to subangular very fine to course stones.	CBPSS-035-0100-SO	0.0	BW
	1.0		1.0 ft			
		CL	5Y 6/1 gray with 10YR 5/8 yellowish brown mottling (20%) lean clay fine to medium sand; damp; medium to subangular stones	CBPSO-035-0104-SO	0.0	BW
	2.0					
	3.0		3.0 ft			
			Bottom of borehole			
	4					
	5					
	6					
	7					
	8					
	9					
	10					

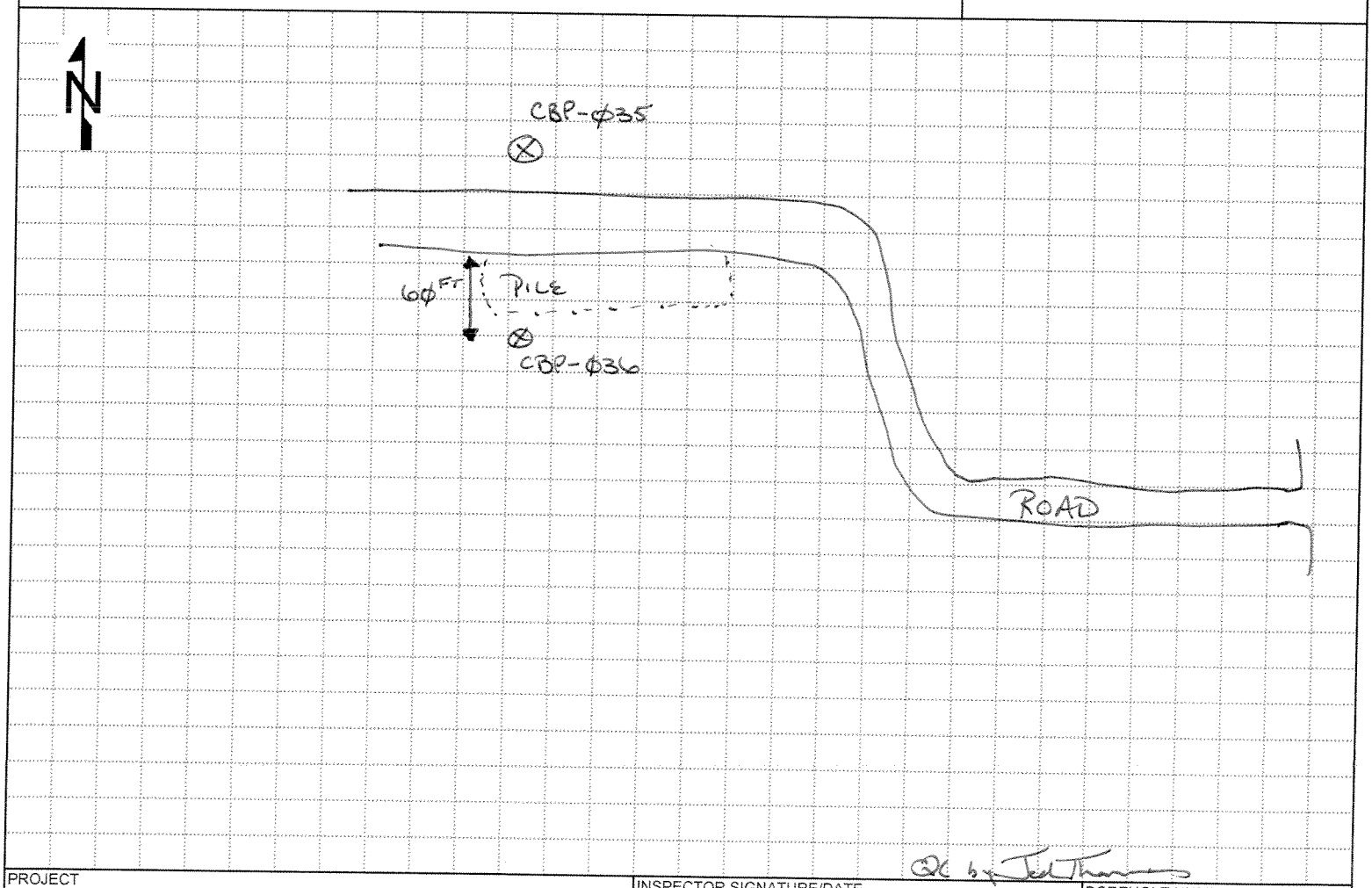
BW 11/14/05

PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Will 11/14/05	BOREHOLE NUMBER: CBP-035

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-Ø36
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: Ø825 COMPLETED: Ø855	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A - Surface water at GS.	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: METALS EXPL OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/05	DATE COMPLETED/ABANDONED: 11/16/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Jeff Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05	CBP-Ø36

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-Φ36
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC Martha Clough	6. DIRECTION OF BOREHOLE: ☒ VERTICAL ☐ INCLINED DEGREES	
7. NOTES: PID MAKE/MODEL: Perkins Elmer Photovac 2Φ2Φ PID SERIAL#: ED KP 383		

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	Φ.2	SM	2.5Y 3/2 Very dark grayish brown silt with BW coarse-medium sand; wet; roots; organic layer	CBPSS-Φ36-Φ1Φ2-SO	Φ.Φ	Martha Clough
	1.Φ	CL	2.5Y 5/4 (light olive brown BW lean clay with fine to medium sand; wet; low to medium BW plasticity.	1.Φ ft		
				CBPSS.Φ36-Φ1Φ3-SO	Φ.Φ	Martha Clough
	2.Φ		BW			
	3.Φ		3.Φ ft Bottom of borehole			
	4					
	5		BW 11/16/Φ5			
	6					
	7					
	8					
	9					
	10					

QC by [illegible]

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Will 11/16/Φ5	CBP-Φ36

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-Ø37
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in) S.S. Bowl & Spoon (BW)	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: N/A
	10. DRILL DATE/TIME STARTED: 1Ø85 COMPLETED: 1Ø3Ø (BW) 1Ø2Ø
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 3 ft.	

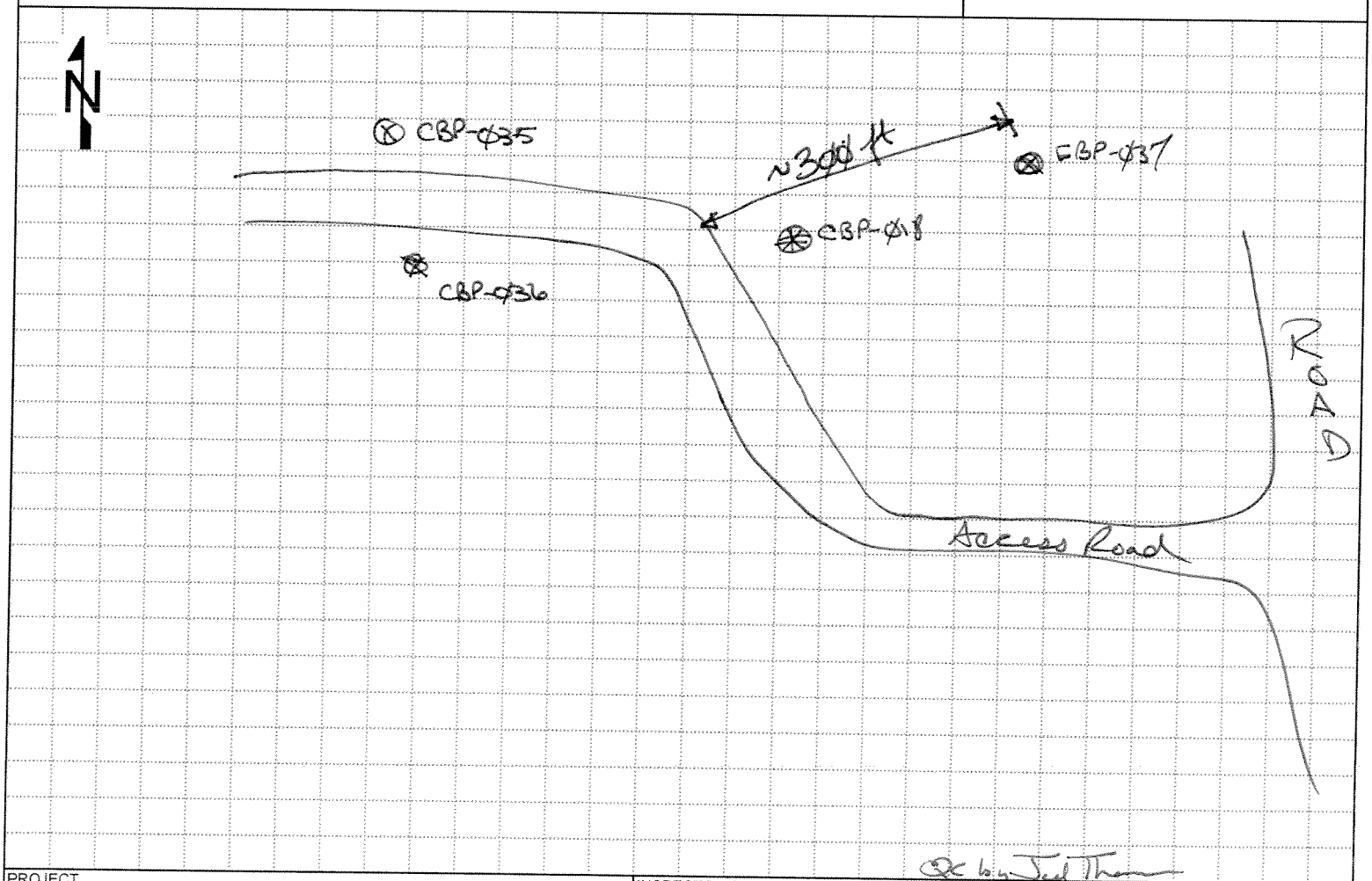
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: ——— DISTURBED: ——— 19. TOTAL NUMBER OF CORE BOXES: N/A

20. CHEMICAL SAMPLES: (METALS) (EXPL) ~~OTHER:~~ ——— 21. TOTAL CORE RECOVERY %: N/A

22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/Ø5 DATE COMPLETED/ABANDONED: 11/16/Ø5

BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/Ø5	CBP-Ø37

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-Ø37
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2Ø2Ø	PID SERIAL#: ED KR 3Ø3	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	Ø.4	OL	2.5Y 3/2 very dark grayish brown silt with medium sand; moist; roots; organic layer	CBPSS-Ø37-Ø1Ø4-SO	Ø.Ø	CBPSS-Ø37-Ø12Ø-SO Duplicate BW Ø12:
	1	CL	2.5Y 4/4 olive brown soft lean clay BW 5% fine to medium sand; damp; fine roots; 10YR 5/8 yellowish brown mottling (15%)	1.Ø ft		CBPSO-Ø37-Ø128-SO Split BW Ø12 Martha Clough 1.Ø ft
	1.2					
	2	CL	2.5Y 6/1 gray with 10YR5/8 yellowish brown mottling (5%) fine sand; 1% course sand	CBPSO-Ø37-Ø1Ø5-SO	Ø.Ø	Jed Thomas
	3		3.Ø			
	4		Bottom of borehole			
	5		BW 11/16/Ø5			
	6					
	7					
	8					
	9					
	10					

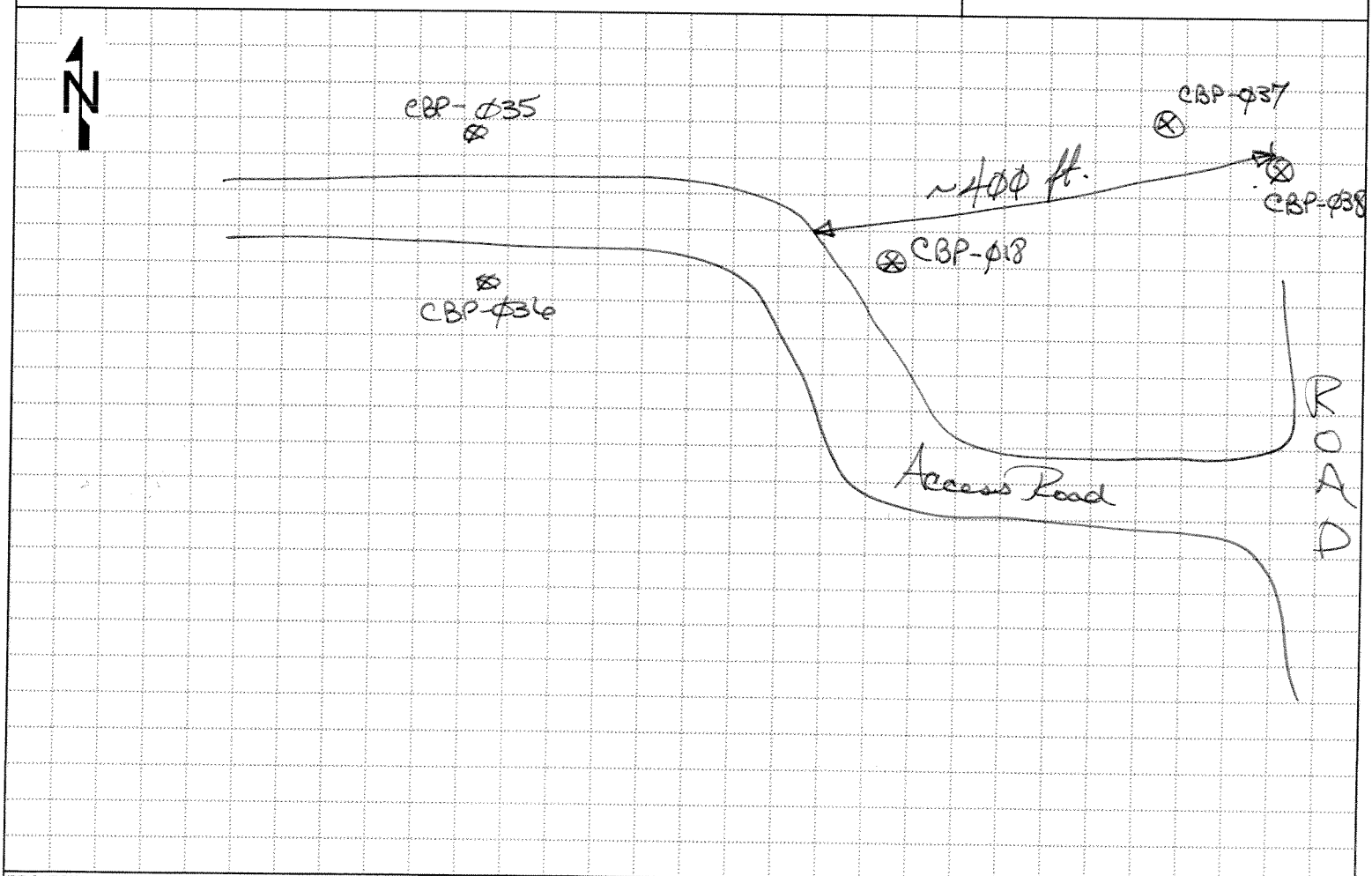
QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/Ø5	CBP-Ø37

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-038
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in) S.S. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1105 COMPLETED: 1125	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft.		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: DISTURBED:	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: ~~GW~~ N/A (METALS) (EXPL) OTHER:	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/05	DATE COMPLETED/ABANDONED: 11/16/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	Qc by Jed Thomas B. Williams 11/16/05	CBP-038

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-038
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. DIRECTION OF BOREHOLE: X VERTICAL ☐ INCLINED ___ DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

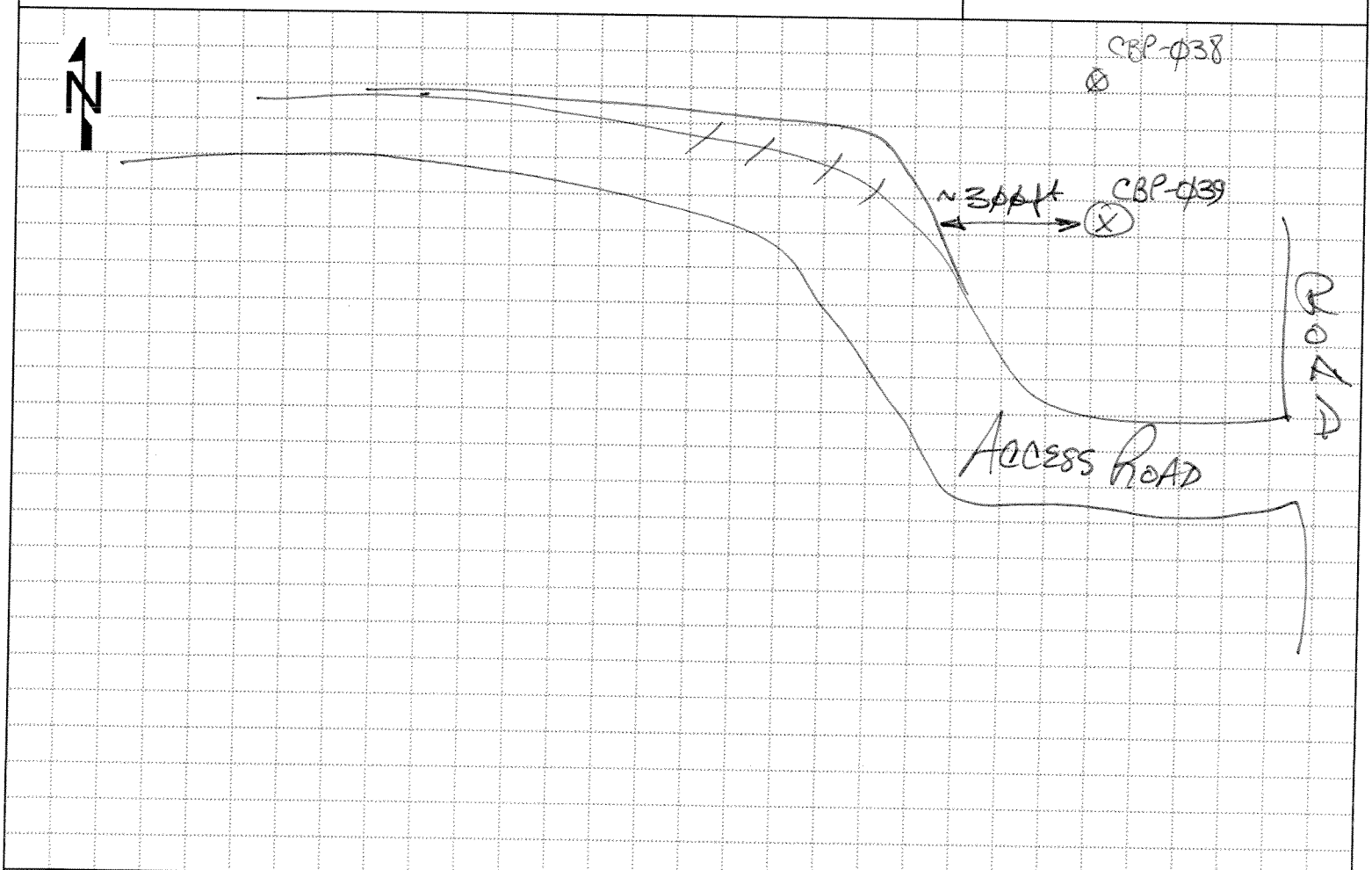
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
0.4	0.4	CL	2.5Y 4/2 dark grayish brown with 15% mottling: 7.5YR 4/6 strong brown. Mottling appears to be associated with fine roots; lean clay with fine sand; moist; 3% subangular stones; Roots throughout; organic layer	CBPss-0038-0106-SO	0.0	Martha Clough
	1.0	CL		1.0 ft		
CL	1.2	BW		CBPso-0038-0107-SO	0.0	Jed Thomas
	2.0					
		BW	2.5Y 6/1 gray with 50% mottling: 10YR 4/6 dark yellowish brown, clay (lean) with medium to course sand; Very fine to fine subangular stones; course flat & weathered shale pieces - 1%. 3.0 ft	BW		BW
3.0	3.0					
	4		Bottom of borehole			
	5					
	6		BW 11/16/05			
	7					
	8					
	9					
	10					

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Will 11/16/05	CBP-038

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-039
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon BW	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1105 COMPLETED: 1125	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft.		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/05	DATE COMPLETED/ABANDONED: 11/16/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05	CBP-039

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-039
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED ____ DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

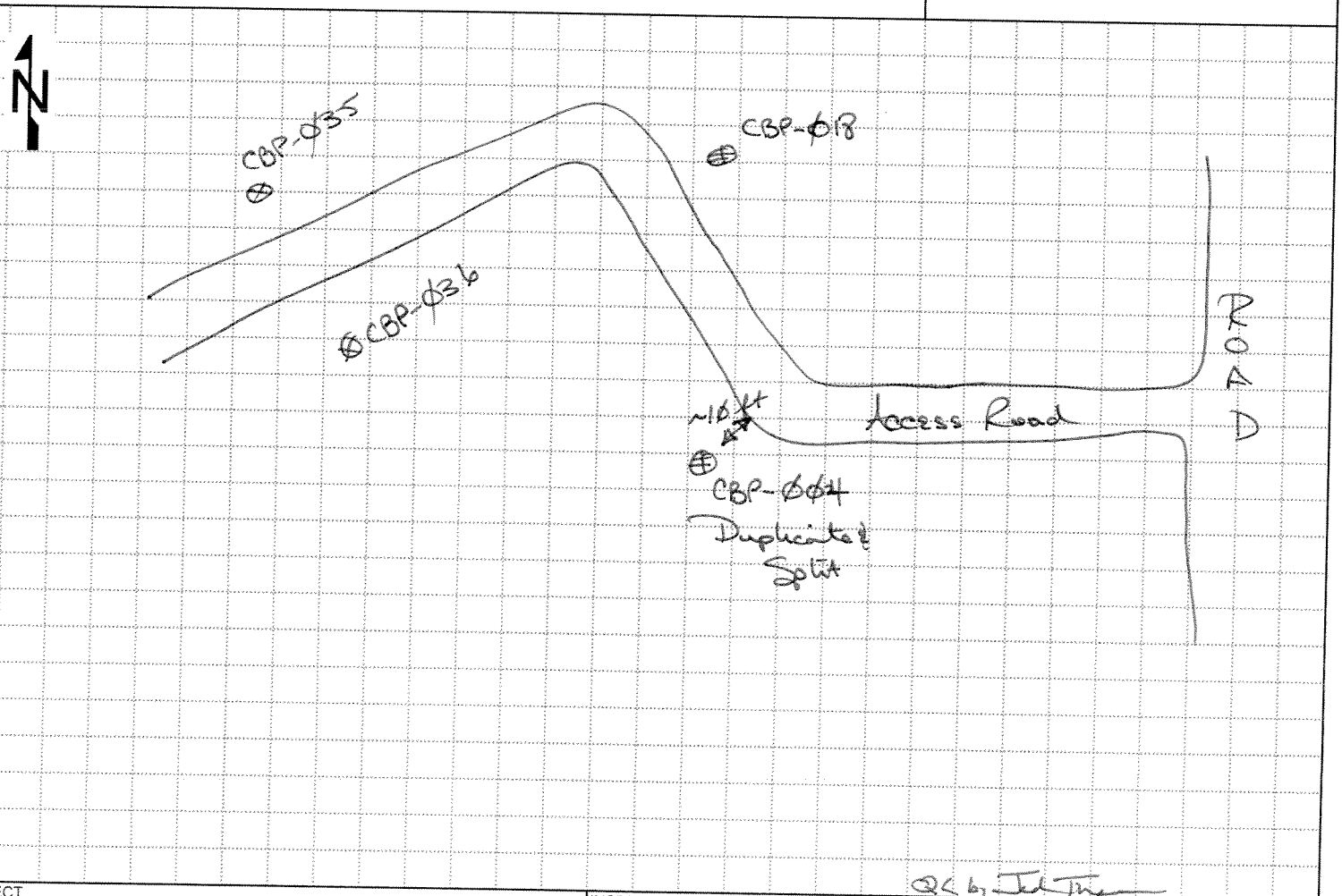
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.3	CL	2.5Y 4/2 dark grayish brown with 15% mottling: 7.5YR 4/6 strong brown. Mottling appears to be associated with fine roots.; lean clay with fine sand; moist; 3% subangular stones; roots throughout; organic layer	CBPSS-039-0108-SO	0.0	Martha Clough
	1.0	CL		CBPSO-039-0109-SO	0.1	Jed Thomas
	2	CL				
	3		2.5Y 6/1 gray with 5% mottling: 10YR 4/6 dark yellowish brown; lean clay with medium to fine sand (15%); moist.			
	4		Same as 0.3 - 1.0 ft interval ~~without mottling~~ BW mottling: 10YR 5/6 yellowish brown. 3.0 ft.			
	5		Bottom of borehole			
	6		BW 11/16/05			
	7					
	8					
	9					
	10					

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05 QC by Jed Thomas	CBP-039

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-0004
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3.in) S.S. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 0920 COMPLETED: 0930	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 1 ft.		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: METALS EXPL OTHER: Hex Chromium	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/16/05	DATE COMPLETED/ABANDONED: 11/16/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/05	CBP-0004

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-ØØ4
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR:	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. DIRECTION OF BOREHOLE: ☒ VERTICAL ☐ INCLINED DEGREES	
7. NOTES: PID MAKE/MODEL: Perkins Elmar Photorae 2Ø2Ø PID SERIAL#: ED KR 2Ø BW 3Ø3		

ELEVATION	DEPTH (0.1 Feet) (FT)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	BW Ø.5	SM	1ØYR 2/1 Black medium (to course) Sand with silt; roots; damp to moist; course angular gravel; loose.	CBPss-Ø52-Ø122-5Ø	Ø.Ø	Slag; burnt-septic like odor
				CBPss-BW Ø52-Ø125 Ø123 -5Ø DUPLICATE		Refusal at 1.Ø ft
	Ø.8					
	1.Ø	SP	1ØYR 4/4 dark yellowish brown; same material as above; some pieces of loose material are hard crust-like aggregate that breaks with minimal finger pressure but does not crush with finger pressure; less roots. 1.Ø ft	CBPss-BW Ø52-Ø126 SPLIT -5Ø Ø135 BW -Ø135 BW → CBPss-Ø52-Ø135-5Ø (Split)		
	BW 3					
	BW 4		Bottom of borehole			
	BW 5					
	BW 6					
	BW 7		BW 11/16/Ø5			
	BW 8					
	BW 9					
	BW 10					

QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/16/Ø5	CBP-ØØ4

MULTI-INCREMENT SOIL SAMPLES

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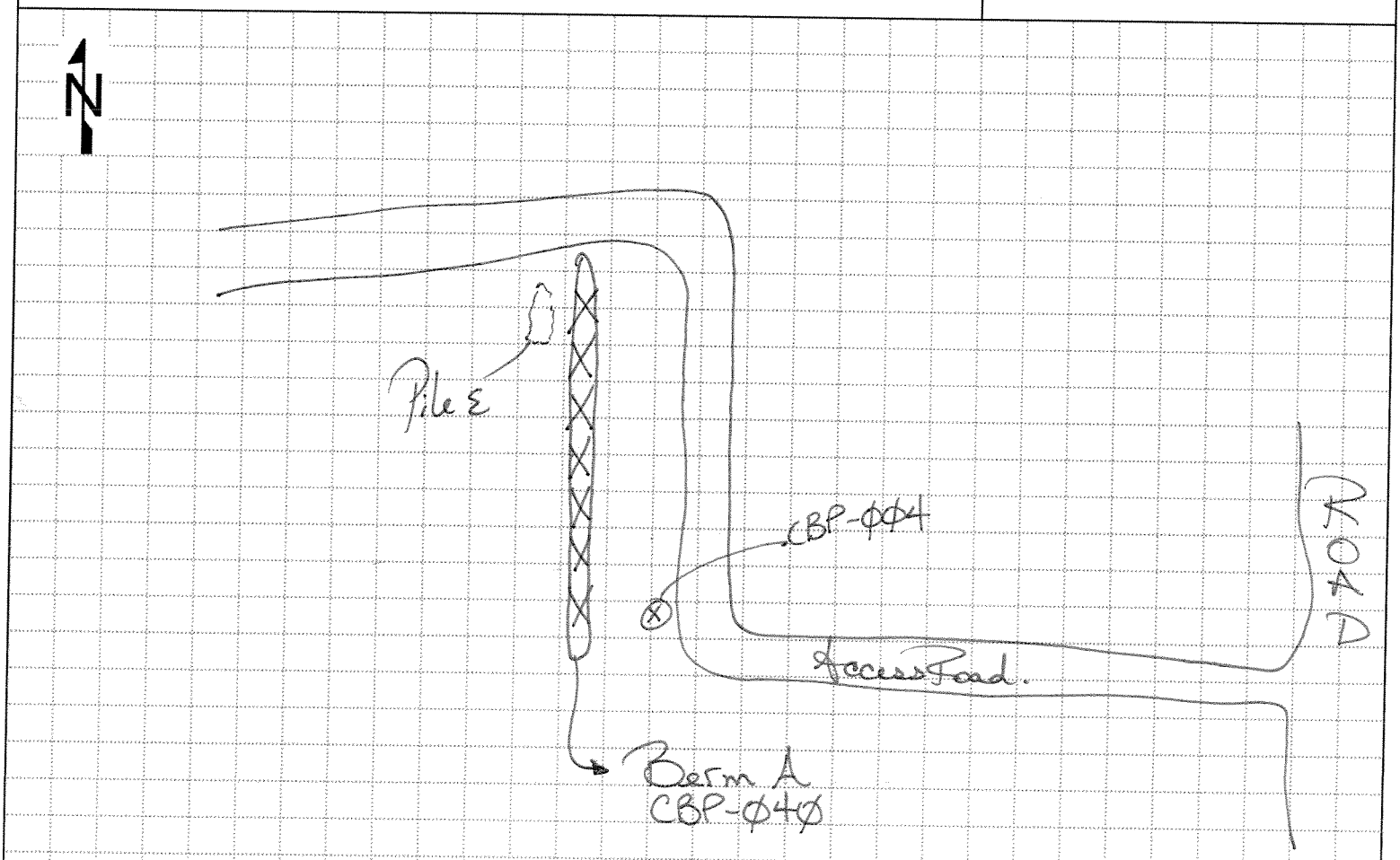
HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-04Ø
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	BW Pile Berm A SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Beau Williams & Martha Clough	6. MAKE/MODEL OF DRILL: BW na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Soil Probe (1in) SS. Bowl & Spoon BW	8. BOREHOLE LOCATION: BW Central Burn Pits
	9. SURFACE ELEVATION/DATUM: Berm is ~3ft above Ground Surface
	10. DRILL DATE/TIME STARTED: ØØØØ COMPLETED: Ø93Ø
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: Range from 0ft to 3ft. (3ft Pile)	
18. GEOTECHNICAL SAMPLES: BW N/A UNDISTURBED: N/A DISTURBED: N/A	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: Hex. Chrome.	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05 BW DATE COMPLETED/ABANDONED: 11/17/05	
BACKFILL TYPE: ☐ GROUT ☐ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL No Backfill	

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/17/05	BOREHOLE NUMBER: CBP-04Ø

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	CBP-040

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	SHEET
SAIC	N/A	2 OF 2

3. PROJECT	4. LOCATION
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE
SAIC-Martha Clough & Beau Williams	[X] VERTICAL [ ] INCLINED DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED ~~AK~~ BD KR 3053

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1.0	ML & CL	ML - silt with sand 2.5Y 2.5/1 Black with roots & organic layer. CL - lean clay with fine sand, some locations were mottled. (~30% of locations) 2.5Y 5/4 light olive brown. Some location 20% mottling 10YR 5/8 yellowish brown. Various subround to angular stones (very fine to medium)	CBPss-040-0110M-SO	0.0	- General soil description of 30 boreholes - Berm is ~3 ft thick. Several holes were advanced 2 times to collect full 3 ft interval. - Many locations had refusal due to slag stones or roots.
	2.0					
	3.0			3.0 ft Bottom of borehole		
	4		* MANY 2-3 inch size slag rocks in pile. Some sides were ~~exposed~~ as primarily slag without vegetation. Slag fragments pulverized during sample collection. (Sample soil probe cut through the rocks). Sulfer odor in soil bowl & associated, in part anyway, to the pulverization of slag stones. Berm has Sycamore and Honey Locust trees growing through it.			
	5					
	6					
	7					
	8					
	9					
	10					

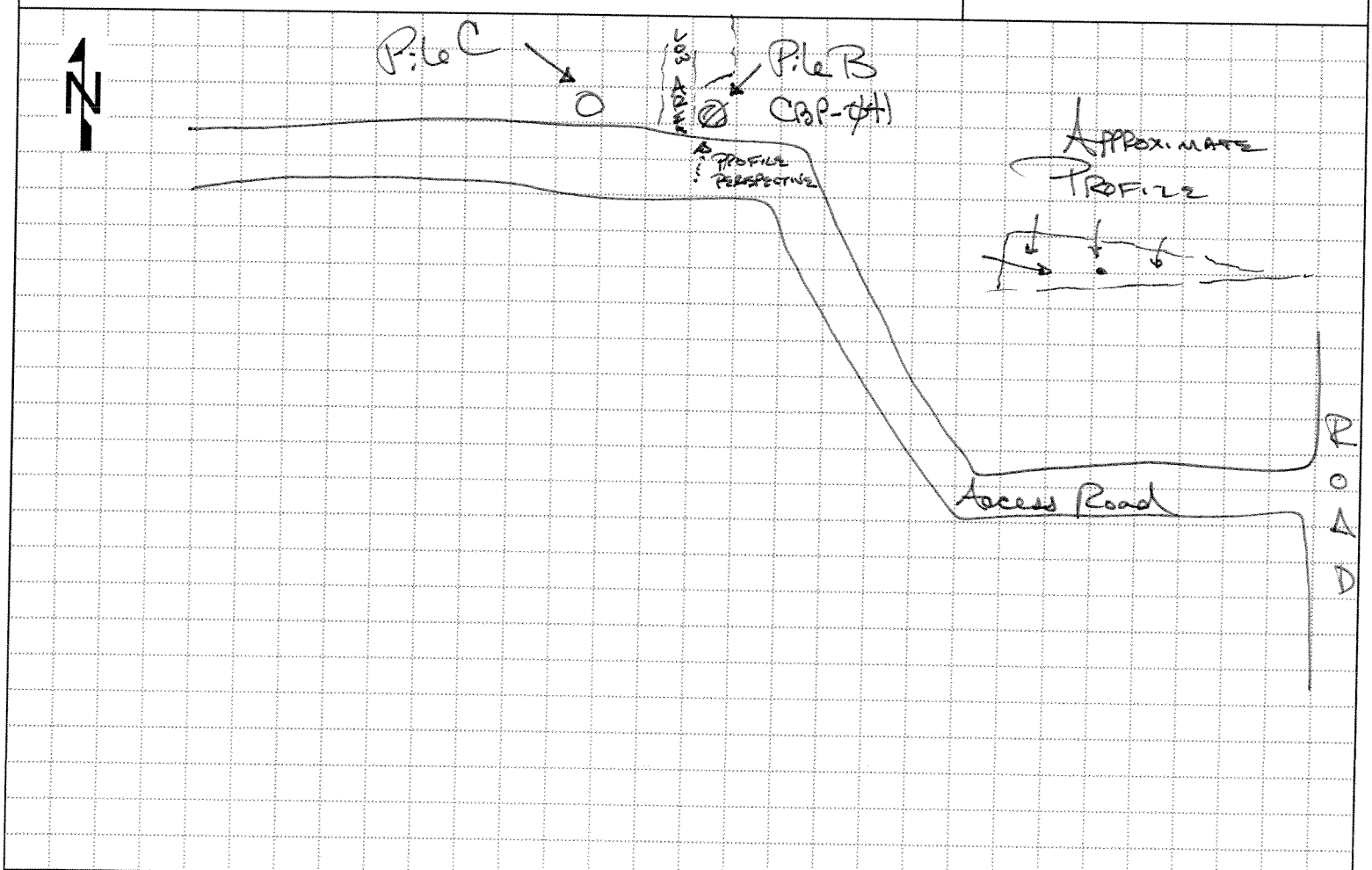
BW 11/17/05

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05 QC by [illegible]	CBP-040

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-041 Pile B.
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: Str-Martha Clough & Beau Williams	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS Soil Probe (1-in) SS Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pit	
	9. SURFACE ELEVATION/DATUM: ø-7ft above Ground Surface	
	10. DRILL DATE/TIME: STARTED: 11/17/05 COMPLETED: 1130	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: ø-4ft (total) ø-3ft. (Sample)		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: METALS EXPL TCLP OTHER: Grain	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED: 11/17/05	
BACKFILL TYPE: GROUT BENTONITE IN HAND AUGER HOLES TEMPORARY WELL POINT MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: QC by Jack Thomas B. Williams 11/17/05	BOREHOLE NUMBER: CBP-041

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-041 File 3
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Brian Williams	6. DIRECTION OF BOREHOLE: X VERTICAL	X INCLINED ~0-5% DEGREES
7. NOTES PID MAKE/MODEL: Perkins Elmer Photorae 2020	PID SERIAL#: SD KR 2020	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.5	SM	Silt 2.5Y 3/1 very dark gray; Silt with sand; poorly sorted angular to subangular very fine to fine stones. Larger rocks on sides of pile; organic layer.	CBPSS-041-0111M-SO	0.0	Slag stones Sandstone, large tree growing through center of pile. Some side samples were driven in/collected horizontally.
	2	CL	2.5Y 5/6 light olive brown; lean clay with fine sand and fine subangular stones Dry.			0-0.5 layer. generally consistent over top of pile
	10					

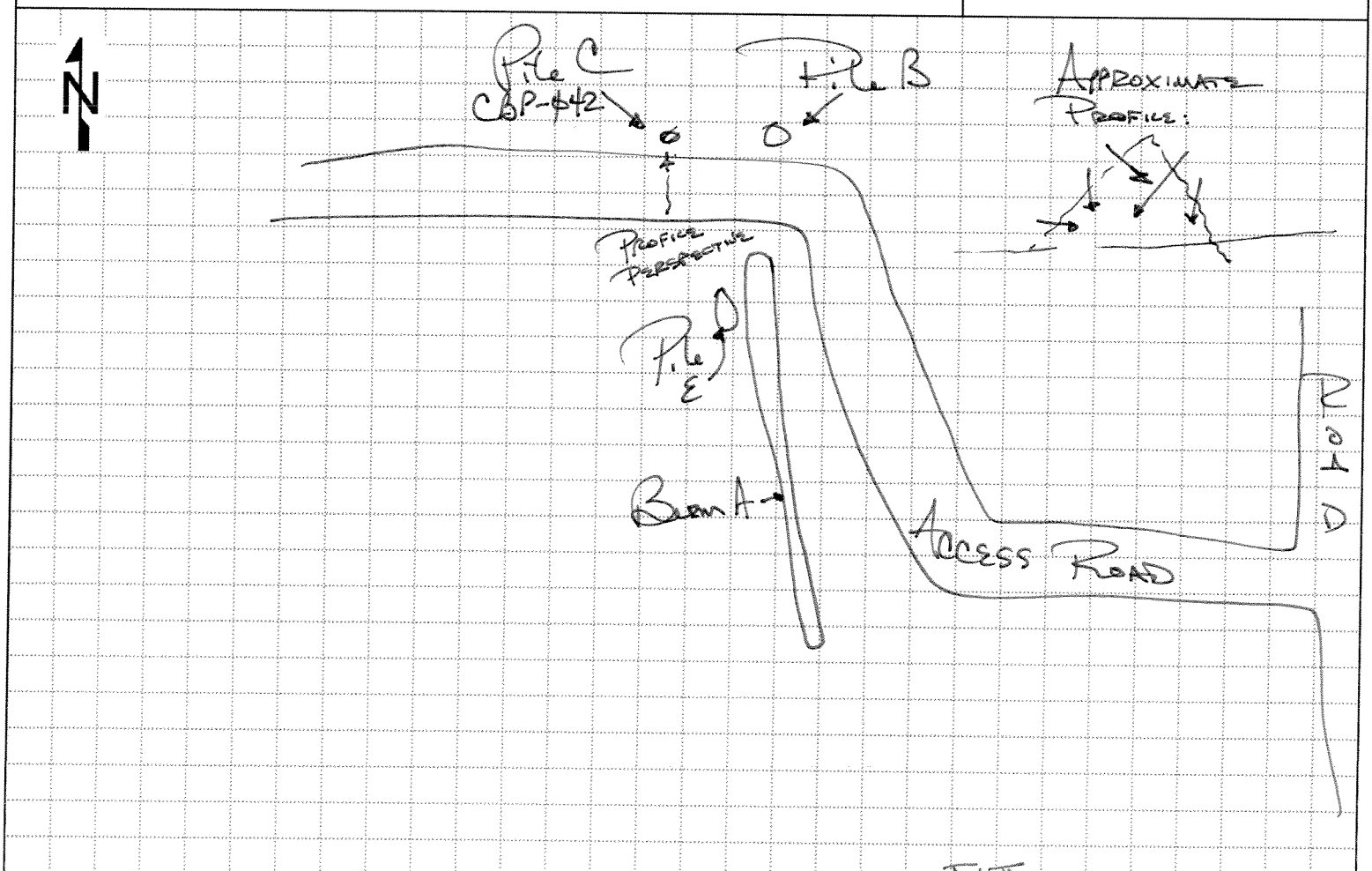
BW 11/17/05

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05 (OK by Jed Thomas)	CBP-041

HTRW DRILLING LOG

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-042 (SW Base Pile C)
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in); S.S. Soil Probe (1-in); S.S. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: ~10 ft Above Ground Surface	
	10. DRILL DATE/TIME: STARTED: 1025 COMPLETED: 1130	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 0-5 ft (sample hole)		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: N/A DISTURBED: N/A	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: Cr+6	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED: 11/17/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE (to hand auger hole) ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05 (for Jed Thomas)	CBP-042

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-042 Pile C
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: Jed Thomas	6. DIRECTION OF BOREHOLE: [X] VERTICAL [X] INCLINED ~0-30° DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	BW 1.0	SC & CL	2.5Y 2.5/1 Black BW Sand-clay mixture; medium to course stones 30% RD angular to subangular; roots; moist; medium to course sands. BW 11/17/05	CBPss-042-0112M-SO	0.0	Slag stones; sandstones; burnt wood; Some holes were inclined at varying angles ie: Light BW thin organic layer over top of pile.
	2.0					
	3.0					
	4.0					
	5.0					
	6		BW 11/17/05			
	7					
	8					
	9					
	10					

QC by Jim Thomas

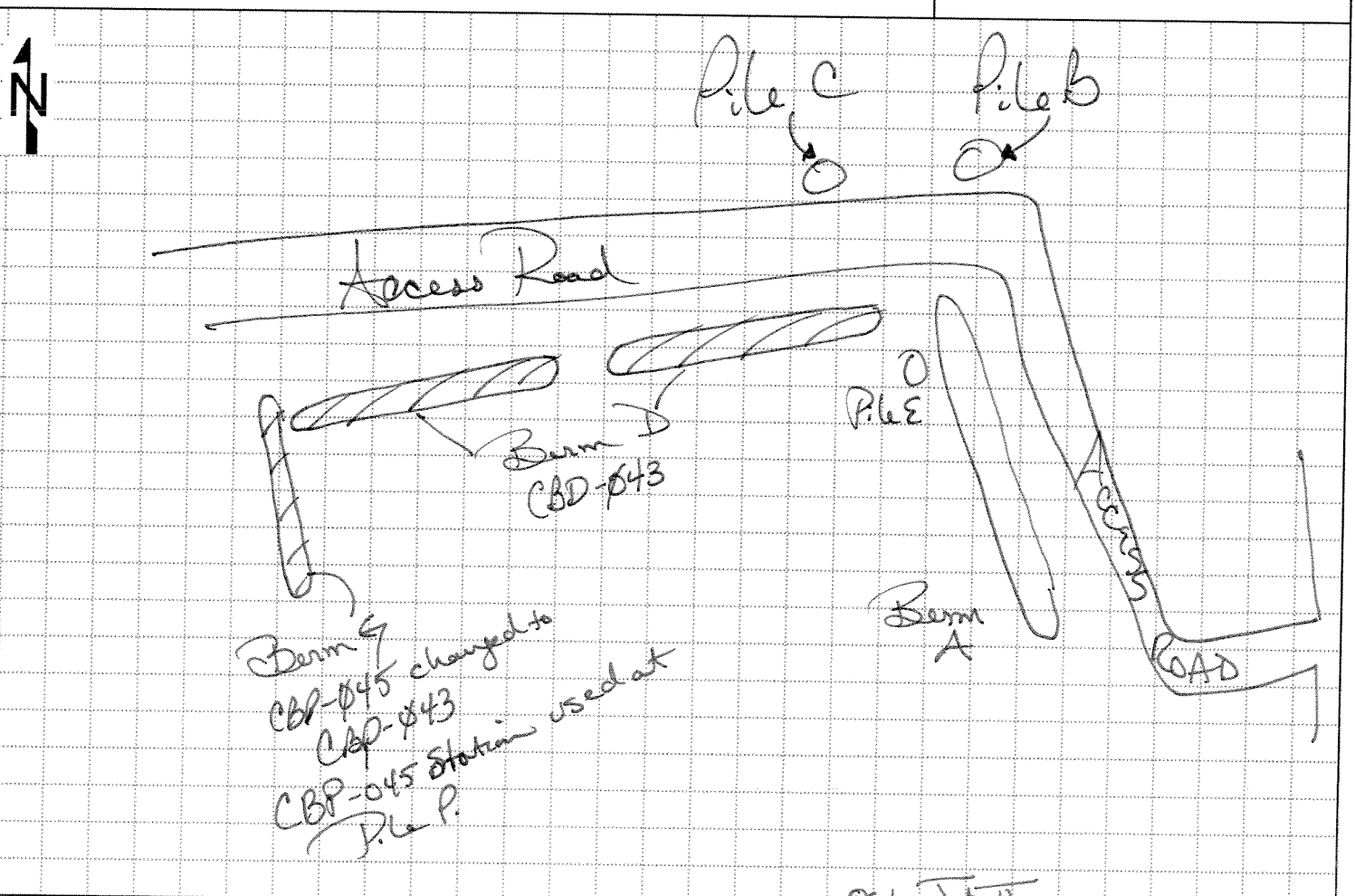
PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05	CBP-042

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-043 Berm D & G
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Jed Thomas	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Soil Probe (1-in) S.S. Bowl & spoons BW	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: ~0-4 ft (highest point)
	10. DRILL DATE/TIME STARTED: 1225 COMPLETED: 1345
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A BW	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 0-3 ft (samples)	
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: METALS EXPL TCLP OTHER: Cr+le	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED: 11/17/05
BACKFILL TYPE: ~~GROUT~~ ~~BENTONITE~~ ~~TEMPORARY WELL POINT~~ ~~MONITORING WELL~~ BW N/A	

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05	CBP-043

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-043 Berm Pt E2
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. DIRECTION OF BOREHOLE: X VERTICAL	X INCLINED 0-90 DEGREES
7. NOTES: PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	SM & CL	Primarily 2.5Y 3/1 Very dark gray, silt with medium sands, subangular to subround medium to fine stones; Roots & organic material; damp; BW Some 2.5Y 5/3 light olive brown 5% mottled: 10YR 5/6 BW lean Clay; damp. (BW & yellowish brown)	CBPSS-043-0113M-SO	0.0	BW
	2					
	3					
	3.5					
	4					
	5					
	6		BW 11/17/05			
	7					
	8					
	9					
	10					

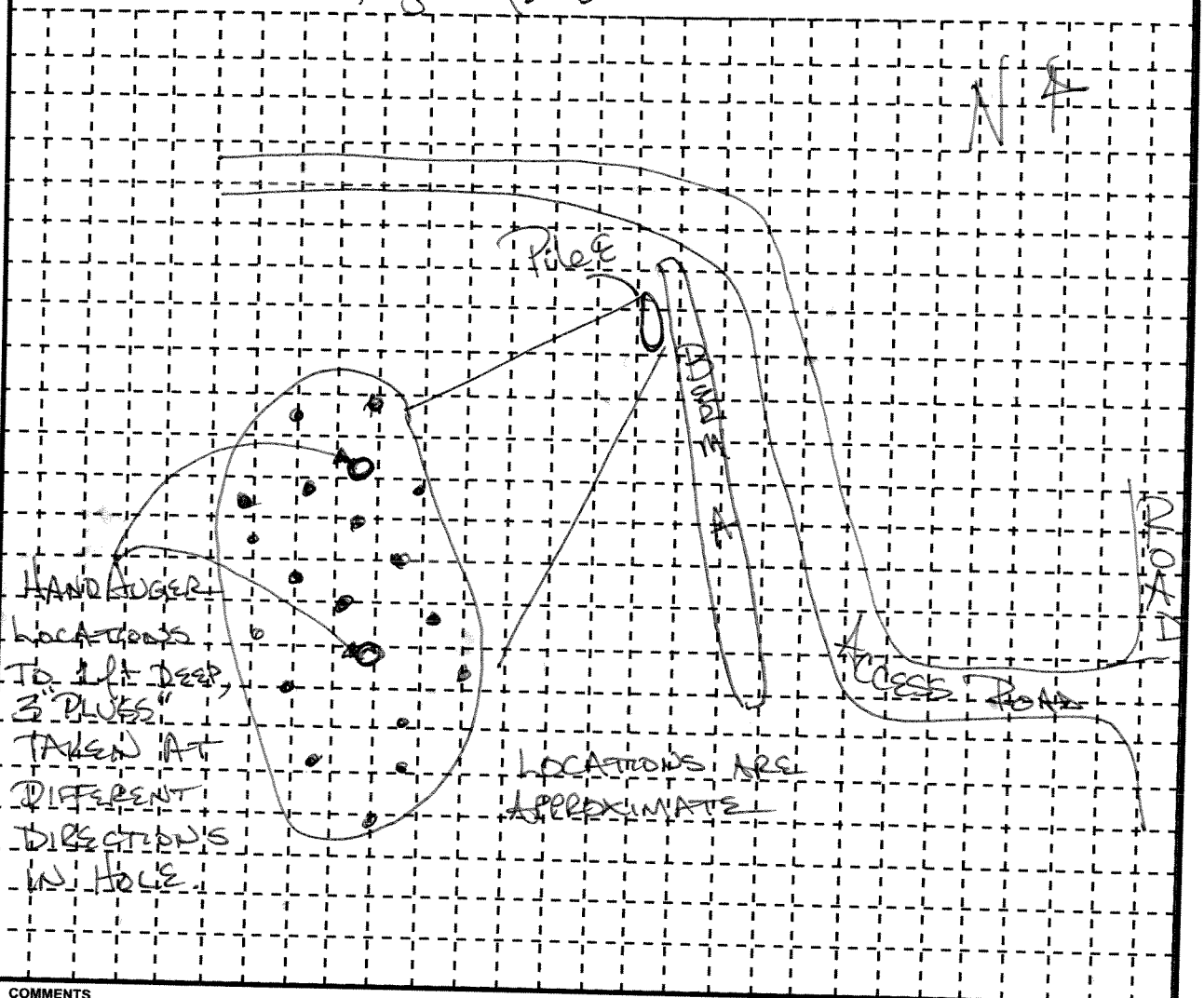
QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05	CBP-043

SAMPLE LOCATION SKETCH

PROJECT: CBP Supplemental PII Soil Sample	HOLE NUMBER: Pile E (CBP-044)
LOCATION STATION: CBP-044	ELEVATION TOP OF HOLE: N/A
	DATUM FOR ELEVATION SHOWN: N/A

LOCATION SKETCH Page 1 of 23 **SCALE:** N/A



COMMENTS

Pile was 30-50% slag stones (2-3 inch size). The sampler was hammered into sample locations, many times it encountered stone & either broke through or pushed it/advanced into soil pile. 3 locations were sampled at two different depths.

SIGNATURE OF INSPECTOR/DATE	PROJECT	HOLE NO.
B. Williams 11/16/99 QC by Jack Thomas	CBP Supplemental PII Soil	Pile E (CBP-044)

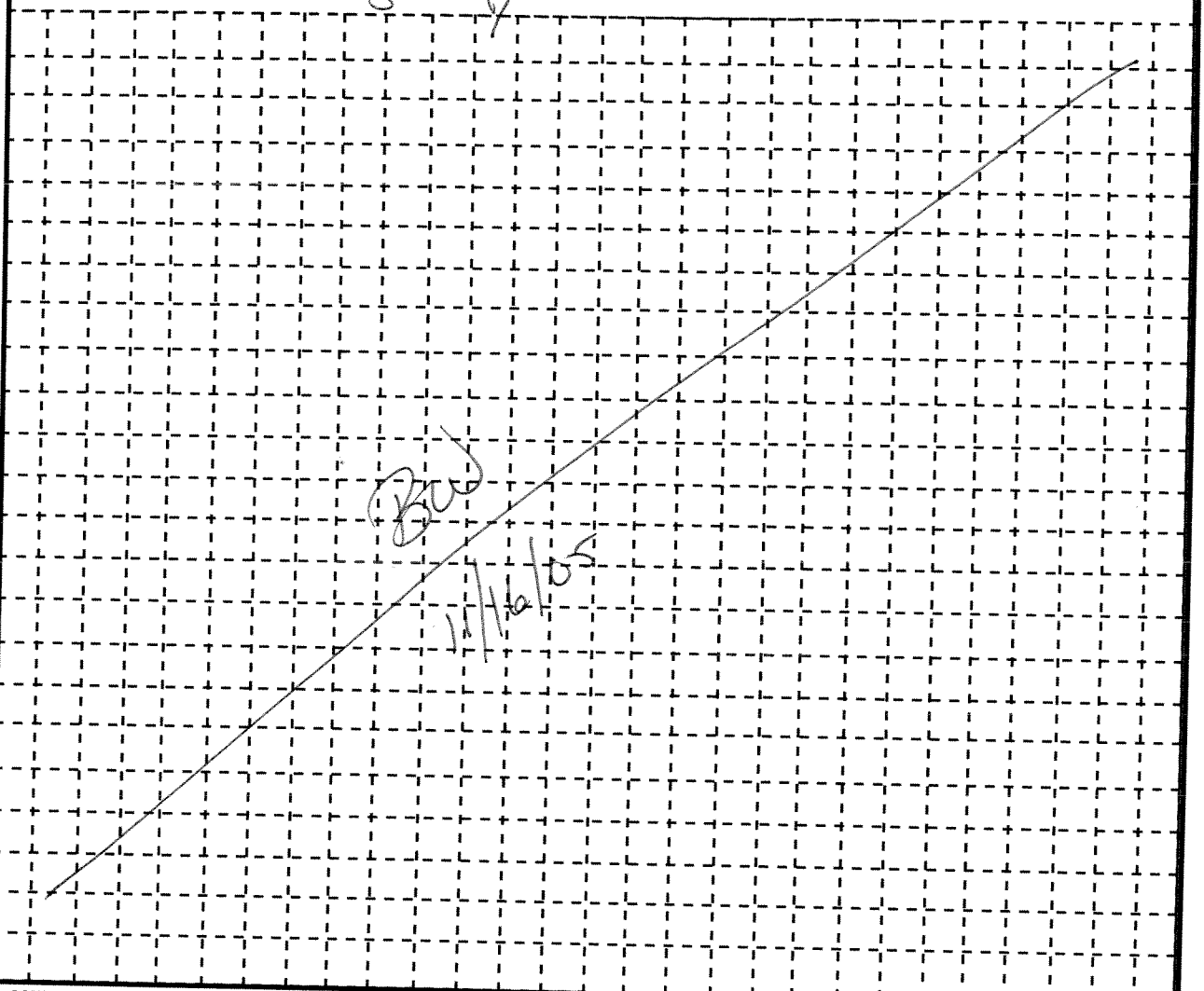
99-011M(P65)/040899

FTP-1215, Revision 0, 4/07/99

SAMPLE LOCATION SKETCH

PROJECT: CBP Supplemental PII Soil Sample	HOLE NUMBER: Pit E (CBP-044)
LOCATION STATION: CBP-044	ELEVATION TOP OF HOLE: N/A
	DATUM FOR ELEVATION SHOWN: N/A

LOCATION SKETCH Page 2 of 3 (BW) SCALE: N/A



COMMENTS

General soil description: Silt with medium to course sand, clay intervals throughout. Silt: 2.5Y 4/2 dark grayish brown; Clay = lean clay 2.5Y 5/4 light olive brown. Slag throughout. Sulfer odor from slag fragments.

SIGNATURE OF INSPECTOR/DATE	PROJECT	HOLE NO.
B. Williams 11/16/05 QC by Jack Thomas	Supplemental PII Sampling at CBP ODA2, FBQ	CBP-044

99-011M(P65)/040899

FTP-1215, Revision 0, 4/07/99

SAMPLE LOCATION SKETCH

HOLE NUMBER: Pile E (CBP-044)

PROJECT: CBP Supplemental PII Soils

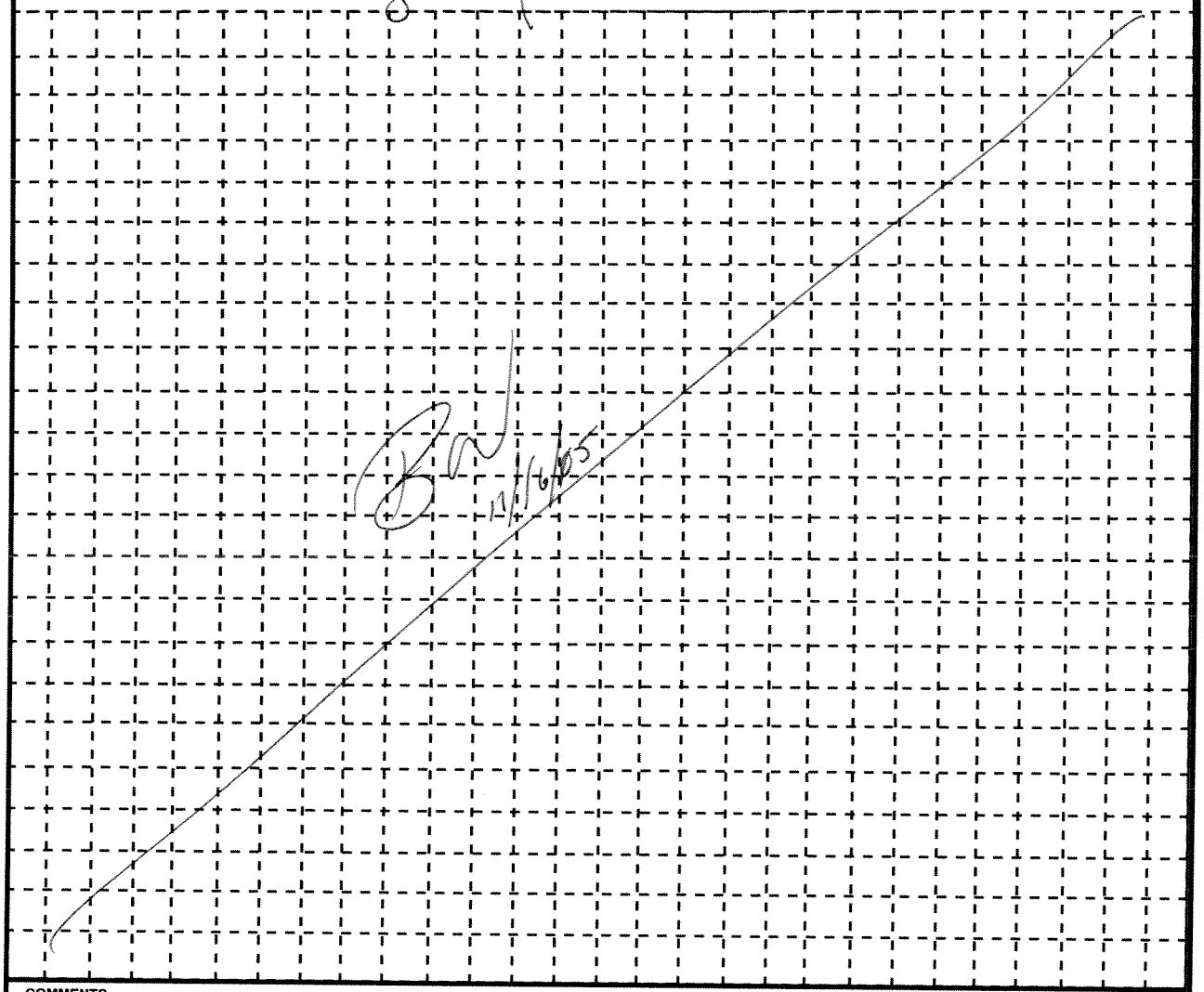
ELEVATION TOP OF HOLE: N/A

LOCATION STATION: CBP-044

DATUM FOR ELEVATION SHOWN: N/A

LOCATION SKETCH Page 3 of 3

SCALE: N/A



COMMENTS

CBPss-044-0114M-S0 collected between 1430 to 1600.

0.0 PPM throughout sampling Photorae 2026 Serial#: EDKR3003

Samplers: Beau Williams, Jed Thomas, Dale (UXO)

Photographs taken

SIGNATURE OF INSPECTOR/DATE	PROJECT	HOLE NO.
B. Williams 11/16/05	Phase 2 Supplemental Sampling at CBP ODA2 FBQ	CBP-044

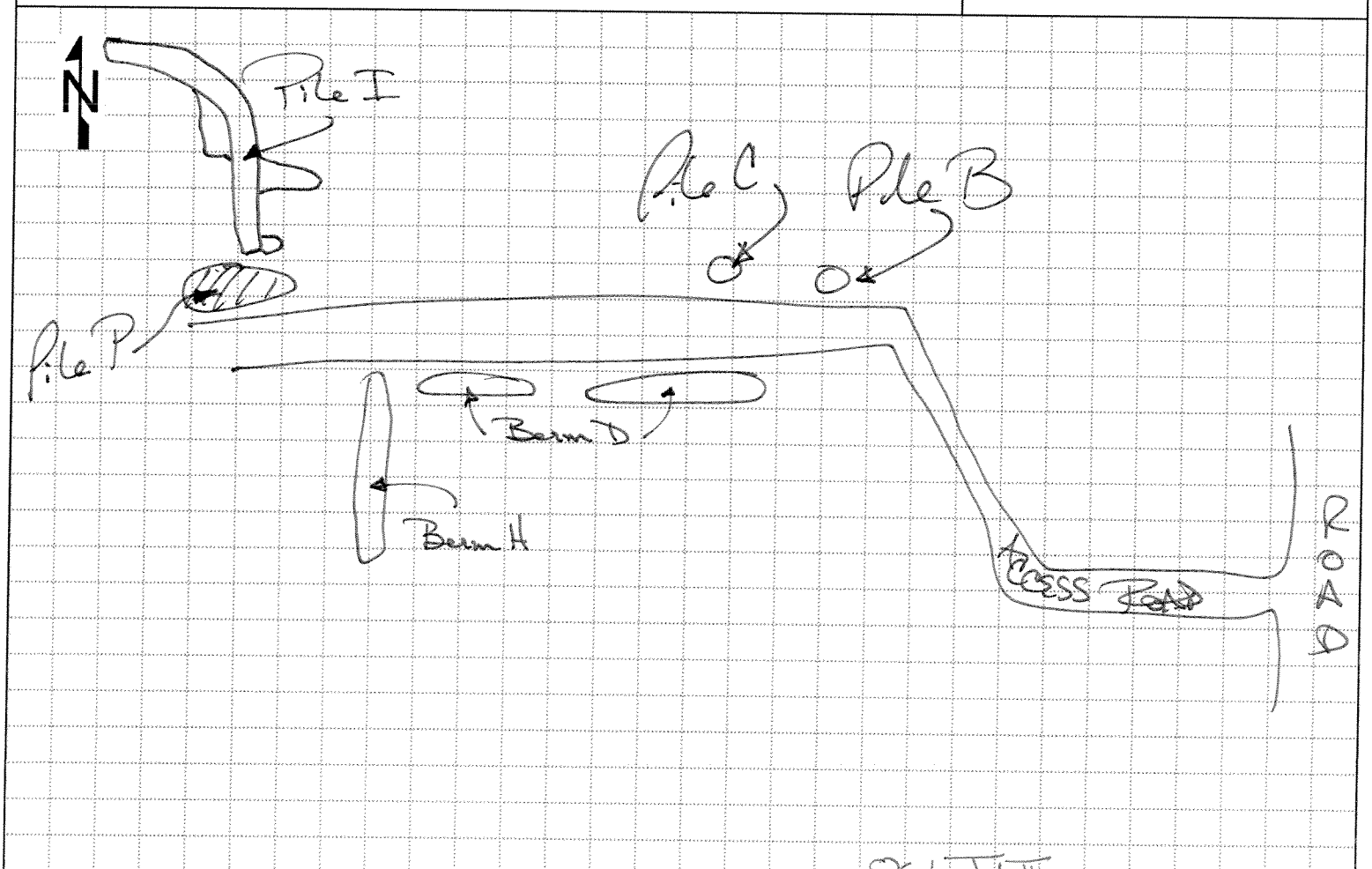
QC by Jed Thomas

HTRW DRILLING LOG

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-045 Pile P
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Jed Thomas	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Soil Probe (1-in) SS. Hand Auger (3-in.) SS. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: ~0-8ft (highest Point)
	10. DRILL DATE/TIME STARTED: 1350 COMPLETED: 1450
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 0-3ft (sampling)	
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: C, Hg	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED: 11/17/05
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE IN HAND AUGER HOLES ☐ TEMPORARY WELL POINT ☐ MONITORING WELL	

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Will 11/17/05	CBP-045

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	CBP-045

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	
SAIC	N/A	File P. SHEET 2 OF 2

3. PROJECT	4. LOCATION
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE
SAIC - Jed Thomas	X VERTICAL X INCLINED ~~0-90~~ DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: SD KR 303

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	SC	2.5Y 3/3 dark olive brown clay and medium to course sand mixture; very fine to 2-3ft size stone; moist	~~CBP~~ BW CBP-045-0115M-SD	0.0	2-3ft pieces of sandstone on & likely inside file - angular pieces collected; ie:
	2		BW 11/17/05	BW 11/17/05	BW 11/17/05	
	3					
	4					
	5					BW 11/17/05
	6		BW 11/17/05			
	7					
	8					
	9					
	10					

QC by Jed Thomas

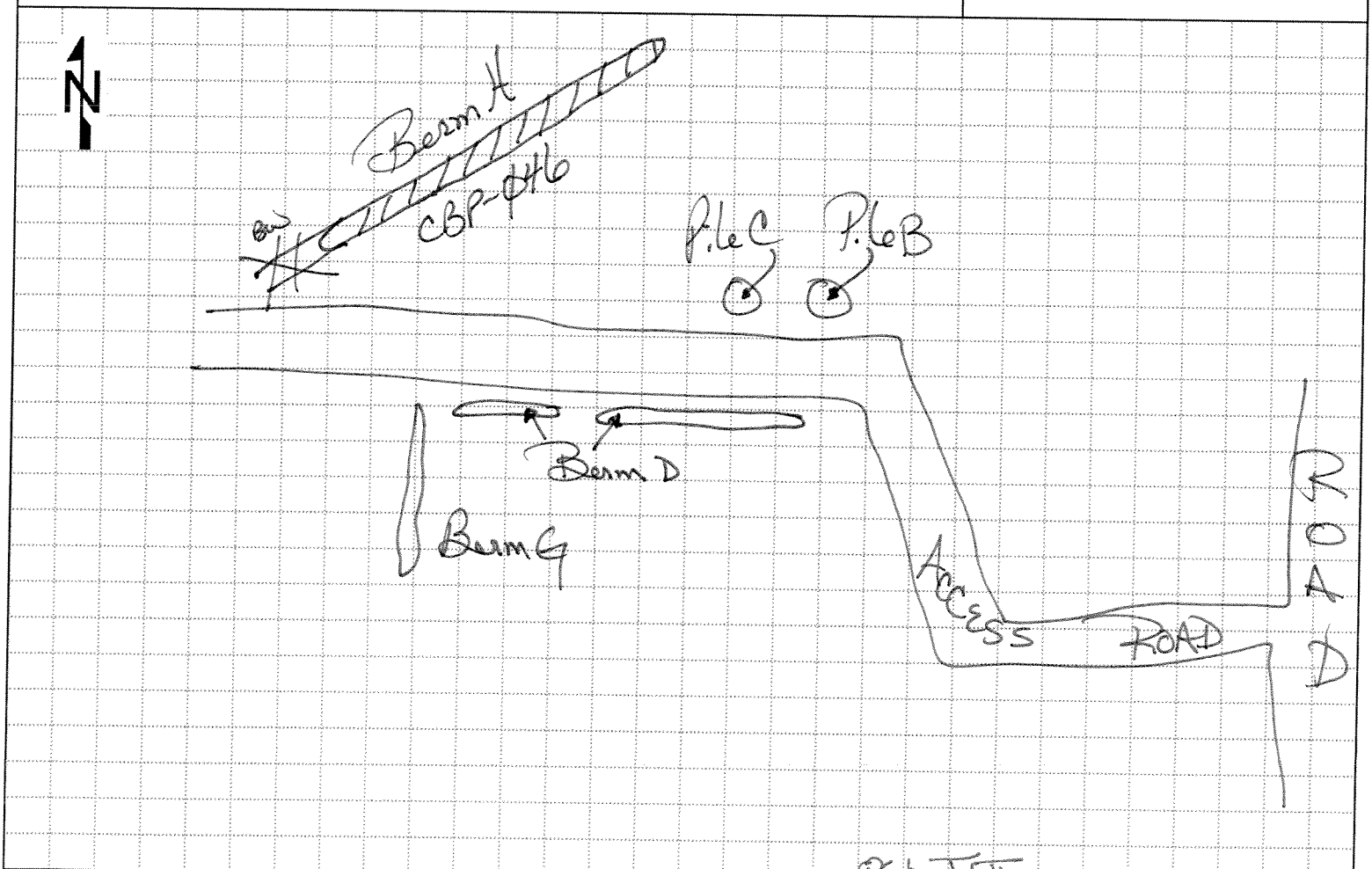
PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Wilson 11/17/05	CBP-045

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-Ø46 Berm H
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Brian Williams & Martha Clough	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Soil Probe (1.in) S.S. Bowl & Spoon BW	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: ~Ø-3ft (highest point)
	10. DRILL DATE/TIME STARTED: 1245 COMPLETED: 1430
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: Ø-2 ft sample	
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: METALS EXPL TCLP OTHER: Cr+6	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05	DATE COMPLETED/ABANDONED: 11/17/05
BACKFILL TYPE: ~~GROUT~~ ~~BENTONITE~~ ~~TEMPORARY WELL POINT~~ ~~MONITORING WELL~~	N/A

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Jeff Thomas

PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/17/05	BOREHOLE NUMBER: CBP-Ø46

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-Ø46
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	Bore H. SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Beau Williams & Martha Cooper	6. DIRECTION OF BOREHOLE: X VERTICAL X INCLINED ~Ø-Ø DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	GC	2.5Y 3/2 Very dark grayish brown; gravel-sand-clay mixture; well sorted (uniform size & shape) gravel throughout sandy clay. Gravel comprises ~50% of site BW borm's composition. Some organic matter & roots in top BW 1-in.	CBPss-Ø46-Ø116M-SO	Ø.Ø	Appears to be gravel with some sandy BW/ST clay - uniformity suggests anthropogenic source.
	2			BW	BW	
	3					
	4					
	5		BW 11/17/05			
	6					
	7					
	8					
	9					
	10					

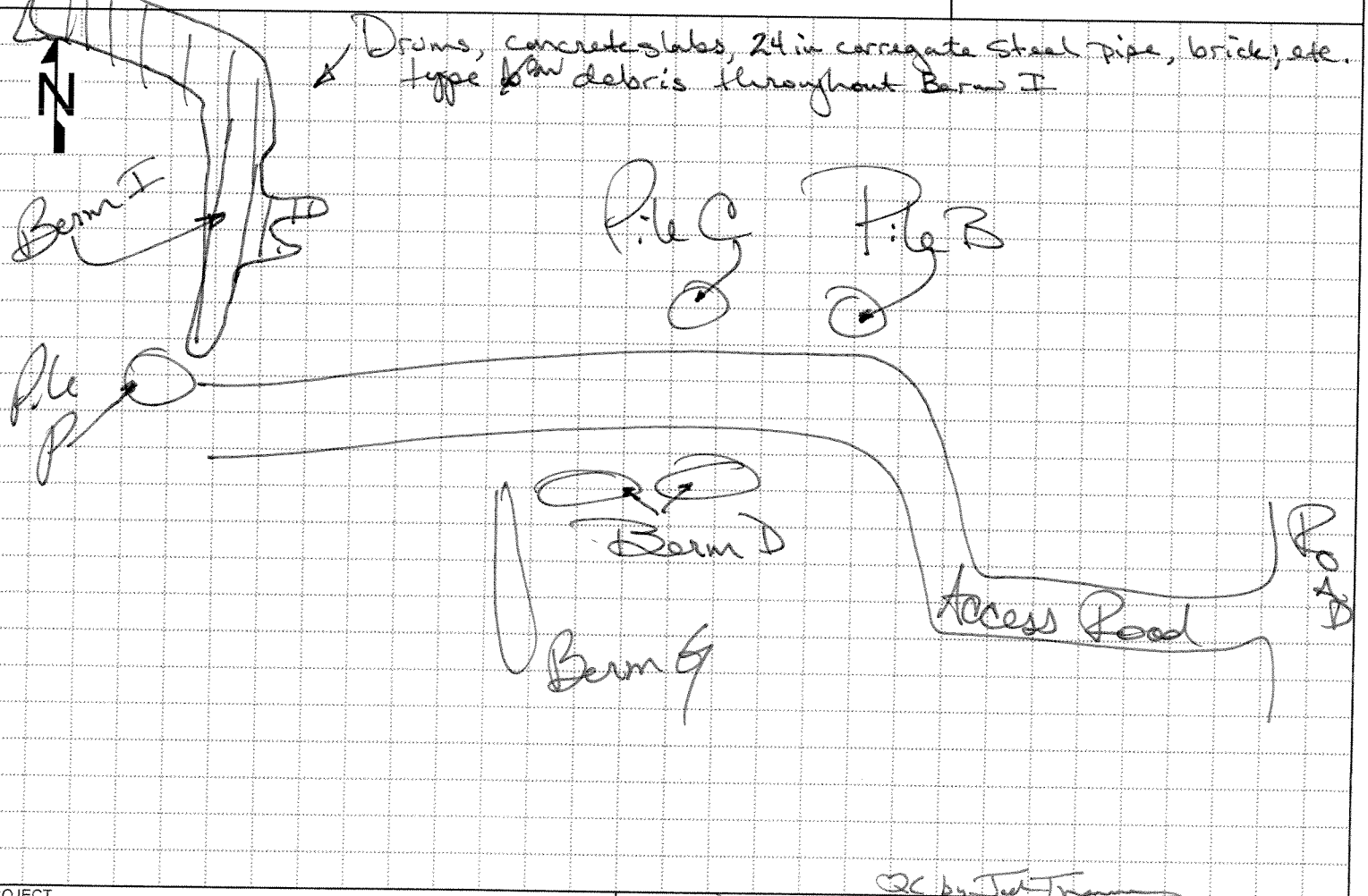
QC by JT

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05	CBP-Ø46

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-045 Pile I
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Beau Williams	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Soil Probe (1-m); SS. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits	
	9. SURFACE ELEVATION/DATUM: 0-8 ft at highest Point	
	10. DRILL DATE/TIME STARTED: 0945 COMPLETED: 1045	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
12. OVERBURDEN THICKNESS: N/A		
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 0-4 ft		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: C, TOC	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/18/05	DATE COMPLETED/ABANDONED: 11/18/05	
BACKFILL TYPE: ~~GROUT~~ ~~BENTONITE~~ ~~TEMPORARY WELL POINT~~ ~~MONITORING WELL~~ N/A		

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by Joel Francis

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/18/05	CBP-045

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-047 P.1 of 1
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Beau Williams	6. DIRECTION OF BOREHOLE: X VERTICAL	X INCLINED Ø - 22.5 DEGREES
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	CL	2.5Y 5/3 light olive brown lean clay with 15% medium sand; damp; top 1-inch generally was a silty organic layer (black); Pieces of brick in sample. BW	CBPSS-Ø47-Ø117M-SO	Ø.Ø	- Samples collected from inside of 2 corrugated pipes with soil in bottom. - no samples collected beneath concrete slabs.
	2					
	3					
	4					
	5					
	6		BW 11/18/05			
	7					
	8					
	9					
	10					

QC by Jack Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/18/05	CBP-047

HTRW DRILLING LOG

1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	DISTRICT: USACE - Louisville
		BOREHOLE NUMBER: CBP-048 (Berm K)
		SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2

4. LOCATION: RVAAP

5. NAME OF DRILLER: SAIC - Beau Williams

6. MAKE/MODEL OF DRILL: na

7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Bowl & Spoon; SS. Soil Probe (3 in); SW

8. BOREHOLE LOCATION: Central Burn Pits

9. SURFACE ELEVATION/DATUM: ~0.3 ft (highest point)

10. DRILL DATE/TIME: STARTED: 1530 COMPLETED: 1630

15. DEPTH GROUNDWATER ENCOUNTERED: N/A

16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA

12. OVERBURDEN THICKNESS: N/A

13. DEPTH DRILLED INTO BEDROCK: N/A

14. TOTAL DEPTH OF BOREHOLE: 0-2 ft

17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA

18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —

19. TOTAL NUMBER OF CORE BOXES: N/A

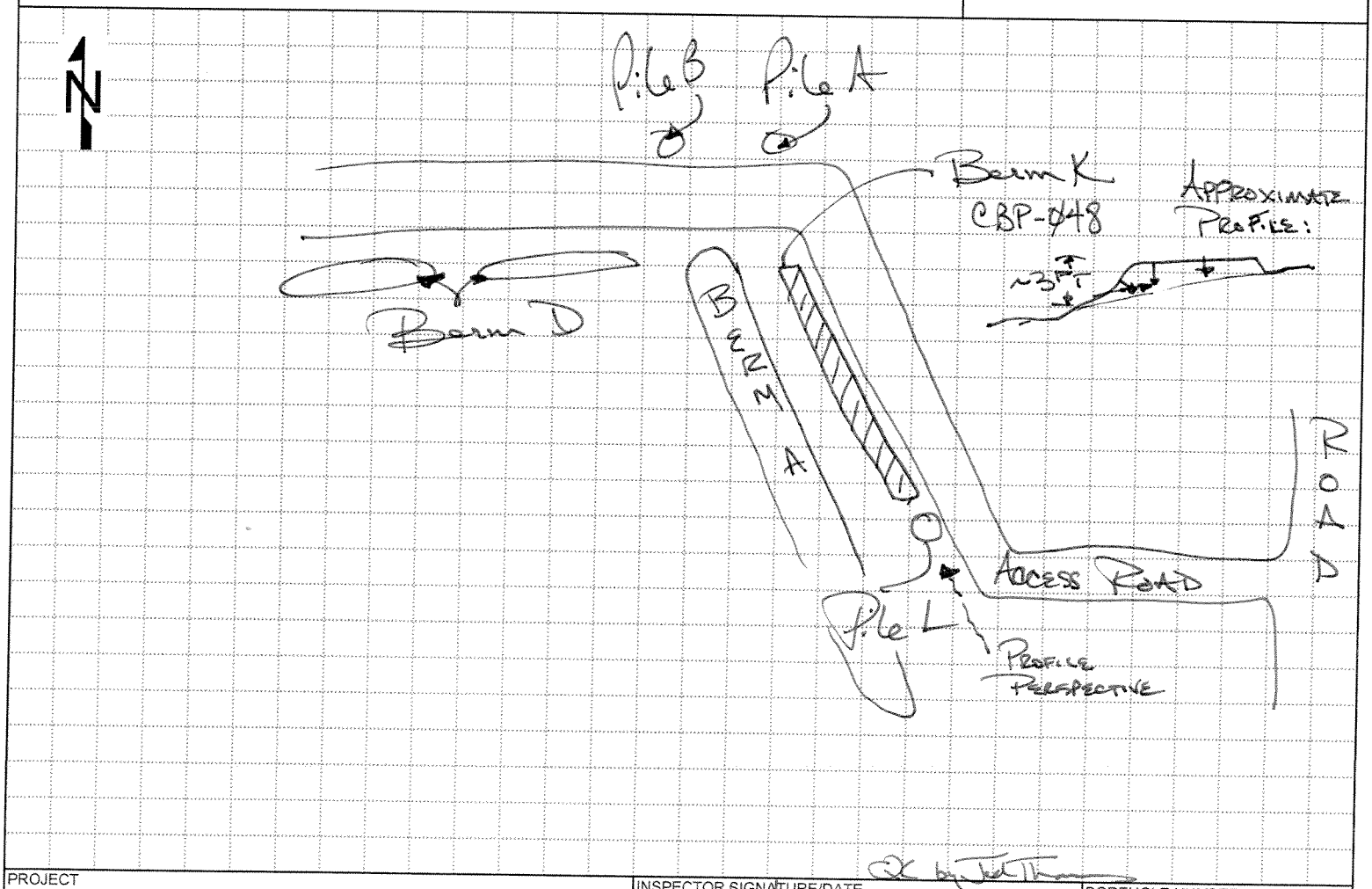
20. CHEMICAL SAMPLES: METALS EXPL TCLP OTHER: Cr+6

21. TOTAL CORE RECOVERY %: N/A

22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/17/05 DATE COMPLETED/ABANDONED: 11/17/05

BACKFILL TYPE: ☐ GROUT ☐ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL BW

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/17/05	BOREHOLE NUMBER: CBP-048

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-Ø48 Berm K
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Beau Williams	6. DIRECTION OF BOREHOLE: X VERTICAL X INCLINED ~Ø-70 DEGREES (BW)	
7. NOTES: PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KR 303		

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	SM & CL	2.5Y 3/3 dark olive brown SM sand-silt mixture; dense roots; Sand is medium to coarse; some CL lean clay with same color.	CBP-Ø48-Ø118M-SO	Ø.Ø	Sand stone light gray to reddish Sands pulled up in Samples in layers, ~Ø.5 - Ø.75 in thick. Some sand is cut by probe but retained its cohesiveness & could not be crushed with finger pressure
	2		2.5Y 4/2 dark grayish brown with 2% mottling: 10YR 5/6 yellowish brown lean clay (CL) with 5% course sand. This clay was ~20-25% of composite sample.			
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

BW 11/17/05

QC by [illegible]

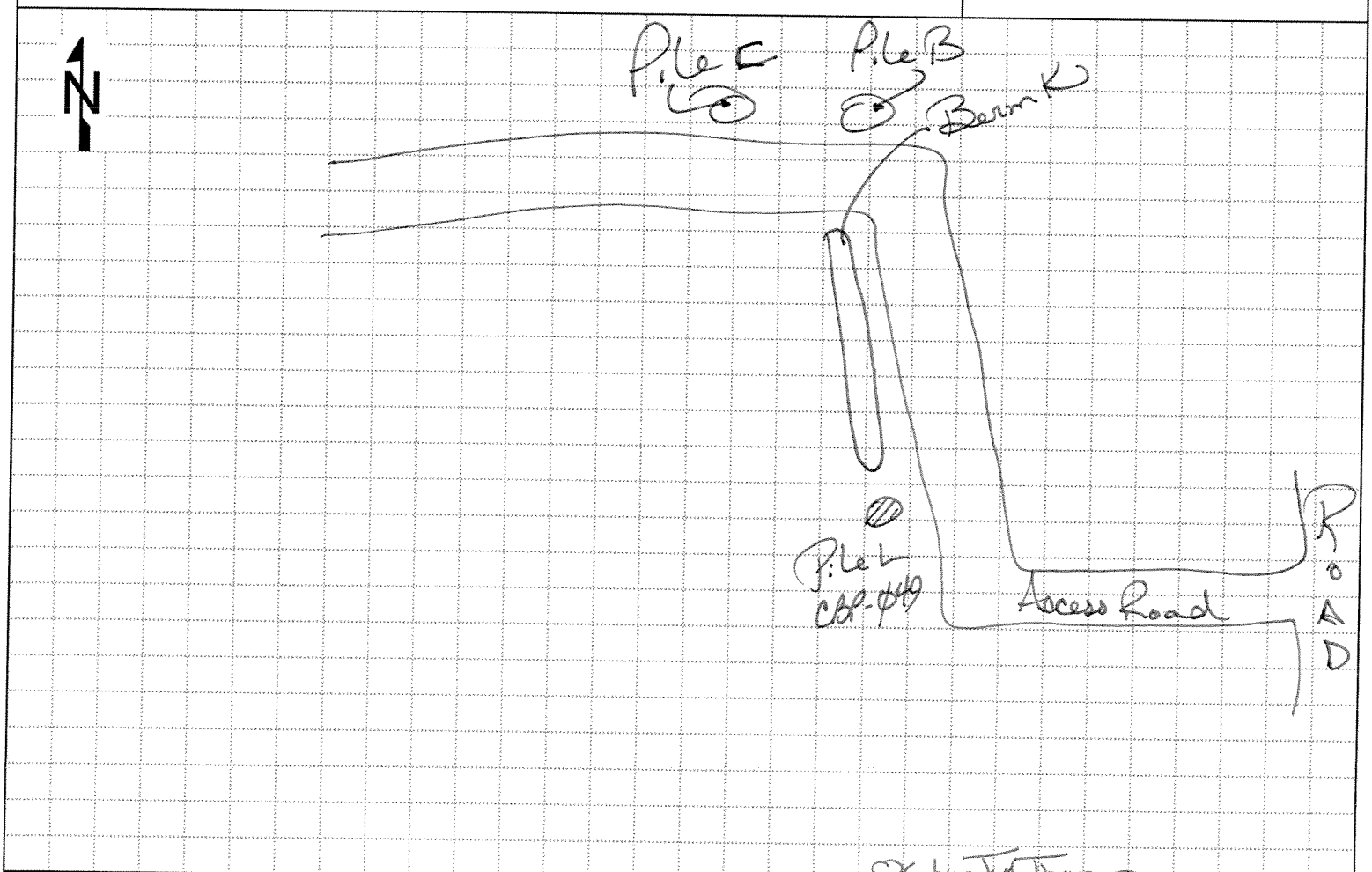
PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/17/05	CBP-Ø48

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-049
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	Pile L SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC Beau Williams	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: 3S. Soil Probe; 3S. Bowl & Spoons; JW	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: ~ 0-5 ft (highest point)
	10. DRILL DATE/TIME STARTED: 0800 COMPLETED: 0845
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 0-3ft	
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: ____ DISTURBED: ____	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: Grain	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/18/05	DATE COMPLETED/ABANDONED: 11/18/05
BACKFILL TYPE: ☐ GROUT ☐ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL	N/A

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by [illegible]

PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/18/05	BOREHOLE NUMBER: CBP-049

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: CBP-049 Pilot
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Beau Williams	6. DIRECTION OF BOREHOLE: X VERTICAL X INCLINED ~0 - 80 DEGREES	
7. NOTES: PID MAKE/MODEL: Parkins Elmer Photovac 2020 PID SERIAL#: ED KR 303		

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	SM to CL	2.5Y 3/3 dark olive brown Sand - silt mixture; medium to course sand; slag in pile; angular to subangular stones; damp. BW Occasional clay zone - CL lean clay; same color as above with 5% 10YR 5/6 yellowish brown mottling.	CBPss-049-0119M-SO	0.0	~5-6 inch stones through pile; ~3 ft stones on outside of pile. - Slag in pile
	2				BW 11/18/05	
	3					
	4					
	5					
	6				BW 11/18/05	
	7					
	8					
	9					
	10					

QC by JT

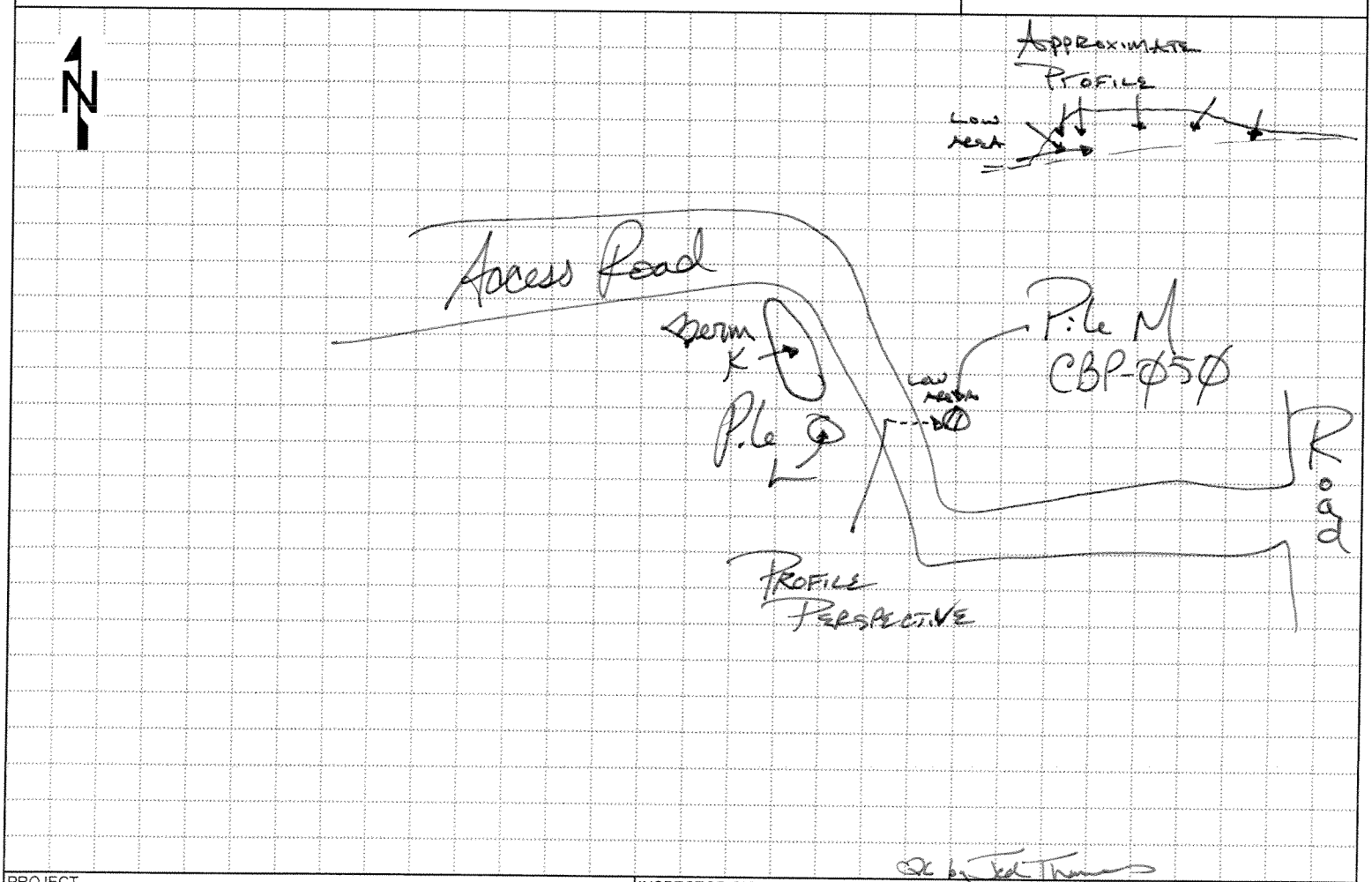
PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/18/05	CBP-049

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-Ø5Ø, Pile M
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC. Martha Clough	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS Soil Probe; SS Bowl & Spoon; BW	8. BOREHOLE LOCATION: Central Berm Pits
	9. SURFACE ELEVATION/DATUM: Ø-6 ft
	10. DRILL DATE/TIME STARTED: Ø81Ø COMPLETED: Ø95Ø
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
12. OVERBURDEN THICKNESS: N/A	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: bgs Ø-2.5 ft Ø-3 ft	
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: N/A DISTURBED: N/A	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: Cr+6	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/18/05	DATE COMPLETED/ABANDONED: 11/18/05
BACKFILL TYPE: GROUT BENTONITE TEMPORARY WELL POINT MONITORING WELL N/A	

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/18/05	BOREHOLE NUMBER: CBP-Ø5Ø

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-05Ø
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough	6. DIRECTION OF BOREHOLE: X VERTICAL ___ INCLINED Ø - ___ DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer - Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1.Ø	SM	2.5Y 3/1 Very dark gray sand-silt mixture; medium to course sands; Very fine to course angular to subangular Stones throughout the pile; damp.	CBP05Ø-Ø12ØM-SO	Ø.Ø	BW
BW	2.Ø					
	3		3.Ø ft sample depths			
	4					
	5					
	6					
	7					BW 11/18/05
	8					
	9					
	10					

PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/18/05	BOREHOLE NUMBER: CBP-05Ø

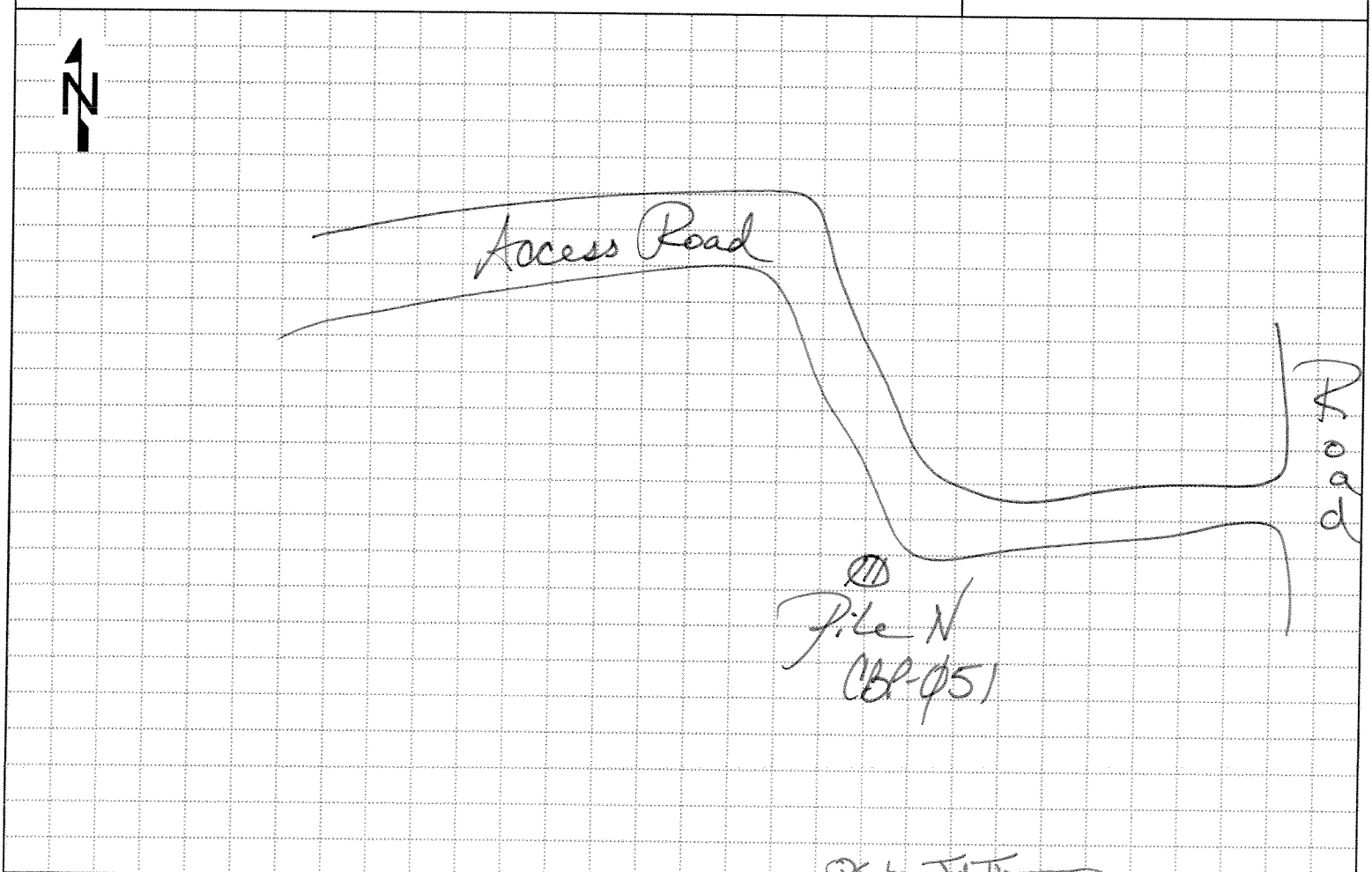
QC by Jeff Thomas

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-051
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	Pile N SHEET 1 OF 2

3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP
5. NAME OF DRILLER: SAIC - Jed Thomas	6. MAKE/MODEL OF DRILL: na
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger BW; SS. Soil Probe; SS. Bowl & Spoon	8. BOREHOLE LOCATION: Central Burn Pits
	9. SURFACE ELEVATION/DATUM: ~0-6 ft (highest point)
	10. DRILL DATE/TIME STARTED: 0805 COMPLETED: 11/09/05
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA
14. TOTAL DEPTH OF BOREHOLE: 0-4 ft.	
18. GEOTECHNICAL SAMPLES: @ N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A
20. CHEMICAL SAMPLES: (METALS) (EXPL) TCLP OTHER: Cr+6	21. TOTAL CORE RECOVERY %: N/A
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/18/05	DATE COMPLETED/ABANDONED: 11/18/05
BACKFILL TYPE: ~~GROUT~~ ~~BENTONITE~~ IN HAND AUGER HOLES BW ~~TEMPORARY WELL POINT~~ ~~MONITORING WELL~~ N/A	

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: OK by Jed Thomas B. Williams 11/18/05	BOREHOLE NUMBER: CBP-051

HTRW DRILLING LOG (continued)

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: CBP-051 File N
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas	6. DIRECTION OF BOREHOLE: ☒ VERTICAL ☒ INCLINED 90-80 DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer PhotoVac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1	OL→ PT	10YR 4/3 Brown silt - with organics; soft & very loose; fine texture; 10% medium sand; dry	CBPss-051-0121M-SO	0.0	- Soil probe was easily pressed into pile, material is soft & loose - has a burnt (slight) odor
	2		BW 11/8/05			
	3					
	4					
	5					
	6		BW 11/8/05			
	7					
	8					
	9					
	10		QC by Jed Thomas			

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/8/05	CBP-051

APPENDIX B

IDW LETTER REPORT

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An Employee-Owned Company

Science Applications International Corporation

December 21, 2005

Mr. Paul Zorko
U.S. Army Corps of Engineers, Louisville District
ATTN: CELRL-ED-E
600 Martin Luther King, Jr. Place
P.O. Box 59
Louisville, KY 40202-0059

SUBJECT: **Contract No. GS-10F-0076J Delivery Order W912QR-05-F-0033, Performance-Based Contract for Six Environmental Areas of Concern at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio**

RE: **DRAFT Investigation Derived Waste (IDW) Characterization and Disposal Report for Soil Cuttings and Decontamination Fluids**

Dear Mr. Zorko:

Investigation activities conducted during November 2005 for the Supplemental Phase II Remedial Investigation (RI) at RVAAP-04 Open Demolition Area #2 (ODA2); RVAAP-16 Fuze and Booster Quarry Landfill/Ponds (FBQ); and RVAAP-49 Central Burn Pits (CBP) at RVAAP resulted in the generation of IDW consisting of soil and decontamination fluids. The purpose of this letter report is to summarize characterization and classification information to assist in determining the proper disposition of IDW consisting of soil cuttings (contained in 2 open-topped 55 gallon drums) and decon fluids from small tool decontamination (contained in 1 close-topped 55 gallon drum).

This letter report includes a summary of IDW generated, its origin (Table 1), as well as classification and recommendations for disposal of the IDW (Table 2). This letter report follows guidance established by the Facility-Wide Sampling and Analysis Plan (SAP) (USACE 2001), the SAP Addendum No. 1 for the Supplemental Phase II RI of ODA2, FBQ, and CBP (November 2005), and Ohio EPA (November 1997) regarding IDW disposition at RVAAP.

Table 1. Summary of Supplemental Phase II RI IDW

CONTAINER NUMBER	CONTAINER TYPE AND SIZE	CONTENTS	GENERATION DATES	SAMPLE ID
DECON-01	55- Gallon Closed Top Drum	Deon Fluids From Small Tool Decon	11/15/2005-11/21/2005	CBP0133
SOIL-01	55-Gallon Open Top Drum	Soil Cuttings	11/15/2005-11/18/2005	CBP0134
SOIL-02	55-Gallon Open Top Drum	Soil Cuttings	11/21/2005	

IDW – WATER:

Per Section 7 of the Facility-Wide SAP, non-indigenous IDW is characterized for disposal on the basis of composite samples collected from waste stream storage containers. A composite waste sample was collected and submitted for laboratory analysis to characterize the waste stream for disposal. One liquid composite sample was collected, CBP0133 (composite of decontamination fluids). Upon receipt of analytical results from the laboratory, the analytical results were reviewed to determine if the waste is potentially hazardous. This review consisted of a comparison of the analytical results against toxicity characteristic leaching procedure (TCLP) criteria presented in Table 7-1, Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR 261.24) presented in the Facility-Wide SAP (USACE 2001).

Attachment 1 presents the analytical laboratory data for TCLP analysis for IDW water (CBP0133) generated during the November 2005 sampling event. All analytical results were below quantitation limits (BQL). The waste is considered non-hazardous, contaminated wastewater.

IDW – SOILS:

Per Section 7 of the Facility-Wide SAP, indigenous IDW contained in 55-gallon open-topped drums are characterized for disposal on the basis of composite samples collected and submitted for laboratory analysis of full TCLP. One composite sample was collected from the two 55-gallon drums of soil cuttings generated during this reporting period. Upon receipt of analytical results from the laboratory, the analytical results were reviewed to determine if any potentially hazardous waste exist. This review consisted of a comparison of the analytical results against the TCLP criteria presented in Table 7-1, Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR 261.24) presented in the Facility-Wide SAP (USACE 2001).

Attachment 1 presents the analytical laboratory data for TCLP analysis for IDW soil cuttings (CBP0134) generated during the November 2005 sampling event. All analytical results were below quantitation limits (BQL). The waste is considered non-hazardous, contaminated solid waste.

Table 2 presents the disposal option identified as a result of these data. Disposal at a permitted solid waste or water treatment facility is recommended for all IDW wastes generated during the November 2005 sampling activities.

Table 2. Summary of Final Waste Classification and Recommended Disposal Options

NON-HAZARDOUS, CONTAMINATED WASTE			
Container Number	**Medium**	**Waste Criterion**	**Disposal Recommendation**
DECON-01	Water	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
SOIL-01	Soils	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
SOIL-02	Soils	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility

Please note the IDW addressed in this letter report has been characterized under provisions of the Facility-Wide SAP and SAP Addendum No. 1 using TCLP analyses and process knowledge. Unless RVAAP has additional information that would result in the IDW meeting, or containing materials that meet, the definition of a listed hazardous waste as defined in 40 CFR Part 261 Subpart D, it is recommended that the IDW, as presently characterized, be disposed as summarized in Table 2.

Since RVAAP, under RCRA, is the generator of this material, SAIC requests concurrence or direction on the waste classification prior to disposal to ensure materials are properly disposed. Following your direction and immediate approval, we will proceed with appropriate waste disposal.

If you have any questions, or require additional information, please do not hesitate to contact me at (330) 405-5804.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Martha Clough
Project IDW Coordinator

cc: Glen Beckham, USACE
Todd Fisher, Ohio EPA DERR
JoAnn Watson, USAEC
Irv Venger, RVAAP
Kevin Jago, SAIC
SAIC Project Files
SAIC CRF

Attachment 1
Analytical IDW Data

Analysis Type	Chemical	Units	Reporting Limit (mg/L)	TCLP Criteria (mg/L)	Results	
					CBP0134 (Soils)	CBP0133 (Water)
Semi-Volatile Organics	1,4-Dichlorobenzene	µg/L	0.05	7.50	BQL	BQL
Semi-Volatile Organics	2,4,5-Trichlorophenol	µg/L	0.05	400.00	BQL	BQL
Semi-Volatile Organics	2,4,6-Trichlorophenol	µg/L	0.05	2.00	BQL	BQL
Semi-Volatile Organics	2,4-Dinitrotoluene	µg/L	0.05	0.13	BQL	BQL
Semi-Volatile Organics	2-methylphenol	µg/L	0.05		BQL	BQL
Semi-Volatile Organics	3 & 4-Methylphenol	µg/L	0.05		BQL	BQL
Semi-Volatile Organics	Hexachlorobenzene	µg/L	0.05	0.13	BQL	BQL
Semi-Volatile Organics	Hexachlorobutadiene	µg/L	0.05	0.50	BQL	BQL
Semi-Volatile Organics	Hexachloroethane	µg/L	0.05	3.00	BQL	BQL
Semi-Volatile Organics	Nitrobenzene	µg/L	0.05	2.00	BQL	BQL
Semi-Volatile Organics	Pentachlorophenol	µg/L	0.1	100.00	BQL	BQL
Semi-Volatile Organics	Pyidine	µg/L	0.05	5.00	BQL	BQL
TCLP Metals	Arsenic	µg/L	0.2	5.00	BQL	BQL
TCLP Metals	Barium	µg/L	1	100.00	BQL	BQL
TCLP Metals	Cadmium	µg/L	0.06	1.00	BQL	BQL
TCLP Metals	Chromium	µg/L	0.05	5.00	BQL	BQL
TCLP Metals	Lead	µg/L	0.1	5.00	BQL	BQL
TCLP Metals	Mercury	µg/L	0.002	0.20	BQL	BQL
TCLP Metals	Selenium	µg/L	0.2	1.00	BQL	BQL
TCLP Metals	Silver	µg/L	0.05	5.00	BQL	BQL
TCLP Herbicides	2,4,5-TP (Silvex)	µg/L	0.005	1.00	BQL	BQL
TCLP Herbicides	2,4-D	µg/L	0.005	10.00	BQL	BQL
TCLP Pesticides and/or PCBs	Chlordane	µg/L	0.005	0.03	BQL	BQL
TCLP Pesticides and/or PCBs	Endrin	µg/L	0.00025	0.02	BQL	BQL
TCLP Pesticides and/or PCBs	Gamma-BHC (Lindane)	µg/L	0.00025	0.40	BQL	BQL
TCLP Pesticides and/or PCBs	Heptachlor	µg/L	0.00025	0.01	BQL	BQL
TCLP Pesticides and/or PCBs	Heptachlor Epoxide	µg/L	0.00025	0.01	BQL	BQL
TCLP Pesticides and/or PCBs	Methoxychlor	µg/L	0.00025	10.00	BQL	BQL
TCLP Pesticides and/or PCBs	Toxaphene	µg/L	0.005	0.50	BQL	BQL
Semi-Volatile Organics	1,1-Dichloroethene	µg/L	0.1		BQL	BQL
Semi-Volatile Organics	1,2-Dichloroethane	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	1,4-Dichlorobenzene	µg/L	0.1	7.50	BQL	BQL
Semi-Volatile Organics	2-Butanone	µg/L	0.1		BQL	BQL
Semi-Volatile Organics	Benzene	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Carbon Tetrachloride	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Chlorobenzene	µg/L	0.1	100.00	BQL	BQL
Semi-Volatile Organics	Chloroform	µg/L	0.1	6.00	BQL	BQL
Semi-Volatile Organics	Tetrachloroethylene	µg/L	0.1	0.70	BQL	BQL
Semi-Volatile Organics	Trichloroethene	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Vinyl Chloride	µg/L	0.1	0.20	BQL	BQL

BQL - below quantitation limits

TCLP - toxicity characteristic leaching procedure

ONYX

ENVIRONMENTAL SERVICES

Please type or print in block letters. (Form designed for use on elite (12-pitch) typewriter.)

NH040

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH5214088265 Manifest Document No. 0001

2. Page 1 of 1

3. Generator's Name and Mailing Address
RAVENNA ARMY AMMO PLANT
8451 SATE RT 5
RAVENNA, OH 44266

4. Generator's Phone (330) 405-5804

A. Non-hazardous Manifest Document Number Z 178520

B. State Generator's ID SAME

5. Transporter 1 Company Name: HAZMAT ENVIRONMENTAL GROUP INC

6. US EPA ID Number: MYD988079495

C. State Trans. ID 124187MY

7. Transporter 2 Company Name

8. US EPA ID Number

D. Transporter's Phone ( )

E. State Trans. ID 716 827-7200

9. Designated Facility Name and Site Address
ONYX ENVIRONMENTAL SVCS,L.L.C.
4301 INFIRMARY ROAD
WEST CARROLLTON, OH 45449

10. US EPA ID Number: OHD980145293

F. Transporter's Phone ( )

G. State Facility's ID

H. Facility's Phone (937) 859-5101

	11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number) HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	L Waste No.
a.	NON RCRA AND DOT NON REGULATED LIQUID, NONE, NONE	004	DM	01600	P	NONE
b.	NON RCRA AND DOT NON REGULATED SOLID, NONE, NONE	002	DM	00800	P	NONE
c.						
d.						

J. Additional Descriptions for Materials Listed Above

a. L/- 236022//NON HAZ WATER

b. S/- 236023//NON HAZ SOIL

c.

d.

K. Handling Codes for Wastes Listed Above

a.

b.

c.

d.

15. Special Handling Instructions and Additional Information
PACKING SLIPS ATTACHED FOR CLARIFICATION - EMERGENCY NUMBER INFOTRAC: 1-800-535-5053

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

I hereby certify that the above-named material is not hazardous waste as defined by 40 CFR Part 261 or any applicable state law.

GENERATOR

Printed/Typed Name: Irv Venger | Signature: Irv Venger | Month Day Year: 10 23 06

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Darrell Ferguson | Signature: Darrell Ferguson | Month Day Year: 10 23 06

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of non-hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month Day Year

1-GENERATOR COPY

SIGNATURE AND INFORMATION *MUST* BE LEGIBLE ON ALL COPIES

APPENDIX C

PROJECT QUALITY ASSURANCE SUMMARY

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TABLE OF CONTENTS

ACRONYMS

CBP	Central Burn Pits
CQC	contractor quality control
FCO	field change order
GPL	GPL Laboratories, Inc.
M&TE	materials and testing equipment
NCR	Nonconformance Report
QA	quality assurance
QC	quality control
RI	remedial investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SOW	Statement of Work
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

C.0 PROJECT QUALITY CONTROL SUMMARY REPORT

This appendix presents the actions and methodologies undertaken to meet the quality assurance/quality control (QA/QC) goals for the Supplemental Phase II remedial investigation (RI) at Central Burn Pits (CBP) at the Ravenna Army Ammunition Plant (RVAAP). These goals were established in the *Facility-Wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant* (USACE 2001) and the *Sampling and Analysis Plan Addendum No. 1 for the Supplemental Phase II Remedial Investigation* (USACE 2005). The field investigation was conducted under one mobilization; this appendix addresses QA/QC goals for the entire project. These goals were implemented through project-specific procedures and requirements, the Science Applications International Corporation (SAIC) QA Program, and the United States Army Corps of Engineers (USACE), Louisville District QA requirements. A large portion of project QA was focused on field and analytical laboratory activities and project administration.

C.1 FIELD QUALITY ASSURANCE

C.1.1 Readiness Review

Field QA was initiated for the Supplemental Phase II RI in the readiness review held at the SAIC Twinsburg, Ohio office on November 10, 2005. The purpose of the readiness review was to ensure that

- project documents and procedures were approved, controlled, and properly distributed;
- assigned personnel were trained or a schedule was established to conduct training;
- mobilization and site logistics were established;
- laboratories were ready to accept samples;
- subcontractors were ready to begin work; and
- QA systems were implemented.

All elements of the readiness review were completed prior to initiating field activities and were approved by the SAIC QA/QC Officer. Readiness review and project kickoff checklists provide documentation of this QA element and are maintained in the project file.

C.1.2 Procedures

Standard operating methods for field activities performed during the Supplemental Phase II RI are incorporated into the governing documents for the project. The facility-wide sampling and analysis plan (SAP) (USACE 2001a) describes the overall approach and methodologies to be used for projects at RVAAP, and the *Supplemental Phase II RI SAP Addendum* (USACE 2005) details project-specific requirements for field implementation. These documents were reviewed by USACE, Louisville District and by the Ohio Environmental Protection Agency prior to implementation. Clarifications and/or planned deviations from these methods were documented as field change orders (FCOs), and variances were documented as Nonconformance Reports (NCRs). Copies of the FCOs issued during the Phase I RI are attached to this appendix.

C.1.3 Training

Field team personnel were trained in all procedures applicable to their assigned tasks. Training was accomplished through a combination of classroom lectures, reading assignments, and on-the-job training. Surveillance performed by the project SAIC contractor quality control (CQC) representative provided assessments of worker proficiency and training effectiveness.

Copies of training records and surveillance reports were maintained in the project file. Copies of training records required for Occupational Safety and Health Administration and United States Department of Transportation compliance also were maintained in the field.

C.1.4 Equipment Calibration

Various types of measuring and testing equipment (M&TE) were used during the field investigation. All M&TE was categorized, assigned unique identifiers, and listed in an inventory in the M&TE logbook. Last and next calibration recall dates were also recorded. As appropriate, instruments were calibrated daily according to the manufacturer's instructions. Only equipment and standards having verifiable traceability to nationally recognized standards were used for calibration. Daily calibration activities and results were recorded in the M&TE logbook, as well as source information for all calibration standards and reagents.

C.1.5 Quality Control Samples

Field QC samples collected included equipment rinsate blanks, source water, and field duplicates. Field QA splits were collected as specified in the *Supplemental Phase II RI SAP Addendum* (USACE 2005) pertaining to CQC. Implementation of the CQC program in the field was done by the SAIC CQC representative. Appendix D presents an evaluation of data quality and analytical performance with respect to field QC results. Field QC data and analyses of QC samples are presented in Appendix E.

C.1.6 Field Records

Field data, observations, activities, and information were recorded on standardized field sheets and in bound field logbooks. The use of standardized field sheets ensured that all necessary data were entered consistently. Logbook entries were checked for accuracy and completeness by independent reviewers. Other field records, which were collected and likewise maintained, included equipment/material certifications, boring logs, and air-bill forms.

C.2 ANALYTICAL LABORATORY QUALITY ASSURANCE

SAIC subcontracted GPL Laboratories, Inc. (GPL) to perform chemical analysis of samples collected during the Supplemental Phase II RI. The selected laboratory is certified by the USACE, Missouri River Division, Mandatory Center of Expertise in Omaha, Nebraska. In addition, this laboratory was technically audited by SAIC prior to contract award. QA split samples were collected and submitted to an independent USACE QA laboratory, Severn Trent Laboratories, Inc., located in North Canton, Ohio.

C.2.1 Readiness Review

Laboratory QA/QC activities were initiated during the readiness review. The readiness review ensured that (1) governing documents and approved analytical methods were controlled and properly distributed, (2) the laboratory was scheduled and ready to conduct the analysis, (3) logistical coordination was established between the laboratory and the field team, and (4) laboratory QA programs were consistent and compatible with the project requirements.

C.2.2 Procedures

Prior to initiation of analytical support for the Supplemental Phase II RI, GPL and SAIC reviewed and negotiated a contract based on a comprehensive laboratory Statement of Work (SOW). The laboratory

SOW detailed project-specific requirements, including the parameters to be measured, analytical methods, adherence to United States Environmental Protection Agency (USEPA) SW-846 protocols, project quantitation goals (sensitivity), and data deliverables requirements. All laboratory comments and questions were resolved before analytical work proceeded.

C.2.3 Laboratory Quality Control

To document laboratory data quality and to measure the quality of the analytical process, laboratory QC samples and data verification/validation were employed. The results of laboratory QC are discussed in the project QC Summary Report (Appendix D). Analytical results of laboratory QC samples are included in the project file and form the basis of the data verification and evaluation process (Section C.2.5).

C.2.4 Laboratory Documentation

GPL maintains comprehensive information regarding the entire analytical process. The laboratory delivered summary data packages and electronic deliverables consistent with those identified in the USEPA SW-846 protocol to SAIC for validation and verification. Laboratory QC sample analyses were cross-referenced to the appropriate environmental field sample analyses in the laboratory deliverables.

C.2.5 Data Verification/Validation

Analytical data generated during this project were subjected to a rigorous process of data verification by SAIC. For verification of data, criteria were established against which the analytical results were compared and from which a judgment was rendered regarding the acceptability and qualification of the data (Appendix D). Upon receipt of data packages from each laboratory, the information was subjected to a systematic examination following standardized checklists and procedures to ensure content, presentation, administrative validity, and technical validity. Routine data changes were documented through data change forms. Data deficiencies or formal laboratory-related nonconformances were documented through an NCR process, as required.

C.3 QUALITY ASSURANCE DOCUMENTATION

Primary methods for documenting QA during the Supplemental Phase II RI include the completion of FCOs requiring USACE concurrence and NCRs generated in accordance with SAIC QA procedures. Copies of FCOs completed during the investigation are included in this appendix. Copies of NCRs are on record in the SAIC RVAAP project file.

C.3.1 Field Change Control

The FCOs are completed during the RI to request and document the rationale and approval for any departures from protocols specified in the approved Facility-Wide SAP and the Supplemental Phase II RI SAP Addendum. Field changes provide clarification to the scope or refinement in the procedural approach to a specific field activity. All FCOs are reviewed and approved by designated technical representatives of USACE, Louisville District prior to implementation. No FCOs were implemented during the Supplemental Phase I RI activities for CBP.

C.3.2 Nonconformance Reports

To identify and correct conditions adverse to quality, as described in the field and laboratory QA plans, NCRs and associated corrective action reports were completed, as necessary. No NCRs were identified throughout the duration of the project.

C.4 REFERENCES

USACE 2001. *Facility-wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-00-D-0001, DO CY 02, March 2001.

USACE 2005. *Sampling and Analysis Plan Addendum No. 1 for Supplemental Phase II Remedial Investigation of ODA2, FBQ, and CBP.* November 2005.

APPENDIX D

DATA QUALITY CONTROL SUMMARY REPORT

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TABLE OF CONTENTS

TABLES

ACRONYMS

ADR	Automated Data Review
AOC	area of concern
CBP	Central Burn Pits
DQA	data quality assessment
DQCR	Data Quality Control Report
DQO	data quality objective
GPL	GPL Laboratories, Inc.
LCS	laboratory control sample
MDL	method detection level
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RPD	relative percent difference
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SDG	sample delivery group
SVOC	semivolatile organic compound
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

D1.0 PURPOSE OF THIS REPORT

Environmental data must always be interpreted relative to its known limitations and its intended use. As can be expected in environmental media of this type, there are areas and data points where the user needs to be cautioned relative to the quality of the project information presented. The data verification process and this data quality assessment (DQA) are intended to provide current and future data users assistance throughout the interpretation of these data.

The purpose of this DQA report is (1) to describe the quality control (QC) procedures followed to ensure data generated by Science Applications International Corporation (SAIC) during these investigations at the Ravenna Army Ammunition Plant (RVAAP) would meet project requirements; (2) to describe the quality of the data collected; and (3) to describe problems encountered during the course of the study and their solutions. A separate Chemical Quality Assessment Report will be completed by the United States Army Corp of Engineers (USACE) quality assurance (QA) representative and will cover data generated from QA split samples remanded to their custody.

This report provides an assessment of the analytical information gathered during the course of the RVAAP Supplemental Phase II Remedial Investigation (RI) for the Central Burn Pit (CBP), area performed during November 2005. It documents that the quality of the data employed for the RI report and evaluation met their objectives. Evaluation of field and laboratory QC measures will constitute the majority of this assessment; however, references will also be directed toward those QA procedures that establish data credibility. The primary intent of this assessment is to illustrate that data generated for these studies can withstand scientific scrutiny, are appropriate for their intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy.

Multiple activities were performed to achieve the desired data quality for this project. As discussed in the report, decisions were made during the initial scoping of the RI to define the quality and quantity of data required. Data quality objectives (DQOs) were established to guide the implementation of the field sampling and laboratory analysis (refer to the *RVAAP Sampling and Analysis Plan [SAP] Addendum* November 2005 [USACE 2005]). A QA program was established to standardize procedures and to document activities (refer to the RVAAP Facility-wide Quality Assurance Project Plan [QAPP] March 2001). This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data were subjected to verification and validation review to identify and qualify problems related to the analysis. These review steps contributed to this final DQA where data used in the investigation are identified as having met the criteria and are being employed appropriately.

D2.0 QUALITY ASSURANCE PROGRAM

A Facility-wide QAPP and a Supplemental Phase II RI QAPP Addendum were developed to guide the investigation. These plans are found in Part II of the Facility-wide SAP for RVAAP (USACE 2001) and the Supplemental Phase II RI SAP Addendum No. 1 (USACE 2005). The purpose of these documents was to enumerate the quantity and type of samples to be taken to inspect the area of concern (AOC), and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The QAPP established requirements for both field and laboratory QC procedures. In general, field QC duplicates and QA split samples were required for each environmental sample matrix collected in the area being investigated; volatile organic compound (VOC) trip blanks were to accompany each cooler containing

water samples for VOC determinations; and analytical laboratory QC duplicates, matrix spikes (MSs), laboratory control samples (LCSs), and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the RVAAP QA Program was to ensure that the quality of results for all environmental measurements were appropriate for their intended use. To this end, the QAPP and standardized field procedures were compiled to guide the investigation. Through the process of readiness review, training, equipment calibration, QC implementation, and detailed documentation, the project has successfully accomplished the goals set for the QA Program. Surveillances were conducted to determine the adequacy of field performance as evaluated against the QA plan and procedures.

D2.1 MONTHLY PROGRESS REPORTS

Monthly Progress Reports (MPRs) were completed by the SAIC Project Manager for the duration of the project. The MPRs contained the following information: work completed, problems encountered, corrective actions/solutions, summary of findings, and upcoming work. These reports were issued to the USACE, Louisville District Project Manager. Access to these reports can be obtained through the USACE, Louisville District Project Manager.

D2.2 DAILY QUALITY CONTROL REPORTS

The Field Team Leader produced all Daily Quality Control Reports (DQCRs). These include information such as, but not limited to, sub-tier contractors onsite, equipment onsite, work performed summaries, QC activities, Health and Safety activities, problems encountered, and corrective actions. The DQCRs were submitted to the USACE, Louisville District Project Manager and may be obtained through his office.

D2.3 LABORATORY "DEFINITIVE" LEVEL DATA REPORTING

The QAPP for this project identified requirements for laboratory data reporting and identified GPL Laboratory Inc. (GPL), Gaithersburg, Maryland as the laboratory for the project. During the execution of the project, the GPL facility performed all of the analyses. United States Environmental Protection Agency (USEPA) "definitive" data have been reported, including the following basic information:

a. laboratory case narratives

b. sample results (soil/sediments reported per dry weight)

c. laboratory method blank results

d. LCS results

e. laboratory sample MS recoveries

f. laboratory duplicate results

g. surrogate recoveries (VOCs, semivolatile organic compounds [SVOCs], pesticides, polychlorinated biphenyls [PCBs], and explosives)

h. sample extraction dates

i. sample analysis dates

This information from the laboratory, along with field information, provides the basis for subsequent data evaluation relative to sensitivity, precision, accuracy, representativeness, and completeness. These have been presented in Chapter 4.0.

D3.0 DATA VERIFICATION

The objective when evaluating the project data quality is to determine its usability. The evaluation is based on the interpretation of laboratory QC measures, field QC measures, and the project DQOs. This project implemented the Automated Data Review (ADR) electronic review process in combination with technical oversight to facilitate laboratory data review. ADR output was reviewed by the project-designated verification staff and the project laboratory coordinator. The ADR product is retained in the project database and available within that structure.

D3.1 FIELD DATA VERIFICATION

DQCRs were completed by the Field Team Leader. The DQCRs and other field-generated documents such as sampling logs, boring logs, daily health and safety summaries, daily safety inspections, equipment calibration and maintenance logs, and sample management logs were peer reviewed onsite. These logs and all associated field information have been delivered to the USACE, Louisville District Project Manager and can be obtained through his office.

D3.2 LABORATORY DATA VERIFICATION

Analytical data generated for this project have been subjected to a process of data verification and review. The following describes this systematic process and the evaluation activities performed. Several criteria have been established against which the data were compared and from which a judgment was rendered regarding the acceptance and qualification of the data. These and project specific QC criteria are programmed into the database and evaluated using the ADR programming. Because it is beyond the scope of this report to cite those criteria, the reader is directed to the following documents for specific detail:

- SAIC Technical Support Contractor QA Technical Procedure (TP-DM-300-7) Data Verification and Validation;
- USEPA – National Functional Guidelines for Inorganic Data Review, USEPA 540/R-94/013, February 1994;
- USEPA – National Functional Guidelines for Organic Data Review, USEPA-540/R-99/008, October 1999; and
- Supplemental Phase II RI at RVAAP, SAP Addendum, USACE, November 2005.

Upon receipt of field and analytical data, verification staff performed a systematic examination of the reports, utilizing the ADR process to ensure the content, presentation, and administrative validity of the data. Discrepancies identified during this process were recorded and documented utilizing the dataset. As part of data verification, standardized laboratory electronic data deliverables were subjected to review. This technical evaluation ensured that all contract-specified requirements had been met, and that electronic information conformed to reported hardcopy data. QA Program Nonconformance Report and Corrective Action systems were implemented as required.

During the verification phase of the review and evaluation process, data were subjected to a systematic technical review by examining all field and analytical QC results and laboratory documentation, following USEPA functional guidelines, the ADR process, and SAIC internal procedures for laboratory data review. These data review guidelines define the technical review criteria, methods for evaluation of the criteria, and actions to be taken resulting from the review of these criteria. The primary objective of this phase was to assess and summarize the quality and reliability of the data for the intended use and to document factors that may affect the usability of the data. This process did not include in-depth review of raw data instrument out-put or recalculation of results from the primary instrument out-put. This data verification, validation, and analytical review process included, but was not necessarily limited to, the following parameters:

- data completeness;
- analytical holding times and sample preservation;
- calibration (initial and continuing);
- method blanks;
- sample results verification;
- surrogate recovery;
- LCS analysis;
- internal standard performance;
- MS recovery;
- duplicate analysis comparison;
- reported detection limits;
- compound, element, and isotope quantification;
- reported detection levels; and
- secondary dilutions.

As an end result of this phase of the review, the data were qualified based on the technical assessment of the verification/validation criteria. Qualifiers were applied to each field and analytical result to indicate the usability of the data for its intended purpose.

D3.3 DEFINITION OF DATA QUALIFIERS (FLAGS)

During the data verification process, all laboratory data were assigned appropriate data qualification flags and reason codes. Qualification flags are defined as follows:

"U" Indicates the analyte was analyzed for, but not detected above, the level of the associated value.

"J" Indicates the analyte was positively identified; however, the associated numerical value is an approximate concentration of the analyte in the sample.

"UJ" Indicates the analyte was analyzed for, but not detected above, the associated value; however, the reported value is an estimate and demonstrates a decreased knowledge of its accuracy or precision.

"R" Indicates the analyte value reported is unusable. The integrity of the analyte's identification, accuracy, precision, or sensitivity has raised significant questions as to the reality of the information presented.

"=" Indicates the analyte has been validated, the analyte has been positively identified, and the associated concentration value is accurate.

D3.4 DATA ACCEPTABILITY

Twenty-nine environmental soil and field QC samples were collected with approximately 1,500 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The project produced acceptable results for 100% of the sample analyses performed and successfully collected investigation samples under the direction of the SAP and the USACE, Louisville District.

Table D-1 presents a summary of the collected investigation samples. It tallies the successful collection of all targeted field QC and QA split samples, while Table D-2 identifies a cross reference for duplicate and QA split sample pair numbers. Table D-3 provides a summary of rejected analyses grouped by media and analyte category. The majority of estimated values were based on values observed between the laboratory method detection levels (MDLs) and the project reporting levels. Values determined in this region have an inherently higher variability and need to be considered estimated at best.

Table D-1. Central Burn Pits Investigation Summary

Area	Media	Environmental Samples	Field Duplicates	Trip Blanks	Equipment Rinsate Blanks	Site Source Water Blanks	USACE Split Samples
CBP	Soil	22	4	-	1	2	4

USACE = United States Army Corps of Engineers.

Table D-2. Primary, Duplicate, and Split Sample Correlation Table
Central Burn Pits Investigation

Media	Station #	Sample #	Duplicate #	Laboratory SDG #	Split #
Soil	CBP-037	CBPSS-037-0104-SO	CBPSS-037-0125-SO	511101	CBPSS-037-126-SO
Soil	CBP-041	CBPSS-041-0111M-S0	CBPSS-041-0127M-SO	511115	CBPSS-041-0128M-SO
Soil	CBP-042	CBPSS-042-0112M-SO	CBPSS-042-0136M-SO	511115	CBPSS-042-0137M-SO
Soil	CBP-052	CBPSS-052-0122-SO	CBPSS-052-0129-SO	511101	CBPSS-052-0135-SO

SDG = Sample delivery group.

Table D-3. Central Burn Pits Investigation
Summary of Rejected Analytes (Laboratory)
(grouped by medium and analysis group)

Media	Analysis Group	Rejected/	Total	Percent Rejected
Soil (surface and subsurface)	Metals	0/	597	0.0
	Chromium +6	0/	16	0.0
	Explosives	0/	350	0.0
	TCLP parameters	0/	560	0.0
Project Total		0/	1,523	0.0

For this RVAAP study, one field duplicate was analyzed for soil media. Equipment rinsate, site potable water source and deionized water source samples were collected in conjunction with the concurrent sampling program at the Central Burn Pits.

D4.0 DATA QUALITY EVALUATION

D4.1 METALS AND HEXAVALENT CHROMIUM, SOIL

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for all elements analyzed. Method blank levels or continuing calibration blank levels did not result in any qualification of data. Antimony concentrations were consistently qualified as estimated "J or UJ" due to low MS results; however, none of the values were rejected. Arsenic, barium, magnesium, chromium, copper, potassium and vanadium were qualified as estimated "J or UJ" due to MS recoveries being above criteria. Other metals exhibited acceptable recoveries and were not qualified. LCS determinations were considered acceptable throughout the data set. Reporting levels are considered to be acceptable relative to the QAPP goals. Laboratory duplicate comparisons were acceptable. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. All hexavalent chromium data was in order and no qualification of the results were necessary. None of the metal soil results were rejected. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the main text of the report, and can be found in the RVAAP Environmental Information Management System.

D4.2 EXPLOSIVE ANALYSES, SOIL

Analytical holding times were met for all samples. Initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks exhibited detectable concentrations of nitrobenzene causing similar values observed in samples to be qualified as non-detect. No other explosive compounds were observed in the method blanks. Surrogate compound recoveries were acceptable for all analyses, with the exception of slightly elevated recoveries for samples CBPSS-038-0107-SO, CBPSS-038-0106-SO, CBPSS-039-0108-SO, and CBPSS-044-0114M-SO. Impacted compound results were qualified as estimated "J". LCS and MS/matrix spike duplicate (MSD) recoveries were within criteria. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the main text of the report, and can be found in the RVAAP Environmental Information Management System.

D4.3 PRECISION

A field duplicate sample was collected to ascertain the contribution to variability (i.e., precision) due to the combination of environmental media, sampling consistency, and analytical precision. The field duplicate sample was collected from the same spatial and temporal conditions as the primary environmental sample. The sample was collected from the same sampling device, after homogenization.

Field duplicate comparison information in Table D-4 presents the absolute difference or relative percent difference (RPD) for field duplicate measurements, by analyte. RPD was calculated only when both samples were > 5 times the reporting level. When one or both sample values were between the reporting level and 5 times the reporting level, the absolute difference was evaluated. If both samples were not detected for a given analyte, precision was considered acceptable. To review information, this DQA has implemented general criteria for comparison of absolute difference measurements and RPDs. RPD

criteria were set at 50 and absolute difference criteria were set at 3 times the reporting level. All field duplicate comparisons are considered good, with the highest difference being for lead in the soil duplicate pair CBPSS-041-0111M-SO/CBPSS-041-0127M-SO at 45 RPD.

D4.4 SENSITIVITY

Determination of minimum detectable values allows the investigation to assess the relative confidence that can be placed in a value relative to the magnitude or level of analyte concentration observed. The closer a measured value comes to the minimum detectable concentration, the less confidence and more variation the measurement will have. Project sensitivity goals were expressed as quantitation level goals in the QAPP. These levels were achieved or exceeded throughout the analytical process. Actual laboratory MDLs achieved during this investigation achieved project quantitation level goals. Individual analyte reporting levels varied due to matrix differences and contaminant analyte concentrations. Reporting levels were elevated in soil due to inherent moisture content variability and results being reported in the standard dry weight format. Reporting level variations have been considered during data interpretation and statistical applications.

Method blank determinations were performed with each analytical sample batch for each analyte under investigation. These blanks were evaluated during data review to determine their potential impact on individual data points, if any. Review action levels are set at 5 times the reporting level for all analytes, except those designated as common laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone, and phthalate compounds) with action levels set at 10 times reporting levels. During data review, reported sample concentrations are assessed against method blank action levels and the following qualifications are made when reportable quantities of analyte were observed in the associated method blank.

- When the analyte sample concentration is above 5 or 10 times the action level, the data are not qualified and it is considered a positive value.

- When the analyte sample concentration is determined below 5 or 10 times the action level but above the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the analyte value reported. These data are then qualified as “U.

- When the analyte sample concentration is determined below 5 or 10 times the action level and below the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the reporting level. These data are then qualified as “U”.

Table D-4. Field Duplicate Comparison, Central Burn Pit Investigation

Analysis	CBPSS-037-0104-SO/ CBPSS-037-0125-SO Soil RPD	CBPSS-041-0111M-SO/ CBPSS-041-0127M-SO Soil RPD	CBPSS-042-0112M-SO/ CBPSS-042-0136M-SO Soil RPD	CBPSS-052-0122-SO/ CBPSS-052-0129-SO Soil RPD
Metals				
Aluminum	3	3	1	na
Antimony	*	*	*	na
Arsenic	3	3	4	na
Barium	2	9	1	na
Beryllium	*	14	3	na
Cadmium	*	3	2	na
Calcium	0	14	2	na
Chromium	26	*	*	6
Cobalt	14	1	3	na
Copper	0	15	22	na
Iron	0	10	3	na
Lead	2	45	3	na
Magnesium	2	17	5	na
Manganese	10	12	6	na
Mercury	*	*	*	na
Nickel	23	1	5	na
Potassium	4	2	0	na
Selenium	*	*	*	na
Silver	*	*	*	na
Sodium	*	*	*	na
Thallium	*	*	*	na
Vanadium	3	1	3	na
Zinc	1	11	1	na
Chromium+6	na	*	*	*
Explosives				
All compounds	*	*	*	na

* = At least one value is < 5 times the reporting level, and duplicate comparison is within 3 times the reporting level.
RPD = Relative percent difference.
na = Not Analyzed
RVAAP = Ravenna Army Ammunition Plant.
UNAC = At least one value is < 5 times the reporting level, and duplicate comparison is NOT within 3 times the reporting level.

Evaluation of overall project sensitivity can be gained through review of field blank information. These actual sample analyses may provide a comprehensive look at the combined sampling and analysis sensitivity attained by the project. Field QC blanks obtained during sampling activities at RVAAP included samples of VOC trip blank waters and site water sources.

Equipment rinsate sample (CBP-QC-130-QC) did not exhibit any concentrations of explosive compounds. Minor levels of chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, and sodium were observed. All rinsates were associated with soil sampling equipment cleaning operations and none of the contaminant levels impacted the sample values being reported.

Field source water blank CBP-QC-132-QC (deionized water source) exhibited a few analyte levels similar to those observed in the equipment blanks. Source water blank CBP-QC-131-QC (potable water source) contained normal levels of barium, calcium, copper, iron, lead, magnesium, manganese, potassium, sodium, and zinc for this type of water source. Neither of these sources contained any explosive compound levels. There is no indication that the source waters impacted associated sample levels.

D4.5 REPRESENTATIVENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and is the qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include proper preservation, holding times, use of standard sampling and analytical methods, and determination of matrix or analyte interferences. Samples were delivered to the laboratory by overnight express courier, were received in good condition, and at appropriate temperature. All analyses were performed within the recommended analytical holding times. Sample preservation, analytical methodologies, and soil sampling methodologies were documented to be adequate and consistently applied.

Comparability, like representativeness, is a qualitative term relative to an individual project data set. These RVAAP AOC investigations employed appropriate sampling methodologies, site surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through the proper implementation and documentation of these standard practices, the project has established the confidence that the data will be comparable to other project and programmatic information. Table D-5 presents the standardized parameter groups, analytical methods, sample containers, preservation techniques, and associated holding times.

D4.6 COMPLETENESS

Usable data are defined as those data that pass individual scrutiny during the verification and validation process and are accepted for unrestricted application to the human health risk assessment evaluation or equivalent type applications. It has been determined that estimated data are acceptable for RVAAP project objectives.

Objectives for CBP data have been achieved. The project produced usable results for 100% of the sample analyses performed and successfully collected all the samples planned.

D5.0 DATA QUALITY ASSESSMENT SUMMARY

The overall quality of RVAAP CBP information meets or exceeds the established project objectives. Through proper implementation of the project data verification and assessment process, project information has been determined to be acceptable for use.

Data, as presented, have been qualified as usable or estimated “J or UJ”. Data that have been estimated provide indications of either accuracy, precision, or sensitivity being less than desired but adequate for interpretation. Qualifiers have been applied to data when necessary.

Data produced for this project demonstrate that they can withstand scientific scrutiny, are appropriate for its intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy. Data integrity has been documented through proper implementation of QA and QC measures. The environmental information presented has an established confidence that allows utilization for the project objectives and provides data for future needs.

Table D-5. Container Requirements for Soil Samples at RVAAP, Ravenna, Ohio

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Explosive Compounds 8330	One 4-oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Metals 6010B and 7471	One 4-oz glass jar with Teflon®-lined cap	50 g	Cool, 4°C	180 day; Hg @ 28 day

D6.0 REFERENCES

USACE 2001. *Facility-wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-00-D-0001, DO CY 02, March 2001.

USACE 2005. *Sampling and Analysis Plan Addendum No. 1 for Supplemental Phase II Remedial Investigation of ODA2, FBQ, and CBP*. November 2005.

APPENDIX E

LABORATORY ANALYTICAL RESULTS AND COCs

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APPENDIX E
LABORATORY ANALYTICAL RESULTS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

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Table E-1. Discrete Surface Soil Samples - Inorganics

Station		**CBP-035**	**CBP-036**	**CBP-037**
Sample ID		**CBPSS-035-0100-SO**	**CBPSS-036-0102-SO**	**CBPSS-037-0104-SO**
Customer ID		**CBPSS-035-0100-SO**	**CBPSS-036-0102-SO**	**CBPSS-037-0104-SO**
Date		**11/14/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**
Field Type		**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Aluminum	MG/KG	9470 /=	15500 /=	10800 /=
Antimony	MG/KG	0.47 JN/J	0.28 UN/UJ	0.46 JN/J
Arsenic	MG/KG	13.1 N/J	16.5 /=#	10.5 /=
Barium	MG/KG	82.1 N/J	68.6 N/J	53 N/J
Beryllium	MG/KG	0.6 /=	0.84 /=	0.44 /=
Cadmium	MG/KG	0.34 /=#	0.02 U/U	0.02 U/U
Calcium	MG/KG	10300 /=	2950 /=	476 /=
Chromium	MG/KG	25.8 /=#	22.3 /=#	21.3 /=#
Cobalt	MG/KG	7.8 /=	11.1 /=#	8.9 /=
Copper	MG/KG	12.4 /=	22.2 N/J#	7.6 N/J
Iron	MG/KG	15400 /=	31300 /=#	20900 /=
Lead	MG/KG	30.1 /=#	25.3 /=	23.5 /=
Magnesium	MG/KG	2170 N/J	3690 N/J#	1390 N/J
Manganese	MG/KG	619 /=	227 /=	532 /=
Mercury	MG/KG	0.1 /=#	0.03 J/J	0.05 /=#
Nickel	MG/KG	21 /=	26.4 /=#	12.1 /=
Potassium	MG/KG	1030 N/J#	1250 N/J#	635 N/J
Selenium	MG/KG	0.74 J/J	0.43 U/U	0.5 J/J
Silver	MG/KG	0.05 U/U	0.04 U/U	0.05 U/U
Sodium	MG/KG	100 J/J	99.7 /U	83.3 J/UJ
Thallium	MG/KG	0.33 U/U	0.52 U/U	0.55 U/U
Vanadium	MG/KG	16.6 N/J	24.9 N/=	24.1 N/=
Zinc	MG/KG	103 /=#	98.9 /=#	55.1 /=

Table E-1. Discrete Surface Soil Samples – Inorganics (continued)

Station		**CBP-037**	**CBP-038**	**CBP-039**
Sample ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Customer ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Date		**11/16/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**
Field Type		**Field Duplicate**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Aluminum	MG/KG	11100 /=	11000 /=	13900 /=
Antimony	MG/KG	0.4 JN/J	0.56 JN/J	0.39 JN/J
Arsenic	MG/KG	10.2 /=	10.4 /=	10.5 /=
Barium	MG/KG	54.1 N/J	92.7 N/J#	77.6 N/J
Beryllium	MG/KG	0.43 /=	0.62 /=	0.47 /=
Cadmium	MG/KG	0.02 U/U	0.08 /=#	0.02 U/U
Calcium	MG/KG	475 /=	1830 /=	1390 /=
Chromium	MG/KG	16.4 /=	18.8 /=#	18.3 /=#
Cobalt	MG/KG	7.7 /=	9.9 /=	9.1 /=
Copper	MG/KG	7.6 N/J	10.4 N/J	9.5 N/J
Iron	MG/KG	21000 /=	20600 /=	22800 /=
Lead	MG/KG	23 /=	29.3 /=#	17.9 /=
Magnesium	MG/KG	1420 N/J	1690 N/J	1970 N/J
Manganese	MG/KG	481 /=	1260 D/=	731 /=
Mercury	MG/KG	0.06 /=#	0.05 /=#	0.06 /=#
Nickel	MG/KG	9.6 /=	14.7 /=	11.4 /=
Potassium	MG/KG	662 N/J	771 N/J	716 N/J
Selenium	MG/KG	0.46 U/U	0.41 U/U	0.74 J/J
Silver	MG/KG	0.05 U/U	0.04 U/U	0.05 U/U
Sodium	MG/KG	88.8 J/UJ	94.3 /U	96.4 /U

Table E-1. Discrete Surface Soil Samples – Inorganics (continued)

Station		**CBP-037**	**CBP-038**	**CBP-039**
Sample ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Customer ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Date		**11/16/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**
Field Type		**Field Duplicate**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Thallium	MG/KG	0.55 U/U	0.99 UD/U	0.54 U/U
Vanadium	MG/KG	24.9 N/=	24.3 N/=	29.5 N/=
Zinc	MG/KG	55.4 /=	101 /=#	57.4 /=

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
= - analyte present and concentration accurate.
J - estimated value less than reporting limits.
U - Not detected
N - Matrix spike recovery outside control limits
* - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference.
P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample
NA – not analyzed
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

Table E-2. Discrete Surface Soil Samples – Hexavalent Chromium

Station		**CBP-052**	**CBP-052**	**CBP-053**	**CBP-054**
Sample ID		**CBPSS-052-0122-SO**	**CBPSS-052-0129-SO**	**CBPSS-053-0123-SO**	**CBPSS-054-0124-SO**
Customer ID		**CBPSS-052-0122-SO**	**CBPSS-052-0129-SO**	**CBPSS-053-0123-SO**	**CBPSS-054-0124-SO**
Date		**11/16/2005**	**11/16/2005**	**11/16/2005**	**11/17/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**	**Total**
Field Type		**Spatial Composite**	**Field Duplicate**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**				
MISC					
Chromium, hexavalent	MG/KG	0.51 U/U	0.49 U/U	0.48 U/U	3.6 /=
Inorganics					
Chromium	MG/KG	105 /=#	112 D/=#	35 /=#	32.3 /=#

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
= - analyte present and concentration accurate.
J - estimated value less than reporting limits.
U - Not detected
N - Matrix spike recovery outside control limits
* - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference.
P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample
NA – not analyzed
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

Table E-3. Discrete Surface Soil Samples - Explosives

Station		**CBP-035**	**CBP-036**	**CBP-037**
Sample ID		**CBPSS-035-0100-SO**	**CBPSS-036-0102-SO**	**CBPSS-037-0104-SO**
Customer ID		**CBPSS-035-0100-SO**	**CBPSS-036-0102-SO**	**CBPSS-037-0104-SO**
Date		**11/14/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**
Field Type		**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Explosives				
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 JB/UJ	0.05 J/J	0.05 J/J
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U

Table E-3. Discrete Surface Soil Samples – Explosives (continued)

Station		**CBP-037**	**CBP-038**	**CBP-039**
Sample ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Customer ID		**CBPSS-037-0125-SO**	**CBPSS-038-0106-SO**	**CBPSS-039-0108-SO**
Date		**11/16/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Filtered		**Total**	**Total**	**Total**
Field Type		**Field Duplicate**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Explosives				
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.05 J/J	0.03 J/J	0.04 J/J
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
J - estimated value less than reporting limits.
N - Matrix spike recovery outside control limits
E - Result estimated because of the presence of interference.
B - for organics-compound was detected in the blank as well as the sample
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

= - analyte present and concentration accurate.
U - Not detected
* - Duplicate analysis outside control limits.
P - greater than 25% difference between two GC columns
NA – not analyzed

Table E-4. Discrete Subsurface Soil Samples - Inorganics

Station		**CBP-035**	**CBP-036**	**CBP-037**	**CBP-038**	**CBP-039**
Sample ID		**CBPSO-035-0101-SO**	**CBPSO-036-0103-SO**	**CBPSO-037-0105-SO**	**CBPSO-038-0107-SO**	**CBPSO-039-0109-SO**
Customer ID		**CBPSO-035-0101-SO**	**CBPSO-036-0103-SO**	**CBPSO-037-0105-SO**	**CBPSO-038-0107-SO**	**CBPSO-039-0109-SO**
Date		**11/14/2005**	**11/16/2005**	**11/16/2005**	**11/16/2005**	**11/16/2005**
Depth (ft)		**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**
Filtered		**Total**	**Total**	**Total**	**Total**	**Total**
Field Type		**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte	**Units**					
Aluminum	MG/KG	14600 /=	13700 /=	13900 /=	9840 /=	12500 /=
Antimony	MG/KG	0.38 JN/J	0.28 UN/UJ	0.27 UN/UJ	0.27 UN/UJ	0.3 JN/J
Arsenic	MG/KG	14.7 N/J	20.9 /=#	20.2 /=#	12 /=	15 /=
Barium	MG/KG	46.8 N/J	81.8 N/J	94.3 N/J	77.7 N/J	101 N/J
Beryllium	MG/KG	0.62 /=	0.82 /=	1 /=#	0.69 /=	0.82 /=
Cadmium	MG/KG	0.01 U/U	0.02 U/U	0.02 U/U	0.02 U/U	0.02 U/U
Calcium	MG/KG	1320 /=	1800 /=	1220 /=	1170 /=	1800 /=
Chromium	MG/KG	22.8 /=	22.8 /=	20.7 /=	15.5 /=	19.6 /=
Cobalt	MG/KG	7.6 /=	16.8 /=	22.6 /=	13.2 /=	13.5 /=
Copper	MG/KG	18.5 /=	23.9 N/J	24.4 N/J	7.9 N/J	21.9 N/J
Iron	MG/KG	25700 /=	34300 /=	34000 /=	25000 /=	28400 /=
Lead	MG/KG	14.1 /=	16.4 /=	16.4 /=	15.6 /=	13.9 /=
Magnesium	MG/KG	2210 N/J	4700 N/J	3720 N/J	1940 N/J	3560 N/J
Manganese	MG/KG	237 /=	403 /=	465 /=	1410 D/=	477 /=
Mercury	MG/KG	0.03 J/J	0.02 J/J	0.02 J/J	0.03 J/J	0.02 J/J
Nickel	MG/KG	15.9 /=	36.3 /=	34.7 /=	16.3 /=	34.1 /=
Potassium	MG/KG	1390 N/J	1530 N/J	1260 N/J	849 N/J	1070 N/J
Selenium	MG/KG	0.54 J/J	0.42 U/U	0.4 U/U	0.4 U/U	0.4 U/U
Silver	MG/KG	0.04 U/U	0.04 U/U	0.04 U/U	0.04 U/U	0.04 U/U
Sodium	MG/KG	64 J/J	135 /U	113 /U	101 /U	104 /U
Thallium	MG/KG	0.47 J/J	0.51 U/U	0.48 U/U	0.98 UD/U	0.48 U/U
Vanadium	MG/KG	29.1 N/J	22.1 N/=	23.5 N/=	22.8 N/=	22.1 N/=
Zinc	MG/KG	43.5 /=	79.2 /=	74.9 /=	62.7 /=	68.8 /=

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers
= - analyte present and concentration accurate.
N - Matrix spike recovery outside control limits
P - greater than 25% difference between two GC columns
J - estimated value less than reporting limits.
* - Duplicate analysis outside control limits.
B - for organics-compound was detected in the blank as well as the sample
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.
- value above facility wide background
U - Not detected
E - Result estimated because of the presence of interference.
NA – not analyzed

Table E-5. Discrete Subsurface Soil Samples - Explosives

Station		CBP-035	CBP-036	CBP-037	CBP-038	CBP-039
Sample ID		CBPSO-035-0101-SO	CBPSO-036-0103-SO	CBPSO-037-0105-SO	CBPSO-038-0107-SO	CBPSO-039-0109-SO
Customer ID		CBPSO-035-0101-SO	CBPSO-036-0103-SO	CBPSO-037-0105-SO	CBPSO-038-0107-SO	CBPSO-039-0109-SO
Date		11/14/2005	11/16/2005	11/16/2005	11/16/2005	11/16/2005
Depth (ft)		1.0 - 3.0	1.0 - 3.0	1.0 - 3.0	1.0 - 3.0	1.0 - 3.0
Filtered		Total	Total	Total	Total	Total
Field Type		Spatial Composite	Spatial Composite	Spatial Composite	Spatial Composite	Spatial Composite
Analyte (mg/kg)	Units					
Explosives						
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.12 B/UJ	0.04 J/J	0.04 J/J	0.03 J/J	0.04 J/J
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
J - estimated value less than reporting limits.
N - Matrix spike recovery outside control limits
E - Result estimated because of the presence of interference.
B - for organics-compound was detected in the blank as well as the sample
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.
= - analyte present and concentration accurate.
U - Not detected
* - Duplicate analysis outside control limits.
P - greater than 25% difference between two GC columns
NA – not analyzed

Table E-6. Multi-Increment Soil Samples - Inorganics

Station		**CBP-040**	**CBP-041**	**CBP-041**	**CBP-042**
Sample ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-041-0127M-SO**	**CBPSS-042-0112M-SO**
Customer ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-041-0127M-SO**	**CBPSS-042-0112M-SO**
Date		**11/17/2005**	**11/17/2005**	**11/17/2005**	**11/17/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 7.0**	**0.0 - 7.0**	**0.0 - 10**
Filtered		**Total**	**Total**	**Total**	**Total**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment Field Duplicate**	**Multi-increment**
Analyte (mg/kg)	**Units**				
MISC					
Chromium, hexavalent	MG/KG	0.42 U/U	0.47 U/U	0.4 U/U	0.4 U/U
Inorganics					
Aluminum	MG/KG	14500 /=	15900 /=	16400 /=	6960 /=
Antimony	MG/KG	0.47 JN/J	0.88 JN/J	1.2 JN/J#	0.93 JN/J
Arsenic	MG/KG	10 /=	14.6 /=	15 /=	21.3 /=#
Barium	MG/KG	121 N/J#	135 N/J#	148 N/J#	87 N/J
Beryllium	MG/KG	1.1 /=#	1.3 /=#	1.5 /=#	0.67 /=
Cadmium	MG/KG	0.35 /=#	0.68 /=#	0.66 /=#	0.92 /=#
Calcium	MG/KG	26300 /=#	32600 /=#	37600 /=#	12700 /=
Chromium	MG/KG	51.6 ND/J#	27.9 ND/J#	26.6 ND/J#	19.2 ND/J#
Cobalt	MG/KG	7.2 /=	8.8 /=	8.9 /=	8.8 /=
Copper	MG/KG	13.9 /=	28.5 /=#	24.5 /=#	113 /=#
Iron	MG/KG	22200 /=	27900 /=#	30700 /=#	22500 /=
Lead	MG/KG	20.7 D/=	75.1 D/=#	119 D/=#	62.1 D/=#
Magnesium	MG/KG	5030 D/=#	5790 D/=#	6860 D/=#	1690 D/=
Manganese	MG/KG	1540 D/=#	1320 D/=	1490 D/=#	1050 D/=
Mercury	MG/KG	0.04 /=#	0.05 /=#	0.05 /=#	0.06 /=#
Nickel	MG/KG	24.6 /=#	20.6 /=	20.4 /=	19.5 /=
Potassium	MG/KG	928 N/J#	1250 N/J#	1220 N/J#	724 N/J
Selenium	MG/KG	1.8 JD/J#	1.6 D/=#	2.3 JD/J#	1.4 JD/J
Silver	MG/KG	0.21 UD/U	0.08 UD/U	0.19 UD/U	0.11 JD/J#
Sodium	MG/KG	167 /U	227 /U	268 /=#	108 J/UJ
Thallium	MG/KG	1.4 UD/U	0.54 UD/U	1.2 UD/U	0.57 UD/U
Vanadium	MG/KG	20.8 /=	20.3 /=	20.1 /=	14.1 /=
Zinc	MG/KG	58.1 /=	131 /=#	146 /=#	151 /=#

Table E-6. Multi-Increment Soil Samples – Inorganics (continued)

Station		**CBP-042**	**CBP-043**	**CBP-044**	**CBP-045**
Sample ID		**CBPSS-042-0136M-SO**	**CBPSS-043-0113M-SO**	**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**
Customer ID		**CBPSS-042-0136M-SO**	**CBPSS-043-0113M-SO**	**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**
Date		**11/17/2005**	**11/17/2005**	**11/16/2005**	**11/17/2005**
Depth (ft)		**0.0 - 10**	**0.0 - 5.0**	**0.0 - 5.0**	**0.0 - 8.0**
Filtered		**Total**	**Total**	**Total**	**Total**
Field Type		**Multi-increment Field Duplicate**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
MISC					
Chromium, hexavalent	MG/KG	0.46 U/U	0.48 U/U	0.43 U/U	0.49 U/U
Inorganics					
Aluminum	MG/KG	7000 /=	18100 /=#	12400 /=	6190 /=
Antimony	MG/KG	1.2 JN/J#	0.4 UN/UJ	0.96 JN/J	0.46 JN/J
Arsenic	MG/KG	20.5 /=#	8.8 /=	15.6 /=#	15 /=
Barium	MG/KG	88.1 N/J	329 N/J#	132 N/J#	73.1 N/J
Beryllium	MG/KG	0.69 /=	2.4 /=#	1.2 /=#	0.37 /=
Cadmium	MG/KG	0.9 /=#	0.69 /=#	0.27 /=#	0.43 /=#
Calcium	MG/KG	12900 /=	117000 D/J#	23400 /=#	11300 /=
Chromium	MG/KG	21.7 ND/J#	28.9 ND/=#	28.3 /=#	13.8 N/J
Cobalt	MG/KG	8.5 /=	3.9 /=	8.2 /=	7.3 /=
Copper	MG/KG	90.3 /=#	13.2 /=	38.7 N/J#	9.9 /=
Iron	MG/KG	23200 /=#	14800 /=	26500 /=#	17100 /=
Lead	MG/KG	60 D/=#	57.9 D/=#	85.3 /=#	29.8 /=#
Magnesium	MG/KG	1770 D/=	10900 D/=#	4930 N/J#	1070 /=
Manganese	MG/KG	1110 D/=	2790 D/=#	3130 D/=#	690 /=
Mercury	MG/KG	0.06 /=#	0.04 /=#	0.04 /=#	0.06 /=#
Nickel	MG/KG	18.5 /=	17.1 /=	24.9 /=#	15.4 /=
Potassium	MG/KG	721 N/J	1460 N/J#	1240 N/J#	729 N/J
Selenium	MG/KG	1.5 D/=#	1.6 JD/J#	0.5 J/J	0.91 /=
Silver	MG/KG	0.08 UD/U	0.24 UD/U	0.04 U/U	0.05 U/U
Sodium	MG/KG	129 J/UJ	487 /=#	166 /U	86 J/UJ
Thallium	MG/KG	0.55 UD/U	1.6 UD/U	2.4 UD/U	0.3 U/U
Vanadium	MG/KG	14.5 /=	15.6 /=	17.5 N/=	12.6 /=

Table E-6. Multi-Increment Soil Samples – Inorganics (continued)

Station		**CBP-046**	**CBP-047**	**CBP-048**	**CBP-049**
Sample ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Customer ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Date		**11/17/2005**	**11/18/2005**	**11/17/2005**	**11/18/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 8.0**	**0.0 - 3.0**	**0.0 - 5.0**
Filtered		**Total**	**Total**	**Total**	**Total**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
Zinc	MG/KG	153 /=#	65.5 /=#	151 /=#	67.2 /=#
MISC					
Chromium, hexavalent	MG/KG	0.53 U/U	0.42 U/U	0.49 U/U	1.2 /=
Inorganics					
Aluminum	MG/KG	16900 /=	12500 /=	32600 /=#	22300 /=#
Antimony	MG/KG	0.69 JN/J	0.34 U/U	0.37 UN/UJ	0.51 J/J
Arsenic	MG/KG	9.9 /=	11.3 /=	5.4 /=	10.8 /=
Barium	MG/KG	222 N/J#	76.8 /=	465 N/J#	264 /=#
Beryllium	MG/KG	2.1 /=#	0.6 /=	3.6 /=#	2.2 /=#
Cadmium	MG/KG	0.79 /=#	0.36 /=#	0.38 /=#	0.27 /=#
Calcium	MG/KG	135000 D/=#	2710 /=	187000 D/=#	91900 D/=#
Chromium	MG/KG	20.5 ND/J#	18.8 /=#	40.8 ND/J#	27.8 D/=#
Cobalt	MG/KG	5.7 /=	9.5 /=	5.4 /=	5.8 /=
Copper	MG/KG	16.4 /=	15.7 /=	14.8 /=	18 /=#
Iron	MG/KG	16800 /=	22900 N/J	10100 /=	19900 N/J
Lead	MG/KG	56.1 D/=#	37.3 /=#	15.4 D/=	21.6 D/=
Magnesium	MG/KG	8620 D/=#	2400 /=	25500 D/=#	12900 D/=#
Manganese	MG/KG	1880 D/=#	733 /=	5290 D/=#	2630 D/=#
Mercury	MG/KG	0.06 /=#	0.06 /=#	0.04 /=#	0.13 /=#
Nickel	MG/KG	18.1 /=	16.5 /=	9 /=	13.9 /=
Potassium	MG/KG	1400 N/J#	1030 /=#	1400 N/J#	1430 /=#
Selenium	MG/KG	1 JD/J	0.73 /=	3.6 JD/J#	2.3 JD/J#
Silver	MG/KG	0.22 UD/U	0.04 U/U	0.9 JD/J#	0.2 UD/U
Sodium	MG/KG	411 /=#	62.4 J/J	848 /=#	451 /=#

Table E-6. Multi-Increment Soil Samples – Inorganics (continued)

Station		**CBP-046**	**CBP-047**	**CBP-048**	**CBP-049**
Sample ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Customer ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Date		**11/17/2005**	**11/18/2005**	**11/17/2005**	**11/18/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 8.0**	**0.0 - 3.0**	**0.0 - 5.0**
Filtered		**Total**	**Total**	**Total**	**Total**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
Thallium	MG/KG	1.5 UD/U	0.27 U/U	2.9 UD/U	1.3 UD/U
Vanadium	MG/KG	16.7 /=	21 /=	14.3 /=	17 /=
Zinc	MG/KG	75.1 /=#	127 /=#	34.3 /=	72.9 /=#

Table E-6. Multi-Increment Soil Samples – Inorganics (continued)

Station		**CBP-051**
Sample ID		**CBPSS-051-0121M-SO**
Customer ID		**CBPSS-051-0121M-SO**
Date		**11/18/2005**
Depth (ft)		**0.0 - 6.0**
Filtered		**Total**
Field Type		**Multi-increment**
Analyte (mg/kg)	**Units**	
MISC		
Chromium, hexavalent	MG/KG	25 /=
Inorganics		
Aluminum	MG/KG	10200 /=
Antimony	MG/KG	6.5 /=#
Arsenic	MG/KG	40.1 /=#
Barium	MG/KG	317 /=#
Beryllium	MG/KG	1.1 /=#
Cadmium	MG/KG	6.2 /=#
Calcium	MG/KG	12900 /=
Chromium	MG/KG	105 /=#
Cobalt	MG/KG	7.7 /=
Copper	MG/KG	380 /=#
Iron	MG/KG	29500 N/J#
Lead	MG/KG	348 /=#
Magnesium	MG/KG	3180 /=#
Manganese	MG/KG	745 /=
Mercury	MG/KG	28 D/=#
Nickel	MG/KG	30.7 /=#
Potassium	MG/KG	1020 /=#
Selenium	MG/KG	2.7 /=#
Silver	MG/KG	98.2 D/=#
Sodium	MG/KG	123 J/J

Table E-6. Multi-Increment Soil Samples – Inorganics (continued)

Station		**CBP-051**
Sample ID		**CBPSS-051-0121M-SO**
Customer ID		**CBPSS-051-0121M-SO**
Date		**11/18/2005**
Depth (ft)		**0.0 - 6.0**
Filtered		**Total**
Field Type		**Multi-increment**
Analyte (mg/kg)	**Units**	
Thallium	MG/KG	0.41 J/J#
Vanadium	MG/KG	15.4 /=
Zinc	MG/KG	490 /=#

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
= - analyte present and concentration accurate.
J - estimated value less than reporting limits.
U - Not detected
N - Matrix spike recovery outside control limits
* - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference.
P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample
NA – not analyzed
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

Table E-7. Multi-Increment Soil Samples – Explosives

Station		CBP-040	CBP-041	CBP-041	CBP-042
Sample ID		CBPSS-040-0110M-SO	CBPSS-041-0111M-SO	CBPSS-041-0127M-SO	CBPSS-042-0112M-SO
Customer ID		CBPSS-040-0110M-SO	CBPSS-041-0111M-SO	CBPSS-041-0127M-SO	CBPSS-042-0112M-SO
Date		11/17/2005	11/17/2005	11/17/2005	11/17/2005
Depth (ft)		0.0 - 3.0	0.0 - 7.0	0.0 - 7.0	0.0 - 10
Field Type		Multi-increment	Multi-increment	Multi-increment Field Duplicate	Multi-increment
Analyte (mg/kg)	Units				
Explosives					
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.08 J/J
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.02 J/J	0.03 J/J	0.03 J/J	0.1 U/U
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U

Table E-7. Multi-Increment Soil Samples – Explosives (continued)

Station		CBP-042	CBP-043	CBP-044	CBP-045
Sample ID		CBPSS-042-0136M-SO	CBPSS-043-0113M-SO	CBPSS-044-0114M-SO	CBPSS-045-0115M-SO
Customer ID		CBPSS-042-0136M-SO	CBPSS-043-0113M-SO	CBPSS-044-0114M-SO	CBPSS-045-0115M-SO
Date		11/17/2005	11/17/2005	11/16/2005	11/17/2005
Depth (ft)		0.0 - 10	0.0 - 5.0	0.0 - 5.0	0.0 - 8.0
Field Type		Multi-increment Field Duplicate	Multi-increment	Multi-increment	Multi-increment
Analyte (mg/kg)	Units				
Explosives					
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.03 J/J	0.1 U/U
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U

Table E-7. Multi-Increment Soil Samples – Explosives (continued)

Station		**CBP-046**	**CBP-047**	**CBP-048**	**CBP-049**
Sample ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Customer ID		**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**	**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**
Date		**11/17/2005**	**11/18/2005**	**11/17/2005**	**11/18/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 8.0**	**0.0 - 3.0**	**0.0 - 5.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
Explosives					
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.05 J/J	0.1 U/U	0.04 J/J	0.1 U/U
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.02 J/J

Table E-7. Multi-Increment Soil Samples – Explosives (continued)

Station		**CBP-050**	**CBP-051**
Sample ID		**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Customer ID		**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Date		**11/18/2005**	**11/18/2005**
Depth (ft)		**0.0 - 6.0**	**0.0 - 6.0**
Field Type		**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**		
Explosives			
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 U/U	0.1 JB/UJ
RDX	MG/KG	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.06 J/J	0.03 J/J

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers
- value above facility wide background = - analyte present and concentration accurate.
J - estimated value less than reporting limits. U - Not detected
N - Matrix spike recovery outside control limits * - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference. P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample NA – not analyzed
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

Table E-8. Multi-Increment Soil Samples – TCLP

Station		**CBP-040**	**CBP-041**	**CBP-042**	**CBP-043**
Sample ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-042-0112M-SO**	**CBPSS-043-0113M-SO**
Customer ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-042-0112M-SO**	**CBPSS-043-0113M-SO**
Date		**11/17/2005**	**11/17/2005**	**11/17/2005**	**11/17/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 7.0**	**0.0 - 10**	**0.0 - 5.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
TCLPHB					
2,4-D TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Silvex TCLP	MG/L	0.005 U/U	0.0019 JP/J	0.005 U/U	0.005 U/U
TCLPIN					
Arsenic TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Barium TCLP	MG/L	1 U/U	1 U/U	1 U/U	1 U/U
Cadmium TCLP	MG/L	0.06 U/U	0.06 U/U	0.06 U/U	0.06 U/U
Chromium TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Lead TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Mercury TCLP	MG/L	0.002 U/U	0.002 U/U	0.002 U/U	0.002 U/U
Selenium TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Silver TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPPP					
Chlordane TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Endrin TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Heptachlor TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Heptachlor epoxide TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Lindane TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Methoxychlor TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Toxaphene TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
TCLPSV					
1,4-Dichlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,5-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,6-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4-Dinitrotoluene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
4-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U

Table E-8. Multi-Increment Soil Samples – TCLP (continued)

Station		**CBP-040**	**CBP-041**	**CBP-042**	**CBP-043**
Sample ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-042-0112M-SO**	**CBPSS-043-0113M-SO**
Customer ID		**CBPSS-040-0110M-SO**	**CBPSS-041-0111M-SO**	**CBPSS-042-0112M-SO**	**CBPSS-043-0113M-SO**
Date		**11/17/2005**	**11/17/2005**	**11/17/2005**	**11/17/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 7.0**	**0.0 - 10**	**0.0 - 5.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
Hexachlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachlorobutadiene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachloroethane TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Nitrobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Pentachlorophenol TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Pyridine TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPVO					
1,1-Dichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,2-Dichloroethane TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,4-Dichlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Butanone TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Benzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Carbon tetrachloride TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Chlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Chloroform TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Tetrachloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Trichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Vinyl chloride TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U

Table E-8. Multi-Increment Soil Samples – TCLP (continued)

Station		**CBP-044**	**CBP-045**	**CBP-046**	**CBP-047**
Sample ID		**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**	**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**
Customer ID		**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**	**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**
Date		**11/16/2005**	**11/17/2005**	**11/17/2005**	**11/18/2005**
Depth (ft)		**0.0 - 5.0**	**0.0 - 8.0**	**0.0 - 3.0**	**0.0 - 8.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
TCLPHB					
2,4-D TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Silvex TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
TCLPIN					
Arsenic TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Barium TCLP	MG/L	1 U/U	1 U/U	1 U/U	1 U/U
Cadmium TCLP	MG/L	0.06 U/U	0.06 U/U	0.06 U/U	0.06 U/U
Chromium TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Lead TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Mercury TCLP	MG/L	0.002 U/U	0.002 U/U	0.002 U/U	0.002 U/U
Selenium TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Silver TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPPP					
Chlordane TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Endrin TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Heptachlor TCLP	MG/L	0.00025 U/U	0.00005 J/J	0.0001 J/J	0.00025 U/U
Heptachlor epoxide TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Lindane TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Methoxychlor TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Toxaphene TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
TCLPSV					
1,4-Dichlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,5-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,6-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4-Dinitrotoluene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U

Table E-8. Multi-Increment Soil Samples – TCLP (continued)

Station		**CBP-044**	**CBP-045**	**CBP-046**	**CBP-047**
Sample ID		**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**	**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**
Customer ID		**CBPSS-044-0114M-SO**	**CBPSS-045-0115M-SO**	**CBPSS-046-0116M-SO**	**CBPSS-047-0117M-SO**
Date		**11/16/2005**	**11/17/2005**	**11/17/2005**	**11/18/2005**
Depth (ft)		**0.0 - 5.0**	**0.0 - 8.0**	**0.0 - 3.0**	**0.0 - 8.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
2-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
4-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/UJ
Hexachlorobutadiene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachloroethane TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Nitrobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Pentachlorophenol TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Pyridine TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPVO					
1,1-Dichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,2-Dichloroethane TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,4-Dichlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Butanone TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Benzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Carbon tetrachloride TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Chlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Chloroform TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Tetrachloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Trichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Vinyl chloride TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/UJ

Table E-8. Multi-Increment Soil Samples – TCLP (continued)

Station		**CBP-048**	**CBP-049**	**CBP-050**	**CBP-051**
Sample ID		**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**	**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Customer ID		**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**	**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Date		**11/17/2005**	**11/18/2005**	**11/18/2005**	**11/18/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 5.0**	**0.0 - 6.0**	**0.0 - 6.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
TCLPHB					
2,4-D TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Silvex TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
TCLPIN					
Arsenic TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Barium TCLP	MG/L	1 U/U	1 U/U	3.58 /=	1 U/U
Cadmium TCLP	MG/L	0.06 U/U	0.06 U/U	0.143 /=	0.06 U/U
Chromium TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Lead TCLP	MG/L	0.1 U/U	0.1 U/U	15.4 /=	0.1 U/U
Mercury TCLP	MG/L	0.002 U/U	0.002 U/U	0.002 U/U	0.002 U/U
Selenium TCLP	MG/L	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Silver TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPPP					
Chlordane TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
Endrin TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Heptachlor TCLP	MG/L	0.00005 JP/J	0.00025 U/U	0.00025 U/U	0.00025 U/U
Heptachlor epoxide TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Lindane TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Methoxychlor TCLP	MG/L	0.00025 U/U	0.00025 U/U	0.00025 U/U	0.00025 U/U
Toxaphene TCLP	MG/L	0.005 U/U	0.005 U/U	0.005 U/U	0.005 U/U
TCLPSV					
1,4-Dichlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,5-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4,6-Trichlorophenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2,4-Dinitrotoluene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
2-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U

Table E-8. Multi-Increment Soil Samples – TCLP (continued)

Station		**CBP-048**	**CBP-049**	**CBP-050**	**CBP-051**
Sample ID		**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**	**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Customer ID		**CBPSS-048-0118M-SO**	**CBPSS-049-0119M-SO**	**CBPSS-050-0120M-SO**	**CBPSS-051-0121M-SO**
Date		**11/17/2005**	**11/18/2005**	**11/18/2005**	**11/18/2005**
Depth (ft)		**0.0 - 3.0**	**0.0 - 5.0**	**0.0 - 6.0**	**0.0 - 6.0**
Field Type		**Multi-increment**	**Multi-increment**	**Multi-increment**	**Multi-increment**
Analyte (mg/kg)	**Units**				
4-Methylphenol TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachlorobenzene TCLP	MG/L	0.05 U/U	0.05 U/UJ	0.05 U/UJ	0.05 U/UJ
Hexachlorobutadiene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Hexachloroethane TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Nitrobenzene TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
Pentachlorophenol TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
Pyridine TCLP	MG/L	0.05 U/U	0.05 U/U	0.05 U/U	0.05 U/U
TCLPVO					
1,1-Dichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
1,2-Dichloroethane TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
1,4-Dichlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
2-Butanone TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Benzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Carbon tetrachloride TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Chlorobenzene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Chloroform TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Tetrachloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Trichloroethene TCLP	MG/L	0.1 U/U	0.1 U/U	0.1 U/UJ	0.1 U/UJ
Vinyl chloride TCLP	MG/L	0.1 U/U	0.1 U/UJ	0.1 U/UJ	0.1 U/UJ

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
J - estimated value less than reporting limits.
N - Matrix spike recovery outside control limits
E - Result estimated because of the presence of interference.
B - for organics-compound was detected in the blank as well as the sample
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

= - analyte present and concentration accurate.
U - Not detected
* - Duplicate analysis outside control limits.
P - greater than 25% difference between two GC columns
NA – not analyzed

Chain of Custody

SAIC

SDG: 511091

Chain of Custody Record

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Page 1 of 2

COC No.: RVAAP-GPL-001
Date: 11/16/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler Signature: Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ☒Explosives (A)	☒Metals, TAL (A)	☒Chromium +6 (A)	☒TCLP- VOC, SVOC, PEST, HERB, MET (A)	☒Chromium +6 and Total Chromium				☒Explosives (A)	☒Metals (C)	☒Chromium +6 (A)			No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
FBQ-193	FBQSS-193-500-SO	0-1	11/15/2005	0825	SO	1	1												2	
FBQ-193	FBQSO-193-0501-SO	1-3	11/15/2005	0835	SO	1	1												2	
FBQ-194	FBQSS-194-0502-SO	0-1	11/15/2005	0810	SO	1	1												2	
FBQ-194	FBQSO-194-0503-SO	1-2.3	11/15/2005	0820	SO	1	1												2	
FBQ-195	FBQSS-195-0504-SO	0-1	11/15/2005	0835	SO	1	1												2	
FBQ-195	FBQSO-195-0505-SO	1-2.3	11/15/2005	0850	SO	1	1												2	
FBQ-196	FBQSS-196-0506-SO	0-1	11/15/2005	0930	SO	1	1												2	
FBQ-196	FBQSS-196-0507-SO	1-2.8	11/15/2005	0945	SO	1	1												2	
FBQ-196	FBQSS-196-0512-SO	0-1	11/15/2005	0930	SO	1	1												2	
FBQ-197	FBQSS-197-0508-SO	0-1	11/14/2005	1400	SO	1	1												2	
FBQ-197	FBQSO-197-0509-SO	1-2.9	11/14/2005	1415	SO	1	1												2	
FBQ-198	FBQSS-198-0510-SO	0-1	11/14/2005	1445	SO	1	1												2	
FBQ-198	FBQSO-198-0511-SO	1-3	11/14/2005	1505	SO	1	1												2	

Subtotal Number of Containers: 26

Relinquished by: Martha Clough — Date: 11/16/05 — Time: 1700 — Company: GPL
Received by: Signature: Chino — Printed Name: Chino — Company: GPL — Date: 11/17/05 — Time: 9:30
Relinquished by — Signature — Printed Name — Company — Date — Time
Received by — Signature — Printed Name — Company — Date — Time

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-01 AND GPL-02

Shipment Method: FEDEX
Airbill No.: 853098788814 853098769603

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

S=soils
W=water

511091

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511093

Chain of Custody Record

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Page 2 of 2

COC No.: RVAAP-GPL-001
Date: 11/16/2005

Name: Science Applications International Corporation
Address: 151 Lafayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ss Explosives (A)	ss Metals, TAL (A)	ss Chromium +6 (A)	ss TCLP- VOC, SVOC, PEST, HERB, MET (A)	ss Chromium +6 and Total Chromium	w Explosives (A)	w Metals (C)	w Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
DA2-125	DA2SS-125-0900-SO	0-1	11/15/2005	1315	SO	1	1							2	
DA2-125	DA2SO-125-0901-SO	1-3	11/15/2005	1330	SO	1	1							2	
DA2-127	DA2SO-127-0905-SO	1-3	11/15/2005	1425	SO	1	1							2	
DA2-128	DA2SS-128-0906-SO	0-1	11/15/2005	1440	SO	1	1							2	
DA2-128	DA2SO-128-0907-SO	1-3	11/15/2005	1455	SO	1	1							2	
DA2-129	DA2SO-129-0909-SO	1-3	11/15/2005	1215	SO	1	1							2	
DA2-129	DA2SO-129-0914-SO	1-3	11/15/2005	1215	SO	1	1							2	
DA2-130	DA2SS-130-0910-SO	0-1	11/15/2005	1230	SO	1	1							2	
DA2-130	DA2SO-130-0911-SO	0-1.9	11/15/2005	1250	SO	1	1							2	
CBP-035	CBPSS-035-0100-SO	0-1	11/14/2005	1410	SO	1	1							2	
CBP-035	CBPSO-035-0101-SO	1-3	11/14/2005	1425	SO	1	1							2	
CBP-QC	CBP-QC-0131-QC	na	11/16/2005	1530	WA						2	1	1	4	
CBP-QC	CBP-QC-0132-QC	NA	11/16/2005	1550	WA						2	1	1	4	

Subtotal Number of Containers: 30 | 1 | 1 | 4
TOTAL NUMBER OF CONTAINERS 58

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

Shipment Method: FEDEX
Airbill No.: 853098769614 853098769603

COOLER IDs: GPL-01 AND GPL-02

Relinquished by: Martha Clough — Company: SAIC — Date: 11/16/05 — Time: 1700
Received by: Chuck — Company: GPL — Date: 11/17/05 — Time: 9:30

Relinquished by — Company — Date — Time
Received by — Company — Date — Time

S=soils
W=water

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

511093

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511101

Chain of Custody Record

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Page 1 of 2

COC No.: RVAAP-GPL-002
Date: 11/17/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature) (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ☆Explosives (A)	☆Metals, TAL (A)	☆Chromium +6 (A)	☆TCLP- VOC, SVOC, PEST, HERB, MET (A)	☆Chromium +6 and Total Chromium	☆Metals, TAL and Chromium +6	W Explosives (A)	W Metals (C)	W Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
DA2-126	DA2SS-126-0902-SO	0-1	11/15/2005	1515	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-126	DA2SO-126-0903-SO	1-3	11/15/2005	1525	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-127	DA2SS-127-0804-SO	0-1	11/15/2005	1405	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-129	DA2SS-129-0908-SO	0-1	11/15/2005	1155	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-129	DASS-129-0912-SO	0-1	11/15/2005	1155	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSO-037-0105-SO	1-3	11/16/2005	1015	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSS-037-0104-SO	0-1	11/16/2005	1005	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSS-037-0125-SO	0-1	11/16/2005	1005	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-038	CBPSS-038-0106-SO	0-1	11/16/2005	1030	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-038	CBPSO-038-0107-SO	1-3	11/16/2005	1040	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-052	CBPSS-052-0122-SO	0-1	11/16/2005	0920	SO				1						1	14-21 day Turn Around Time Requested
CBP-052	CBPSS-052-0129-SO	0-1	11/16/2005	0920	SO					1					1	14-21 day Turn Around Time Requested
CBP-044	CBPSS-044-0114M-SO	0-5	11/16/2005	1430	SO	1									3	7-14 day Turn Around Time Requested
						Subtotal Number of Containers:									25	

Relinquished by: Date 11/17/05 Time 1700
Signature
Printed Name
Company: SAIC

Received by: Date 11/17/05 Time 0920
Signature
Printed Name
Company

Relinquished by: Date Time
Signature
Printed Name
Company

Received by: Date Time
Signature
Printed Name
Company

Relinquished by: Date Time
Signature
Printed Name
Company

Received by: Date Time
Signature
Printed Name
Company

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-03

S=soils
W=water

511101

Shipment Method: FEDEX
Airbill No.: 853098769669

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Science Applications International Corporation

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Page 2 of 2

COC No.: RVAAP-GPL-002
Date: 11/17/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O. #: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name): Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters									No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
						Explosives (A)	Metals, TAL (A)	Chromium +6 (A)	TCLP- VOC, SVOC, PEST, HERB, MET (A)	Chromium +6 and Total Chromium	Metals, TAL and Chromium +6					
CBP-QC	CBP-QC-0130-QC	NA	11/17/2005	1615	WA							2	1	1	4	14-21 day Turn Around Time Requested
CBP-053	CBPSS-053-0123-SO	0-1	11/16/2005	0915	SO					1					1	14-21 day Turn Around Time Requested
CBP-036	CBPSS-036-0102-SO	0-1	11/16/2005	0825	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-036	CBPSO-036-0103-SO	1-3	11/16/2005	0845	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-039	CBPSS-039-0108-SO	0-1	11/16/2005	1105	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-039	CBPSO-039-0109-SO	1-3	11/16/2005	1115	SO	1	1								2	14-21 day Turn Around Time Requested

Subtotal Number of Containers: 13
TOTAL NUMBER OF CONTAINERS 38

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-03

Shipment Method: FEDEX
Airbill No.: 853098789669

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

S=soils
W=water

511101

Relinquished by	Date	Time	Received by	Date	Time
Signature: Martha Clough	11/17/05	1700	Signature: Chris Cox	11/17/05	1700
Printed Name: Martha Clough			Printed Name: Chris Cox		
Company: SAIC			Company: GPL		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511115

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Chain of Custody Record

Page 1 of 1

COC No.: RVAAP-GPL-003

Date: 11/18/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ∞Explosives (A)	∞Metals, TAL (A)	∞Chromium +6 (A)	∞TCLP- VOC, SVOC, PEST, HERB, MET (A)	∞Chromium +6 and Total Chromium (	∞Metals, TAL and Chromium +6	W Explosives (A)	W Metals (C)	W Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
CBP-040	CBPSS-040-0110M-SO	0-3	11/17/2005	0800	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-041	CBPSS-041-0111M-SO	0-7	11/17/2005	0945	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-041	CBPSS-041-0127M-SO	0-7	11/17/2005	0945	SO	1					1				2	7-14 day Turn Around Time Requested
CBP-042	CBPSS-042-0112M-SO	0-10	11/17/2005	1020	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-042	CBPSS-042-0136M-SO	0-10	11/17/2005	1020	SO	1					1				2	7-14 day Turn Around Time Requested
CBP-043	CBPSS-043-0113M-SO	0-5	11/17/2005	1225	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-045	CBPSS-045-0115M-SO	0-8	11/17/2005	1350	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-046	CBPSS-046-0116M-SO	0-3	11/17/2005	1245	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-048	CBPSS-048-0118M-SO	0-3	11/17/2005	1530	SO	1			1		1				3	7-14 day Turn Around Time Requested

Subtotal Number of Containers: 25

Notes: TOTAL NUMBER OF CONTAINERS 25
A: Cool 4°C C: HNO3 to pH<2, Cool 4°C
B: HCl to pH<2, Cool 4°C D: H2SO4 to pH<2, Cool 4°C
E: NaOH + Zn, Cool 4°C F: $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-04

Shipment Method: FEDEX
Airbill No.: 853098769636

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Relinquished by	Date	Time	Received by	Date	Time
Signature: Martha Clough	11/18/2005	1700	Signature: Isaac Clough	11/18/05	1015
Printed Name: Martha Clough			Printed Name: Isaac Clough		
Company: SAIC			Company: GPL		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		

S=soils
W=water

511115

Science Applications International Corporation

Chain of Custody Record

SAIC Science Applications International Corporation
An Employee Owned Company

COC No.: RVAAP-GPL-004
Page 1 of 1
Date: 11/21/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O. #: 01 1700 04 3265 505
Sampler (Signature) [signature] (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT, Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Requested Parameters

Station	Sample ID	Depth	Date	Time	Matrix	S Explosives (1A)	S Metals, TAL and Chromium +6 (A)	S Total Chromium and Chromium +6 (A)	S TCLP - VOC, SVOC, PEST, HERB, MET (A)				W VOC - TCLP (4A)	W SVOCs - TCLP (5A)	W Metals - TCLP (6A)	W Pesticides - TCLP	W Herbicides - TCLP		No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
CBP-054	CBPSS-054-0124-SO	0-1	11/17/2005	0950	SO			1											1	14-21 DAY TURN AROUND
CBP-049	CBPSS-049-0119M-SO	0-5	11/18/2005	0800	SO	1	1		1										3	7-14 DAY TURN AROUND
CBP-047	CBPSS-047-0117M-SO	0-8	11/18/2005	0945	SO	1	1		1										3	7-14 DAY TURN AROUND
CBP-050	CBPSS-050-0120M-SO	0-6	11/18/2005	0810	SO	1	1		1										3	7-14 DAY TURN AROUND
CBP-051	CBPSS-051-0121M-SO	0-6	11/18/2005	0805	SO	1	1		1										3	7-14 DAY TURN AROUND
CBP-IDW	CBP-IDW-0134-SO	NA	11/21/2005	1130	SO				1										1	
CBP-IDW	CBP-IDW-0133-DW	NA	11/21/2005	1230	WA								2	2	1	2	2		9	

Subtotal Number of Containers: 23

Relinquished by	Date	Received by	Date
Signature: [signature]	11/21/05	Signature: Chino [signature]	11/22/05
Printed Name: Martha Clough	Time: 1600	Printed Name: [illegible]	Time: 9:45
Company: SAIC		Company: GPL	
Relinquished by	Date	Received by	Date
Signature:	Time:	Signature:	Time:
Printed Name:		Printed Name:	
Company:		Company:	

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

S=soils
W=water

511120

Shipment Method: **FEDEX**

Airbill No.: 7924 4374 0739

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Science Applications International Corporation

APPENDIX F

TOPOGRAPHIC SURVEY DATA

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Sample ID	Easting	Northing	Elevation	Notes
CBP-035	2366541.11	562150.53	970.62	None
CBP-036	2366582.99	562063.67	971.22	None
CBP-037	2367195.5	562176.02	963.84	None
CBP-038	2367301.23	562185.82	965.54	None
CBP-039	2367310.33	561986.96	966.59	None
SS-004	2367067.59	561726.46	974.55	this was a re-sampled location from original RI
SS-018	2366967.99	562089.13	968.92	this was a re-sampled location from original RI
CBP-040	2366878.691	561931.696	971.1525	Location of approximate center of Berm A
CBP-041	2366701.358	562213.461	978.965	Location of approximate center of Pile B
CBP-042	2366637.363	562187.247	980.296	Location of approximate center of Pile C
CBP-043	2366407.451	562026.189	977.023	Location of approximate center of Berm D
CBP-044	2366750.691	562116.029	976.9515	Location of approximate center of Pile E
CBP-046	2366284.37	562116.291	985.4275	Location of approximate center of Berm H
CBP-047	2365958.915	562036.588	974.712	Location of approximate center of Pile I
CBP-048	2366867.819	562118.898	970.964	Location of approximate center of Berm K
CBP-049	2366920.67	561994.876	969.33	Location of approximate center of Pile L
CBP-050	2367052.957	561956.152	978.098	Location of approximate center of Pile M
CBP-051	2367102.796	561689.679	975.401	Location of approximate center of Pile N
CBP-045	2366174.16	561953.711	978.263	Location of approximate center of Pile P

- coordinate system is Ohio State Plan 1983 Ohio North 3401 NAD 1983 Feet

APPENDIX G

MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE SURVEY REPORT

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4 January 2006

Science Applications International Corporation
Attn: Martha L. Clough
8866 Commons Blvd., Suite 201
Twinsburg, OH 44087

RE: After Action Report (AAR) for the MEC Avoidance Support at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio.

Dear Martha Clough,

USA Environmental, Inc. (USAE) completed the Munitions and Explosives of Concern (MEC) Avoidance Support at the Ravenna Army Ammunition Plant located in Ravenna, Ohio, from 13-19 November 2005. All operations were completed safely, on time, within budgeted funding, and in accordance with the project technical scope of work.

Throughout the project operations, USAE encountered two munitions debris, which were identified as possible fragments from a 3.5-Inch Rocket. Other than the two munitions debris found, USAE did not encounter any unexploded ordnance (UXO)/MEC items at any of the RVAAP areas of concern (AOCs): the Open Demolition Area 2 (RVAAP-04), the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16), and the Central Burn Pits (RVAAP-49).

Upon receipt of the approval of the work plan and a notice to proceed from Science Applications International Corporation (SAIC), USAE mobilized one UXO qualified personnel, Mr. Dale Miller, and the project support equipment to the RVAAP project site. Mr. Miller has completed the U.S. Naval Explosive Ordnance Disposal training, which details procedures for evaluation and disposal of MEC. Prior to beginning work on site, Mr. Miller also completed a health and safety training program, which complies with Occupational Safety and Health Administration (OSHA) Regulations 29 CFR 1910.120e(9). All USAE employees who work on hazardous sites receive training, which includes an equivalent of 40 hours of training off-site and actual field experience under the direct supervision of a trained, experienced Supervisor. Management and Supervisors receive an additional 8 hours of training on program supervision. Each employee receives 8 hours of OSHA refresher training annually.

Mr. Miller arrived on site at Building 1036 at 0830 on 14 November 2005. Mr. Miller coordinated with Ms. Martha Clough (SAIC Site Manager) for site safety and pre-operation orientation. Upon completion of the orientation and prior to beginning the field operations, Mr. Miller performed a tailgate safety briefing for all field personnel. Mr. Miller commenced the marking sample location operations at areas RVAAP 16 and RVAAP-04. During MEC avoidance support of areas RVAAP-16 and RVAAP-04, Mr. Miller did not encounter any MEC/UXO related items.

On 15 November 2005, prior to beginning the field operations, Mr. Miller provided the daily and tailgate safety briefings and then commenced the soil sample collection operations at the RVAAP-16 and RVAAP-04. During the surface sweep of area RVAAP-16, Mr. Miller did not encounter any MEC/UXO related items. However, during the surface sweep of area RVAAP-04, Mr. Miller encountered two pieces of munitions debris located at sample location #130. Mr. Miller identified these items as potential fragments from a 3.5-Inch Rocket. The two munitions debris encountered were reported to SAIC and avoided. Mr. Miller successfully completed the soil sample collection of both areas at RVAAP-16 and RVAAP-04 with no incidents or accidents.

On 16 November 2005, prior to beginning the field operations, Mr. Miller provided the daily and tailgate safety briefings and then commenced the soil sample collection operations at the Central Burn Pits (RVAAP-49). The soil sample collection activities of this sample area continued for the remaining duration of the project. During the surface sweep of area RVAAP-49, Mr. Miller did not encounter any MEC/UXO

related items. Mr. Miller successfully completed the soil sample collection of area RVAAP-49 on 18 November 2005 and demobilized on 19 November 2005.

USAE completed all field operations at the RVAAP in accordance with the approved Work Plan and contract requirements. All site operations were completed safely, efficiently, and in accordance with the Technical Scope of Work.

Sincerely,

Manok N. Synakorn
Project Manager

Encl: Attachment 1, Daily Site Summaries and Daily Safety Briefings

Attachment 1

Daily Site Summaries and Daily Safety Briefings.

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/18/05 **Location:** Ravenna AAP

Time: 7:50 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM/SSHO
Brian Williams	Brian Williams	Tech
Jed Thomas	Jed Thomas	Tech

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/17/05 **Location:** Ravenna AAP

Time: 7:55 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM/55HO
Beau Wilkins	B. Wilkins	Tech
Jed Thomas	Jed Thomas	Tech

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/16/05 **Location:** Ravenna AAP

Time: 7:10 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM SHSO
Jat Thomas	Jat Thomas	Field Crew
Ben Williams	Ben Williams	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/15/05 **Location:** Ravenna AHP

Time: 7:20 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM SHSO
Jed Thomas	Jed Thomas	Field Crew
Beau Williams	Beau Williams	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/14/05 **Location:** Ravenna AAP

Time: 9:15 (AM) PM **Team #:**

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM, SH&SO
Jed Thomas	Jed Thomas	Field Crew
Brian Wilkins	Brian Wilkins	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

DAILY OPERATIONS SUMMARY

DATE: 11/13/05 thru 11/19/05

PAGE 1 OF 5 PAGES

SITE / LOCATION: Ravenna Army Ammunition Plant

1. **WORK SUMMARY**

a. **Work Accomplished:**

	Number Completed	Total Remaining
(1) Survey		
(2) Preparation		
(3) Mag & Flag		
(4) Geophysical		
(5) Intrusive		
(6) Quality Control		
(7) Quality Assurance		

b. **Discrepancies:** _____

c. **Inspection Results:**

	Pass	Fail
(1) Quality Control		
(2) Quality Assurance		
(3) Safety		

2. **INSTRUCTIONS RECEIVED FROM CUSTOMER REPRESENTATIVE:**

Escort SAIC personnel while collecting soil samples to ensure ordnance avoidance in all phases of the project.

Daily Operations Summary Con't.

3. **UXO SUMMARY**

a. **UXO Located:** None

Type:	Quantity:	Live/Prac.:	Remarks:

Daily Operations Summary Con't.

b. Demolition Supplies Expended: None

Type:	Quantity:	Remarks:

c. Scrap Generation / Deposition: None

Type:	Quantity:	Weight:	Remarks:

Daily Operations Summary Con't.

4. Utilization

a. Daily Man-hours:

Labor Category:	Task #:	M/H Used this ~~Today:~~ Week!	M/H Remaining:	% M/H Remaining:	Remarks:
Project Manager					
SUXO					
UXO Tech. III		44			
UXO Tech. II					
UXO Tech. I					
Laborer					
UXOSO					
UXOQCS					
Admin Personnel					
Visitor					
Sub-Contractor Personnel (List by Category)					

Daily Operations Summary Con't.

b. Daily Equipment:

Description:	Task:	Hours Used:	Hours Remaining:	% Hours Remaining:	Remarks:
Schonstedt		44			
Geophysical					
Truck (Heavy)					
Truck (Light)		44			
Radio, Base					
Radio, Handheld					
Backhoe					
Front-end Loader					
Rental Car					
GPS					
Weedeater					
Chainsaw					
Chipper					

5. Operational Remarks:

6. Signature / Date:

Dale E. Miller
SUXO / Project Manager

Date: 11/19/05

11/13/05

Dale E. Miller, Tech III mobilized from Aberdeen, OH to Ravenna Army Ammunition Plant.

1935 Arrived at Hampton Inn, Brimfield, OH

Received 4 packages shipped from USA Environmental.

1 Schoenstadt
1 MK 26 Forrester
1 First Aid Kit
1 Water Jug (5 gal)
2 Radios with chargers
1 Hard Hat
4pr Safety glasses
2pr Gloves
1 Safety Vest
1 roll engineers tape
1 roll package tape
10pr ear plugs
1pkg 9V batteries

Dale E. Miller
11/13/05

11/14/05

0830 Arrived at Ravenna Army Ammunition Plant and met SAIC personnel. Martha Clough, site manager, Jed Thomas and Beau Williams.

0900 Morning safety briefing by Martha Clough.

0920 Departed Bldg 1036 for the field.

0935 Tailgate safety brief.

0945 Commenced marking sample sites in Fuse, Booster Quarry area.

1115 Completed marking sample sites in FBQ area. Moved to Open Demolition Area 2.

1200 Lunch break.

1245 Lunch break over, back to ODA2.

1405 Completed marking sample sites in ODA2. Moving back to FBQ area to begin taking soil samples.

1645 Completed taking samples from two sample sites. Returning to bldg 1036.

1700 Secured for the day. No MEC or residue encountered today.

Dale E. Mullen
11/14/05

11/15/05

0700 Morning safety brief.

0720 Tailgate safety brief.

0725 Departed Bldg 1036 to collect soil samples.

0755 Arrived at the FBQ area to collect samples.

1115 Finished collection of samples in the FBQ area. Will break for lunch.

1145 Lunch break complete. Moving to the Open Detonation Area #2 to collect soil samples.

1320 Encountered two pieces of frag from 3.5" rockets at sample site #130. Items moved to facilitate sampling work. No explosive residue associated with these two items.

1615 Finished collection of samples from ODA2, returning to Bldg 1036.

1657 Secured for the day. No MEC items encountered today.

Dale E. Miller
11/15/05

11/16/05 4

0700 Morning Safety Brief

0710 Tail gate safety brief.

0715 Departed Bldg 1036 to collect soil samples from the central burn pits area.

0740 Arrived at the central burn pits area, started collecting samples.

1210 Returned to Bldg 1036 to turn in collected samples.

1215 Taking lunch break

1245 Lunch break over. Returning to central burn pits area to continue collecting samples.

1625 Returned to Bldg 1036 with soil samples.
No MEC or related residue encountered today.

1640 Secured for the day.

Dale E. Miller
11/16/05

11/17/05

0703 Morning safety brief.

0745 Departed Bldg 1036 to collect soil samples from the central burn area.

0755 Tailgate safety brief.

0800 Started collection of soil samples.

1145 lunch break.

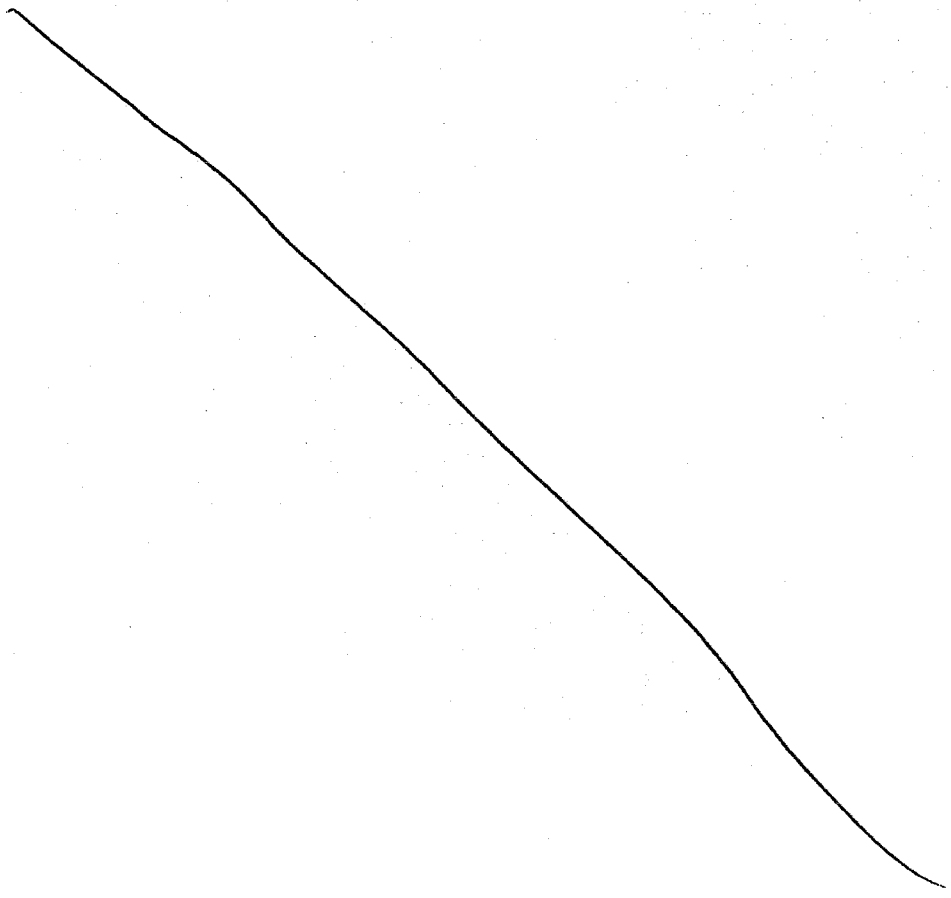
1220 Lunch break over, returned to collecting soil samples.

1650 Returned to Bldg 1036 with collected samples.

1705 Secured for the day.

Dale E. Mullen

11/17/05



11/18/05 6

0600 Gave Mk 26 to desk clerk at Motel, Hampton Inn, who stated that he would call FedEx for pick up. MK 26 is being shipped to James Hannan in Abingdon, MD.

0700 Morning safety brief.

0735 Departed Bldg 1036 to resume collecting soil samples from the central burn area.

0750 Tailgate safety brief.

0800 Resumed collecting soil samples.

1115 Completed collection of all soil samples, returning to Bldg 1036.

1195 Completed packaging of all USHE equipment for shipment back to Tampa, FL.

1200 Departed Ravenna AAP to drop equipment for shipping.

1230 Equipment dropped for shipping.

1400 Completed paperwork for project. On site work complete.

1600 Call Manok Synakorn to report that all documentation will be sent to him via Fedex on Monday.

Dale E. Miller
11/18/05

11/19/05 7

0515 Demolized from Brimfield, Ohio to ~~At~~ Aberdeen, OH.

1230 Washed truck after project use.

1300 Arrived at home of record.

Dale E. Miller

11/19/05

APPENDIX H

RISK CHARACTERIZATION FOR TRESPASSER SCENARIO

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TABLE OF CONTENTS

LIST OF TABLES

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H.0 RISK CHARACTERIZATION FOR TRESPASSER SCENARIO

H.1 INTRODUCTION

The baseline HHRA provided in the RI Report for CBP evaluates the potential health risks to humans resulting from exposure to contamination at CBP. The HHRA presented in the RI Report is based on the methods outlined in the RVAAP FWHHRAM (USACE 2004b) dated January 2004, which addresses five receptors to be evaluated at RVAAP [National Guard Trainee, National Guard Dust/Fire Control Worker, Security Guard/Maintenance Worker, Hunter/Trapper/Fisher, and Resident Subsistence Farmer (adult and child)].

An additional receptor (trespasser scenario) was added in an addendum to the FWHHRAM (USACE 2005c) released in November 2005. The Trespasser (Juvenile and Adult) is evaluated to supplement the baseline HHRA provided in the RI Report to comply with the revised FWHHRAM and provide risk managers with information to support determination of the need for continued security at the facility. This supplemental risk characterization is organized into the same six major sections used in the baseline HHRA:

- data evaluation and COPCs are discussed in Section H.2,
- exposure assessment is presented in Section H.3,
- toxicity assessment is summarized in Section H.4,
- results of the risk characterization are presented in Section H.5,
- the uncertainty analysis is presented in Section H.6, and
- the conclusions of the HHRA are summarized in Section H.7.

H.2 DATA EVALUATION

Data evaluation and COPC screening were conducted as part of the baseline HHRA in the Phase I RI Report for CBP (USACE 2005f).

Under this scenario, the Trespasser (Juvenile and Adult) may be exposed to COPCs in shallow surface soil (0-1 ft bgs), sediment, and surface water. This receptor is not exposed to COPCs in subsurface soil or groundwater. A summary of the exposure media evaluated for the Trespasser (Juvenile and Adult) scenario is provided in Table H-1.

Table H-1. Exposure Media Evaluated for the Trespasser (Juvenile and Adult) Scenario

AOC	Exposure Media		
	Shallow Surface Soil[a]	Sediment	Surface Water
CBP	1 EU	1 EU	No COPCs

[a]Shallow surface soil defined as 0-1 ft bgs for the Trespasser scenario.
AOC = area of concern.
EU = exposure unit.
No COPCs = no chemicals of potential concern (COPCs) identified for this exposure medium in the RI Report.

A summary of the COPCs identified for each medium in the baseline HHRA is provided in Table H-2.

Table H-2. COPCs for each Exposure Medium

COPC	Shallow Surface Soil (0-1 ft bgs)	Sediment
Quantitative COPCs[a]		
Inorganics		
Aluminum	X	X
Arsenic	X	X
Chromium[b]	X	
Copper	X	
Lead[c]	X	
Manganese	X	X
Vanadium	X	X
Organics		
Aroclor-1254	X	
Benzo(a)pyrene	X	X
Qualitative COPCs[d]		
Organics		
Nitrocellulose	X	

[a]Quantitative COPCs have approved toxicity values that allow for further quantitative evaluation in the human health risk assessment.
[b]Chromium is conservatively evaluated with the toxicity values for hexavalent chromium.
[c]Although lead does not have toxicity values for which to quantify risks and/or hazards, it can be evaluated quantitatively with blood lead models from the U. S. Environmental Protection Agency.
[d]Qualitative COPCs do not have approved toxicity values that allow for further quantitative evaluation in the human health risk assessment.
COPC = Chemical of potential concern.
X = Chemical is a COPC for this medium.

H.3 EXPOSURE ASSESSMENT

One receptor [Trespasser (Juvenile and Adult)] is evaluated in this supplemental HHRA. RVAAP/ RTLS is a controlled access facility (it is fenced, gated, and patrolled by security guards); however, a trespasser could enter the property and be exposed to contaminants in shallow surface soil (0-1 ft bgs), sediment, and surface water at CBP. The Juvenile Trespasser is assumed to visit the site approximately once per week (i.e., 50 days/year) between the ages of 8 and 18. The Adult Trespasser is assumed to visit the site slightly more often (75 days/year) for as long as he lives in the area (i.e., 30 years). In reality, the most likely adult trespassers are hunters or National Guard trainees entering unauthorized areas with a much lower frequency than the Hunter/Fisher/Trapper and National Guard Trainee receptors that are included in the baseline HHRA. A Juvenile Trespasser (ages 8 to 18) and Adult Trespasser are evaluated quantitatively for exposure to contaminated shallow surface soil and sediment via incidental ingestion, inhalation of VOCs and particulates, and dermal contact. As described in the FWHHRAM Amendment #1, the Trespasser (Juvenile and Adult) is also evaluated for exposure to contaminated surface water via incidental ingestion and dermal contact; however, no surface water COPCs were identified at CBP.

Exposure equations for each of these pathways are provided in the FWHHRAM (USACE 2004b). Exposure parameters used to calculate potential chemical intakes by the Trespasser (Juvenile and Adult) are from Table 5 of the FWHHRAM Amendment 1 (USACE 2005c) and are provided in Table H-3.

Chemical-specific exposure parameters are provided for all COPCs in Table H-4 at the end of this appendix.

Table H-3. Exposure Parameters for Trespasser (Juvenile and Adult) Scenario[a]

Exposure Pathway and Parameter	Units	Value
Surface Soil[b]		
Incidental Ingestion		
Soil ingestion rate (Adult/Juvenile)	kg/day	0.0001 / 0.0002
Exposure time	hours/day	2
Exposure frequency (Adult/Juvenile)	days/year	75 / 50
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Fraction ingested	unitless	1
Conversion factor	days/hour	0.042
Dermal Contact		
Skin area (Adult/Juvenile)	m^2/event	0.57 / 0.815
Adherence factor (Adult/Juvenile)	mg/cm^2	0.4 / 0.2
Absorption fraction	unitless	Chemical Specific – Table H-4
Exposure frequency (Adult/Juvenile)	events/year	75 / 50
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Conversion factor	(kg-cm^2)/(mg-m^2)	0.01
Inhalation of VOCs and Dust		
Inhalation rate	m^3/day	20
Exposure time	hours/day	2
Exposure frequency (Adult/Juvenile)	days/year	75 / 50
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Volatilization factor	m^3/kg	Chemical Specific – Table H-4
Particulate emission factor	m^3/kg	9.24E+08
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Conversion factor	days/hour	0.042
Sediment		
Incidental Ingestion		
Soil ingestion rate (Adult/Juvenile)	kg/day	0.0001 / 0.0002
Exposure time	hours/day	2
Exposure frequency (Adult/Juvenile)	days/year	75 / 50

Table H-3. Exposure Parameters for Trespasser (Juvenile and Adult) Scenario[a] (continued)

Exposure Pathway and Parameter	Units	Value
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Fraction ingested	unitless	1
Conversion factor	days/hour	0.042
Dermal Contact		
Skin area (Adult/Juvenile)	m^2/event	0.57 / 0.815
Adherence factor (Adult/Juvenile)	mg/cm^2	0.4 / 0.2
Absorption fraction	unitless	Chemical Specific – Table H-4
Exposure frequency (Adult/Juvenile)	events/year	75 / 50
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	0.01
Inhalation of VOCs and Dust		
Inhalation rate	m^3/day	20
Exposure time	hours/day	2
Exposure frequency (Adult/Juvenile)	days/year	75 / 50
Exposure duration (Adult/Juvenile)	years	30 / 10
Body weight (Adult/Juvenile)	kg	70 / 45
Volatilization factor	m^3/kg	Chemical Specific – Table H-4
Particulate emission factor	m^3/kg	9.24E+08
Carcinogen averaging time	days	25,550
Non-carcinogen averaging time (Adult/Juvenile)	days	10,950 / 3,650
Conversion factor	days/hour	0.042

[a]Exposure parameters are from Table 5 of the FWHHRAM Amendment 1 (USACE 2005c).
[b]Surface soil is defined as 0-1 ft bgs (shallow surface soil).

EPCs were calculated for each exposure medium in the baseline HHRA as detailed in the RI Report. These EPCs are provided in Tables H-9 through H-16 at the end of this appendix.

H.4 TOXICITY ASSESSMENT

Toxicity factors from USEPA sources are provided in Table H-5 (noncancer reference dose [RfDs]) and Table H-6 (cancer slope factors [CSFs]) at the end of this appendix. These are the same toxicity factor values used to evaluate the five receptors evaluated in the baseline HHRA for CBP.

Chronic RfDs are developed for protection from long-term exposure to a chemical (from 7 years to a lifetime); subchronic RfDs are used to evaluate short-term exposure (from 2 weeks to 7 years) (USEPA 1989). The Juvenile Trespasser scenario assumes an exposure duration of 10 years and the Adult Trespasser assumes an exposure duration of 30 years; therefore, only chronic RfDs are used in this supplemental HHRA.

Reference air concentrations (RfCs) and inhalation unit risks were converted to RfDs and CSFs using default adult inhalation rate and body weight [i.e., (RfC × 20 m3/day)/70 kg = RfD, Unit Risk × 70 kg × 1,000 μg/mg)/20 m3/day = CSF] (USEPA 1989).

Dermal RfDs and CSFs are estimated from oral toxicity values using chemical-specific gastrointestinal absorption factors (GAFs) to calculate total absorbed dose as recommended by USEPA (2004). The GAF values used and resulting dermal toxicity values are listed in Tables H-5 and H-6 at the end of this appendix.

As discussed in the baseline HHRA, total chromium is evaluated using the toxicity values for hexavalent chromium at CBP. This is the form of chromium with the most conservative toxicity values.

Per the FWHHRAM (USACE 2004b) toxicity equivalent factors (TEFs) are applied to carcinogenic polycyclic aromatic hydrocarbons (cPAHs) to convert the cPAHs to an equivalent concentration of benzo(a)pyrene.

No RfDs or CSFs are available for one COPC (nitrocellulose) because the non-carcinogenic and/or carcinogenic effects of this chemical has not yet been determined. Although this chemical may contribute to health effects from exposure to contaminated media, its effects cannot be quantified at the present time.

No RfDs or CSFs are available for lead. USEPA (1999) recommends the use of the interim adult lead model (ALM) to support its goal of limiting risk of elevated fetal blood lead concentrations due to lead exposures to women of child-bearing age. This model is used to estimate the probability that the fetal blood lead level will exceed 10 μg/dL as a result of maternal exposure. Complete documentation of the model is available at http://www.epa.gov/superfund/programs/lead/products/adultpb.pdf (USEPA 2003). The model-supplied default values were used for all parameters, with the exception of the site-specific media concentration and exposure frequency. Input parameters and results of this model are provided in Tables H-7 (Juvenile Trespasser) and H-8 (Adult Trespasser) at the end of this appendix. The Integrated Exposure Uptake Biokinetic (IEUBK) model for lead in children (available at http://www.epa.gov/superfund/programs/lead/ieubk.htm) was not used to evaluate the Juvenile Trespasser because this receptor is assumed to be age 8 to 18 years and the IEUBK applies to children age 0 to 6 years.

H.5 RISK CHARACTERIZATION RESULTS FOR TRESPASSER FOR CBP

Risk characterization integrates the findings of the exposure and toxicity assessments to estimate the potential for receptors to experience adverse effects as a result of exposure to contaminated media. Risk

characterization for the Trespasser (Juvenile and Adult) in this supplemental HHRA follows the same methodology used for risk characterization for the other receptors evaluated in the baseline HHRA for CBP.

Risk characterization results including identification of COCs are presented for CBP in the following subsections. COCs are defined as COPCs having an ILCR greater than 1.0E-06 and/or an HI greater than 1.

H.5.1 CBP Surface Soil (0-1 ft bgs)

Detailed hazard and risk results for direct contact with COPCs in shallow surface soil (0-1 ft bgs) are presented in Tables H-9 and H-10 (Juvenile Trespasser) and H-11 and H-12 (Adult Trespasser) at the end of this appendix. Direct contact includes incidental ingestion of soil, inhalation of VOCs and particulates (i.e., dust) from soil, and dermal contact with soil.

The total HIs for the Juvenile Trespasser and Adult Trespasser exposed to shallow surface soil (0-1 ft bgs) are 0.025 and 0.029 respectively, which are below the threshold of 1.0; thus, no non-carcinogenic shallow surface soil COCs are identified at CBP for either receptor.

The total risk across all COPCs for the Juvenile Trespasser exposed to shallow surface soil is 8.8E-07, which is below the threshold of 1E-06; thus, no carcinogenic shallow surface soil COCs are identified at CBP for this receptor. The total risk across all COPCs for the Adult Trespasser exposed to shallow surface soil is 3.1E-06, which is above the threshold of 1E-06. Arsenic is identified as a carcinogenic COC for the Adult Trespasser exposed to shallow surface soil at CBP; however, the arsenic risk (2.3E-06) is not in excess of Ohio EPA's level of concern of 1E-05.

Lead was identified as a surface soil COPC at CBP. Lead model results for the Juvenile Trespasser and Adult Trespasser are provided in Tables H-7 and H-8, respectively, at the end of this appendix. The estimated probability of fetal blood lead concentrations exceeding acceptable levels is less than 1% for both a Juvenile Trespasser and an Adult Trespasser exposed to shallow surface soil at CBP; therefore, lead is not a COC.

H.5.2 CBP Sediment

Detailed hazard and risk results for contact with COPCs in sediment are presented in Tables H-13 and H-14 (Juvenile Trespasser) and Tables H-15 and H-16 (Adult Trespasser) at the end of this appendix. Direct contact includes incidental ingestion of sediment, inhalation of VOCs and particulates (i.e. dust) from sediment, and dermal contact with sediment.

The total HIs for the Juvenile Trespasser and Adult Trespasser exposed to sediment are 0.026 and 0.029, respectively, which are below the threshold of 1.0; thus, no non-carcinogenic sediment COCs are identified at CBP for either receptor.

The total risk across all COPCs for the Juvenile Trespasser exposed to sediment is 1E-06, which is equal to the threshold of 1E-06; however, because all individual chemicals have total risk less than 1.0E-06, no carcinogenic sediment COCs are identified at CBP for this receptor. The total risk across all COPCs for the Adult Trespasser exposed to sediment is 3.5E-06, which is above the threshold of 1E-06. Arsenic is identified as a carcinogenic COC for the Adult Trespasser exposed to sediment at CBP; however, the arsenic risk (2.9E-06) is below Ohio EPA's level of concern of 1E-05.

H.5.3 CBP Surface Water

No COPCs were identified for surface water at CBP in the RI Report; therefore, no COCs were identified for this medium at CBP.

H.5.4 Summary of Risk Characterization Results for Trespasser at CBP

Risks, hazards, and COCs are summarized in Table H-17 for Trespasser (Juvenile and Adult) exposed to shallow surface soil (0-1 ft bgs), sediment, and surface water at CBP.

Table H-17. Summary of Risks and Hazards for Trespasser (Juvenile and Adult) at CBP

Exposure Medium	Total HI	Non-carcinogenic COCs	Total ILCR	Carcinogenic COCs
Juvenile Trespasser				
Shallow Surface Soil (0-1 ft bgs)	0.025	None	8.8E-07	None
Sediment	0.026	None	1.0E-06	None
Surface Water	NA	None	NA	None
Adult Trespasser				
Shallow Surface Soil (0-1 ft bgs)	0.029	None	3.1E-06	arsenic
Sediment	0.029	None	3.5E-06	arsenic
Surface Water	NA	None	NA	None

COC = Chemical of concern.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = not applicable, no COPCs were identified for surface water at CBP.

H.6 UNCERTAINTY ANALYSIS

Uncertainties associated with each step of the risk assessment process (i.e., data evaluation, exposure assessment, toxicity assessment, and risk characterization) are described in the baseline HHRA for CBP.

While anticipated future land use has been identified as the RTLS (USACE 2004b), and OHARNG will manage the property, there is uncertainty surrounding the future land use. To address this uncertainty, a Trespasser (Juvenile and Adult) is evaluated in this supplemental risk assessment.

H.7 SUMMARY AND CONCLUSIONS

This supplemental HHRA was conducted to evaluate risks and hazards associated with impacted media at CBP for a Trespasser (Juvenile and Adult) scenario. The following steps were used to generate conclusions regarding human health risks and hazards:

- identification of COPCs (in the baseline HHRA included in the RI Report for CBP),
- calculation of risks and hazards, and
- identification of COCs.

At CBP all HIs for the Trespasser (Juvenile and Adult) are below the threshold value of 1.0; thus, no non-carcinogenic COCs are identified. The total ILCRs for the Juvenile Trespasser exposed to shallow surface soil (0-1 ft bgs) and sediment are at or below the threshold value of 1E-06; thus, no carcinogenic COCs are identified for this receptor. The total ILCRs for the Adult Trespasser exposed to shallow surface soil and sediment are just above the threshold value of 1E-06; arsenic is identified as the only carcinogenic COC for the Adult Trespasser exposed to shallow surface soil and sediment. No COPCs and consequently, no COCs, are identified for surface water at CBP.

Table H-4. Chemical-Specific Exposure Parameters

COPC	Dermal Absorption Factor[a] (unitless)	Permeability Constant[b] (cm/hr)	Volatilization Factor[c] (m^3/kg)
Inorganics			
Aluminum	1.0E-03	2.1E-03	--
Arsenic	3.0E-02	1.9E-03	--
Chromium (as Chromium VI)	1.0E-03	1.0E-03	--
Copper	1.0E-03	3.1E-04	--
Manganese	1.0E-03	1.3E-03	--
Vanadium	1.0E-03	1.4E-03	--
Organics			
Aroclor-1254	1.4E-01	1.3E+00	--
Benzo(a)pyrene	1.3E-01	1.2E+00	--

[a] Chemical-specific absorption factor values from USEPA, 2004. When chemical-specific values are not available the following default values are used for soil and sediment only: SVOCs = 0.1, VOCs = 0.01, inorganics = 0.001 per USEPA Region 4 Supplemental Guidance to RAGS.
[b] From Risk Assessment Information System (RAIS) *http://risk.lsd.ornl.gov/tox/tox_values.shtml* for surface water.
[c] Volatilization factors (VFs) calculated using the 1996 USEPA Soil Screening Guidance Methodology, using site-specific parameter values for Cleveland, Ohio. Only used for soil and sediment VOCs.
COPC = Chemical of potential concern.
RAGS = Risk Assessment Guidance for Superfund.
SVOC = semivolatile organic compound
USEPA = United States Environmental Protection Agency
VOC = volatile organic compound
-- = No value available.

Table H-5. Non-carcinogenic Reference Doses for COPCs

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI absorption[a]	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
Inorganics								
Aluminum	1.0E+00	NA	1	1.0E+00	1.4E-03	NA	NA	(O) UF=10
Arsenic	3.0E-04	Medium (O)	0.95	3.0E-04	--	Oral, oral-water	Hyperpigmentation and keritosis and possible vascular complication	(O) UF=3
Chromium (as Cr VI)	3.0E-03	Low (O)	0.025	7.5E-05	2.9E-05	Oral (rat)	Reduced liver/spleen weight	(O) UF=100
Copper	4.0E-02	NA	1	4.0E-02	--	NA	NA	
Manganese (food)	1.4E-01	Medium (O)	0.04	5.6E-03	1.4E-05	Oral	(O) lethargy, tremors, mental disturbance, muscle tonus, and central nervous system effects	(O) UF=1 (O) MF=1
Manganese (soil/water)	4.6E-02	Medium (O)	0.04	1.8E-03	1.4E-05	Oral: water, inhalation	(O) lethargy, tremors, mental disturbance, muscle tonus, and central nervous system effects	(O) UF=1 (O) MF=1 (I) UF=1000
Vanadium	7.0E-03	Low	0.026	1.8E-04	--	Oral (rat)	Decreased hair cystine	UF=100
Organics								
Aroclor 1254	2.0E-05	Medium	0.9	1.8E-05	--	Oral	Ocular exudate, inflamed and prominent Meibomian glands	(O) MF=1 (O) UF=300

[a] % GI absorption values from USEPA 2004.
(O) indicates oral, (I) indicates inhalation.
RfD = Reference dose.
MF = Modifying factor (the default modifying factor is 1).
UF = Uncertainty factor.
NA = Not available
-- = No value available

1

Table H-6. Cancer Slope Factors for COPCs

COPC	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	% GI absorption[a]	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	EPA Class	TEF	Type of Cancer
Inorganics							
Arsenic	1.5E+00	0.95	1.5E+00	1.5E+01	A	--	Respiratory system tumors
Chromium (as Cr VI)	--	0.025	--	4.2E+01	A	--	Lung tumors
Organics							
Aroclor 1254 (soil/food)	2.0E+00	0.9	2.2E+00	2.0E+00[b]	B2	--	Hepatocellular carcinomas, melanoma of the skin, cancer of the liver, biliary tract, or gall bladder
Aroclor 1254 (water)	4.0E-01	0.9	4.4E-01	3.5E-01[b]	B2	--	Hepatocellular carcinomas, melanoma of the skin, cancer of the liver, biliary tract, or gall bladder
Benzo(a)pyrene	7.3E+00	0.58	7.3E+00	3.1E+00	B2	1	Stomach, nasal cavity, larynx, tracheak, and pharnyx

2 [a] % GI absorption values from USEPA 2004.
3 TEF = Toxicity Equivalency Factor is based on the relative potency of each carcinogenic polycyclic aromatic hydrocarbon (PAH) relative to that of benzo(a)pyrene.
4 -- = No value available.

Table H-7. CBP Shallow Surface (0-1 ft bgs) Soil Calculations of Blood Lead Concentrations for Juvenile Trespasser

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Juvenile Trespasser	
	1*	2*			GSDi = 1.8	GSDi = 2.1
PbS	X	X	Soil lead concentration	ug/g or mg/kg	59.3	59.3
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.8	2.1
PbB_0	X	X	Baseline PbB	ug/dL	2.2	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.2	0.2
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	0.2	0.2
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}		X	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	50	50
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adult receptor, geometric mean**			**ug/dL**	**2.3**	**1.8**
$PbB_{fetal, 0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.4**	**5.4**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**
P(PbB > PbB_t)	**Probability that PbB > PbB_t, assuming lognormal distribution**			**%**	**0.4%**	**0.7%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}). When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

* Equation 1, based on Eq. 1, 2 in USEPA (2003). USEPA Technical Review Workgroup for Lead, Adult Lead Committee.

$PbB_{adult} = (PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$

$PbB_{fetal, 0.95} = PbB_{adult} * (GSD_i^{1.645} * R_{fetal/maternal})$

Table H-8. CBP Shallow Surface Soil (0-1 ft bgs) Calculations of Blood Lead Concentrations for Adult Trespasser

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Adult Trespasser	
	1*	2*			GSDi = 1.8	GSDi = 2.1
PbS	X	X	Soil lead concentration	ug/g or mg/kg	59.3	59.3
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.8	2.1
PbB_0	X	X	Baseline PbB	ug/dL	2.2	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.1	0.1
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	0.1	0.1
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}		X	Mass fraction of soil in dust	--	--	--
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	75	75
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adult receptor, geometric mean**			**ug/dL**	**2.3**	**1.8**
$PbB_{fetal,0.95}$	**95th percentile PbB among fetuses of adult workers**			**ug/dL**	**5.3**	**5.4**
PbB_t	**Target PbB level of concern (e.g., 10 ug/dL)**			**ug/dL**	**10.0**	**10.0**
$P(PbB > PbB_t)$	**Probability that $PbB > PbB_t$, assuming lognormal distribution**			**%**	**0.3%**	**0.6%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}). When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

* Equation 1, based on Eq. 1, 2 in USEPA (2003). US EPA Technical Review Workgroup for Lead, Adult Lead Committee.

$PbB_{adult} = (PbS * BKSF * IR_{S+D} * AF_{S,D} * EF_{S,D} / AT_{S,D}) + PbB_0$

$PbB_{fetal,0.95} = PbB_{adult} * (GSD_i^{1.645} * R_{fetal/maternal})$

Table H-9. Juvenile Trespasser Shallow Surface Soil (0-1 ft bgs) Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.5E+04	7.5E-04	7.4E-05	8.2E-08	7.5E-04	7.4E-05	5.7E-05	8.9E-04	
Arsenic	1.6E+01	8.2E-07	2.4E-06	8.8E-11	2.7E-03	8.0E-03		1.1E-02	
Chromium	1.8E+01	9.1E-07	8.9E-08	9.9E-11	3.0E-04	1.2E-03	3.5E-06	1.5E-03	
Copper	3.9E+01	2.0E-06	1.9E-07	2.1E-10	4.9E-05	4.8E-06		5.4E-05	
Manganese	1.4E+03	7.2E-05	7.0E-06	7.8E-09	1.6E-03	3.8E-03	5.5E-04	5.9E-03	
Vanadium	2.2E+01	1.1E-06	1.1E-07	1.2E-10	1.6E-04	6.0E-04		7.6E-04	
Inorganics Pathway Total					5.6E-03	1.4E-02	6.1E-04	2.0E-02	
Aroclor-1254	1.4E-01	7.2E-09	9.9E-08	7.8E-13	3.6E-04	4.9E-03		5.3E-03	
Benzo(a)pyrene	2.2E-01	1.1E-08	1.4E-07	1.2E-12					
Organics Pathway Total					3.6E-04	4.9E-03		5.3E-03	
Pathway Total - Chemicals					5.9E-03	1.9E-02	6.1E-04	2.5E-02	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
HI = Hazard Index.

Table H-10. Juvenile Trespasser Shallow Surface Soil (0-1 ft bgs) Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.5E+04	1.1E-04	1.1E-05	1.2E-08					
Arsenic	1.6E+01	1.2E-07	3.4E-07	1.3E-11	1.8E-07	5.1E-07	1.9E-10	6.9E-07	
Chromium	1.8E+01	1.3E-07	1.3E-08	1.4E-11			5.9E-10	5.9E-10	
Copper	3.9E+01	2.8E-07	2.7E-08	3.0E-11					
Manganese	1.4E+03	1.0E-05	1.0E-06	1.1E-09					
Vanadium	2.2E+01	1.6E-07	1.6E-08	1.7E-11					
Inorganics Pathway Total					1.8E-07	5.1E-07	7.8E-10	6.9E-07	
Aroclor-1254	1.4E-01	1.0E-09	1.4E-08	1.1E-13	2.1E-09	2.8E-08	2.2E-13	3.0E-08	
Benzo(a)pyrene	2.2E-01	1.6E-09	2.0E-08	1.7E-13	1.2E-08	1.5E-07	5.4E-13	1.6E-07	
Organics Pathway Total					1.4E-08	1.8E-07	7.6E-13	1.9E-07	
Pathway Total - Chemicals					1.9E-07	6.9E-07	7.8E-10	8.8E-07	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
ILCR = Incremental Lifetime Cancer Risk.

Table H-11. Adult Trespasser Shallow Surface Soil (0-1 ft bgs) Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.5E+04	3.6E-04	1.0E-04	7.9E-08	3.6E-04	1.0E-04	5.5E-05	5.2E-04	
Arsenic	1.6E+01	3.9E-07	3.2E-06	8.5E-11	1.3E-03	1.1E-02		1.2E-02	
Chromium	1.8E+01	4.4E-07	1.2E-07	9.5E-11	1.5E-04	1.6E-03	3.3E-06	1.8E-03	
Copper	3.9E+01	9.4E-07	2.6E-07	2.0E-10	2.4E-05	6.4E-06		3.0E-05	
Manganese	1.4E+03	3.5E-05	9.5E-06	7.5E-09	7.5E-04	5.2E-03	5.3E-04	6.4E-03	
Vanadium	2.2E+01	5.4E-07	1.5E-07	1.2E-10	7.7E-05	8.1E-04		8.8E-04	
Inorganics Pathway Total					2.7E-03	1.8E-02	5.8E-04	2.2E-02	
Aroclor-1254	1.4E-01	3.5E-09	1.3E-07	7.5E-13	1.7E-04	6.7E-03		6.8E-03	
Benzo(a)pyrene	2.2E-01	5.4E-09	1.9E-07	1.2E-12					
Organics Pathway Total					1.7E-04	6.7E-03		6.8E-03	
Pathway Total - Chemicals					2.9E-03	2.5E-02	5.8E-04	2.9E-02	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
HI = Hazard Index.

Table H-12. Adult Trespasser Shallow Surface Soil (0-1 ft bgs) Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.5E+04	1.6E-04	4.3E-05	3.4E-08					
Arsenic	1.6E+01	1.7E-07	1.4E-06	3.7E-11	2.5E-07	2.1E-06	5.5E-10	2.3E-06	R
Chromium	1.8E+01	1.9E-07	5.2E-08	4.1E-11			1.7E-09	1.7E-09	
Copper	3.9E+01	4.0E-07	1.1E-07	8.7E-11					
Manganese	1.4E+03	1.5E-05	4.1E-06	3.2E-09					
Vanadium	2.2E+01	2.3E-07	6.3E-08	5.0E-11					
Inorganics Pathway Total					2.5E-07	2.1E-06	2.3E-09	2.3E-06	
Aroclor-1254	1.4E-01	1.5E-09	5.7E-08	3.2E-13	3.0E-09	1.1E-07	6.4E-13	1.2E-07	
Benzo(a)pyrene	2.2E-01	2.3E-09	8.2E-08	5.0E-13	1.7E-08	6.0E-07	1.5E-12	6.2E-07	
Organics Pathway Total					2.0E-08	7.1E-07	2.2E-12	7.3E-07	
Pathway Total - Chemicals					2.7E-07	2.8E-06	2.3E-09	3.1E-06	

a COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.

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Table H-13. Juvenile Trespasser Sediment Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.9E+04	9.7E-04	9.5E-05	1.0E-07	9.7E-04	9.5E-05	7.3E-05	1.1E-03	
Arsenic	2.0E+01	1.0E-06	3.0E-06	1.1E-10	3.4E-03	1.0E-02		1.3E-02	
Manganese	2.6E+03	1.3E-04	1.3E-05	1.4E-08	2.9E-03	7.0E-03	1.0E-03	1.1E-02	
Vanadium	3.0E+01	1.5E-06	1.5E-07	1.7E-10	2.2E-04	8.3E-04		1.0E-03	
Inorganics Pathway Total					7.4E-03	1.8E-02	1.1E-03	2.6E-02	
Benzo(a)pyrene	2.1E-01	1.1E-08	1.4E-07	1.2E-12					
Organics Pathway Total									
Pathway Total - Chemicals					7.4E-03	1.8E-02	1.1E-03	2.6E-02	

Table H-14. Juvenile Trespasser Sediment Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.9E+04	1.4E-04	1.4E-05	1.5E-08					
Arsenic	2.0E+01	1.5E-07	4.3E-07	1.6E-11	2.2E-07	6.4E-07	2.4E-10	8.6E-07	
Manganese	2.6E+03	1.9E-05	1.8E-06	2.0E-09					
Vanadium	3.0E+01	2.2E-07	2.2E-08	2.4E-11					
Inorganics Pathway Total					2.2E-07	6.4E-07	2.4E-10	8.6E-07	
Benzo(a)pyrene	2.1E-01	1.5E-09	1.9E-08	1.6E-13	1.1E-08	1.4E-07	5.1E-13	1.5E-07	
Organics Pathway Total					1.1E-08	1.4E-07	5.1E-13	1.5E-07	
Pathway Total - Chemicals					2.3E-07	7.8E-07	2.4E-10	1.0E-06	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
ILCR = Incremental Lifetime Cancer Risk.

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Table H-15. Adult Trespasser Sediment Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.9E+04	4.7E-04	1.3E-04	1.0E-07	4.7E-04	1.3E-04	7.1E-05	6.7E-04	
Arsenic	2.0E+01	4.9E-07	4.0E-06	1.1E-10	1.6E-03	1.3E-02		1.5E-02	
Manganese	2.6E+03	6.3E-05	1.7E-05	1.4E-08	1.4E-03	9.4E-03	9.6E-04	1.2E-02	
Vanadium	3.0E+01	7.4E-07	2.0E-07	1.6E-10	1.1E-04	1.1E-03		1.2E-03	
Inorganics Pathway Total					3.6E-03	2.4E-02	1.0E-03	2.9E-02	
Benzo(a)pyrene	2.1E-01	5.1E-09	1.8E-07	1.1E-12					
Organics Pathway Total									
Pathway Total - Chemicals					3.6E-03	2.4E-02	1.0E-03	2.9E-02	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
HI = Hazard Index.

1

Table H-16. Adult Trespasser Sediment Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
CBP									
Aluminum	1.9E+04	2.0E-04	5.5E-05	4.3E-08					
Arsenic	2.0E+01	2.1E-07	1.7E-06	4.6E-11	3.2E-07	2.6E-06	6.9E-10	2.9E-06	R
Manganese	2.6E+03	2.7E-05	7.4E-06	5.9E-09					
Vanadium	3.0E+01	3.2E-07	8.7E-08	6.9E-11					
Inorganics Pathway Total					3.2E-07	2.6E-06	6.9E-10	2.9E-06	
Benzo(a)pyrene	2.1E-01	2.2E-09	7.8E-08	4.8E-13	1.6E-08	5.7E-07	1.5E-12	5.9E-07	
Organics Pathway Total					1.6E-08	5.7E-07	1.5E-12	5.9E-07	
Pathway Total - Chemicals					3.3E-07	3.2E-06	6.9E-10	3.5E-06	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).

COPC - Chemical of Potential Concern.

EPC = Exposure Point Concentration.