Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part I: Field Sampling Plan (FSP)
Part II: Site Safety and Health Plan (SSHP)
Part III: Quality Assurance Project Plan (QAPP)

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Leidos
11951 Freedom Drive
Reston, Virginia 20190

April 8, 2016

REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
08-04-2016	Technical	October 2013 to November 2018

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Final PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4, Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio	W912QR-12-D-0020
	5b. GRANT NUMBER NA
	5c. PROGRAM ELEMENT NUMBER NA
6. AUTHOR(S) Peterson, Vasudha, K., P.E., PMP Adams Heather, R., P.G.	5d. PROJECT NUMBER Delivery Order No. 0008
	5e. TASK NUMBER NA
	5f. WORK UNIT NUMBER NA
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Leidos 11951 Freedom Drive Reston, Virginia 20190	8. PERFORMING ORGANIZATION REPORT NUMBER NA
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USACE - Louisville District U.S. Army Corps of Engineers 600 Martin Luther King Jr., Place PO Box 59 Louisville, Kentucky 40202-0059	10. SPONSOR/MONITOR'S ACRONYM(S) USACE
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) NA

12. DISTRIBUTION/AVAILABILITY STATEMENT

Reference distribution page.

13. SUPPLEMENTARY NOTES

Reference distribution page.

14. ABSTRACT

Leidos has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to execute the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process by completing an approved Feasibility Study (FS) Addendum for soil, sediment, and surface water at five areas of concern (AOCs) (Load Lines 1, 2, 3, 4, and 12) at Camp Ravenna, formerly the Ravenna Army Ammunition Plant (RVAAP), in Portage and Trumbull Counties, Ohio. Tasks associated with achieving this objective include: conducting a data gap analysis and developing this Sample and Analysis Plan (SAP) Addendum that includes an SSHP and a QAPP and recommendations for additional sampling to be collected in support of the FS. This SAP provides recommendations, procedures, and locations for conducting surface water and sediment sampling at Load Lines 1 through 4 to define nature and extent of contamination for incorporation in the FS Addendum for each AOC.

15. SUBJECT TERMS

CERCLA, Feasibility Study (FS), Sample and Analysis Plan (SAP) Addendum, data screening, surface water and sediment, Load Line 1, Load Line 2, Load Line 3, and Load Line 4.

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
U	U	U	U	419	Quyet La
					19b. TELEPHONE NUMBER *(Include area code)* 502-315-6892

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

DISCLAIMER STATEMENT

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Leidos has completed the PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4 for Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, 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 U.S. Army Corps of Engineers (USACE) policy.

	4/8/2016
	Date

	4/8/2016
Study/Design Team Leader, Main Author	Date

C. Allen Motley	4/8/2016
Independent Technical Review Team Leader	Date

Significant concerns and the explanation of the resolution are as follows:

Internal Leidos Independent Technical Review comments are recorded on a Document Review Record per Leidos Quality Assurance Administrative 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.

	4/8/2016
	Date

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

May 6, 2016

Re: **US Army Ravenna Ammunition Plt RVAAP**
Remediation Response
Project records
Remedial Response
Portage County
267000859030

Mr. Mark Leeper
Army Nation Guard Directorate
ARNGD-ILE Clean Up
111 South George Mason
Arlington, VA 22203

Subject: **Approval of the "PBA 13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4" for the Former Ravenna Army Ammunition Plant (RVAAP)" Document, as Amended in the April 8, 2016 Response to Ohio EPA Comments Letter (Work Activity No. 267-000859-030)**

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA) received the PBA 13 Sample and Analysis Plan (SAP) Addendum for Surface Water and Sediments for Load Lines 1, 2, 3, and 4. With your responses to our comments provided in the April 8, 2016 letter, regarding these Areas of Concern (AOC), Ohio EPA is issuing a final approval of the SAP for these load lines.

Ohio EPA understands from the February 23, 2016 meeting, held at Ohio EPA, NEDO that the evaluation of the sewer discharge associated with Load Line 2 and Kelly's Pond will be addressed under the Facility-Wide Sewers AOC in the EE/CA. It was anticipated that the sewer is the source of contamination and a removal action is pending.

If you have questions or need clarification regarding the comments, please feel free to contact me at (330) 963-1201 or e-mail at susan.netzly-watkins@epa.ohio.gov.

Sincerely,

Sue Netzly-Watkins

Sue Netzly-Watkins
Site Coordinator
Division of Environmental Response and Revitalization

SN-W/nvr

cc: Nat Peters, USACE Louisville
Gail Harris, Vista Sciences Corp
Vasudha Peterson, Leidos
Katie Tait, OHARNG, Camp Ravenna
Gregory F. Moore, USACE, Louisville District
Kevin Sedlak, ARNG-ILE, Camp Ravenna

ec: Rod Beals, NEDO, DERR
Brian Tucker, CO-DERR
Carrie Rasik, CO-DERR
Bob Princic, NEDO, DERR
Ed D'Amato, NEDO, DERR

Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part I: Field Sampling Plan (FSP)
Part II: Site Safety and Health Plan (SSHP)
Part III: Quality Assurance Project Plan (QAPP)

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:
United States Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:
Leidos
11951 Freedom Drive
Reston, Virginia 20190

April 8, 2016

DOCUMENT DISTRIBUTION
for the
Final PBA13 Sample and Analysis Plan Addendum
for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Name/Organization	Number of Printed Copies	Number of Electronic Copies
Susan Netzly-Watkins, Ohio EPA NEDO-DERR	2	2
Rodney Beals, Ohio EPA NEDO-DERR	E-mail Transmittal Letter Only	
Brian Tucker, Ohio EPA CO-DERR	1	1
Justin Burke, Ohio EPA CO-DERR	0	1
Bob Princic, Ohio EPA NEDO-DERR	E-mail Transmittal Letter Only	
Mark Leeper, ARNG-ILE Cleanup	0	1
Katie Tait, OHARNG, Camp Ravenna	E-mail Transmittal Letter Only	
Kevin Sedlak, ARNG	E-mail Transmittal Letter Only	
Gail Harris, Vista Sciences Corporation	2	2
Quyet La, USACE – Louisville District	1	1
Gregory Moore, USACE – Louisville District	E-mail Transmittal Letter Only	
Vasu Peterson, Leidos	1	1
Heather Adams, Leidos	1	1
Pat Ryan, Leidos-REIMS	0	1

ARNG = Army National Guard
CO = Central Office
DERR = Division of Environmental Response and Revitalization
NEDO = Northeast District Office
OHARNG = Ohio Army National Guard
Ohio EPA = Ohio Environmental Protection Agency
REIMS = Ravenna Environmental Information Management System
USACE = U.S. Army Corps of Engineers

Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part I: Field Sampling Plan

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Leidos
11951 Freedom Drive
Reston, Virginia 20190

April 8, 2016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
AOC	Area of Concern
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CO	Central Office
COEC	Chemical of Ecological Concern
COI	Chemical of Interest
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSM	Conceptual Site Model
CUG	Cleanup Goal
DERR	Division of Environmental Response and Revitalization
DFFO	Director's Final Findings and Orders
DNT	Dintrotoluene
DPT	Direct-Push Technology
DQO	Data Quality Objective
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESV	Ecological Screening Value
EU	Exposure Unit
FS	Feasibility Study
FSP	Field Sampling Plan
FWCUG	Facility-Wide Cleanup Goal
FWFSP	Facility-Wide Field Sampling Plan
FWHHRAM	Facility-Wide Human Health Risk Assessment Methodology
FWQAPP	Facility-Wide Quality Assurance Project Plan
FWSAP	Facility-Wide Sampling and Analysis Plan
FWSHP	Facility-Wide Safety and Health Plan
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IDW	Investigation-Derived Waste
IROD	Interim Record of Decision
MDC	Maximum Detected Concentration
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Site
MS	Matrix Spike

ACRONYMS AND ABBREVIATIONS (continued)

MSD	Matrix Spike Duplicate
NAD83	North American Datum 1983
NEDO	Northeast District Office
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
OE	Ordnance and Explosives
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OMZA	Outside Mixing Zone Average
OMZM	Outside Mixing Zone Maximum
ORAM	Ohio Rapid Assessment Method
P.E.	Professional Engineer
P.G.	Professional Geologist
PAH	Polycyclic Aromatic Hydrocarbon
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
PMP	Project Management Professional
PPE	Personal Protective Equipment
PWS	Performance Work Statement
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RBC	Risk-Based Concentration
REIMS	RVAAP Environmental Information Management System
RGO	Remedial Goal Objective
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SRV	Sediment Reference Value
SSHP	Site Safety and Health Plan
SSL	Soil/Screening Level
TCLP	Toxicity Characteristic Leaching Procedure
TNT	2,4,6-Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USP&FO	U.S. Property and Fiscal Officer
VOC	Volatile Organic Compound
WOE	Weight-of-Evidence

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

Leidos has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to execute the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process by completing an approved Feasibility Study (FS) Addendum for specified environmental media at four areas of concern (AOCs) at Camp Ravenna, formerly the Ravenna Army Ammunition Plant (RVAAP), in Ravenna, Ohio (Figure 1-1). This work is being performed under a firm fixed price basis in accordance with USACE, Louisville District Contract No. W912QR-12-D-0020, Delivery Order No. 0008, under a Performance-Based Acquisition (PBA). The performance objectives were specified in the Revised Performance Work Statement (PWS), which was issued by the Army on July 3, 2013 (USACE 2013), and a Contract Modification 0001 Scope of Work, which was issued on February 21, 2014 (USACE 2014). Planning and performance of all elements of this PBA will be in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (DFFO) for RVAAP, dated June 10, 2004 (Ohio EPA 2004). The elements of work included in this work plan are to develop an FS Addendum for sediment and surface water at the following four AOCs in conformance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Figure 1-2):

- RVAAP-08: Load Line 1;
- RVAAP-09: Load Line 2;
- RVAAP-10: Load Line 3; and
- RVAAP-11: Load Line 4.

The Facility-Wide Sampling and Analysis Plan (FWSAP) establishes the methods and procedures for environmental investigations at the RVAAP AOCs (USACE 2011a). The FWSAP is composed of the following three documents:

- Facility-Wide Field Sampling Plan (FWFSP);
- Facility-Wide Quality Assurance Project Plan (FWQAPP); and
- Facility-Wide Safety and Health Plan (FWSHP) (USACE 2011b).

This Sampling and Analysis Plan (SAP) Addendum (herein referred to as the SAP Addendum) is developed to append the three plans listed above with only those elements specific to individual AOC environmental investigations that are not included in the FWSAP. All addenda are to be used in conjunction with the existing facility-wide plans.

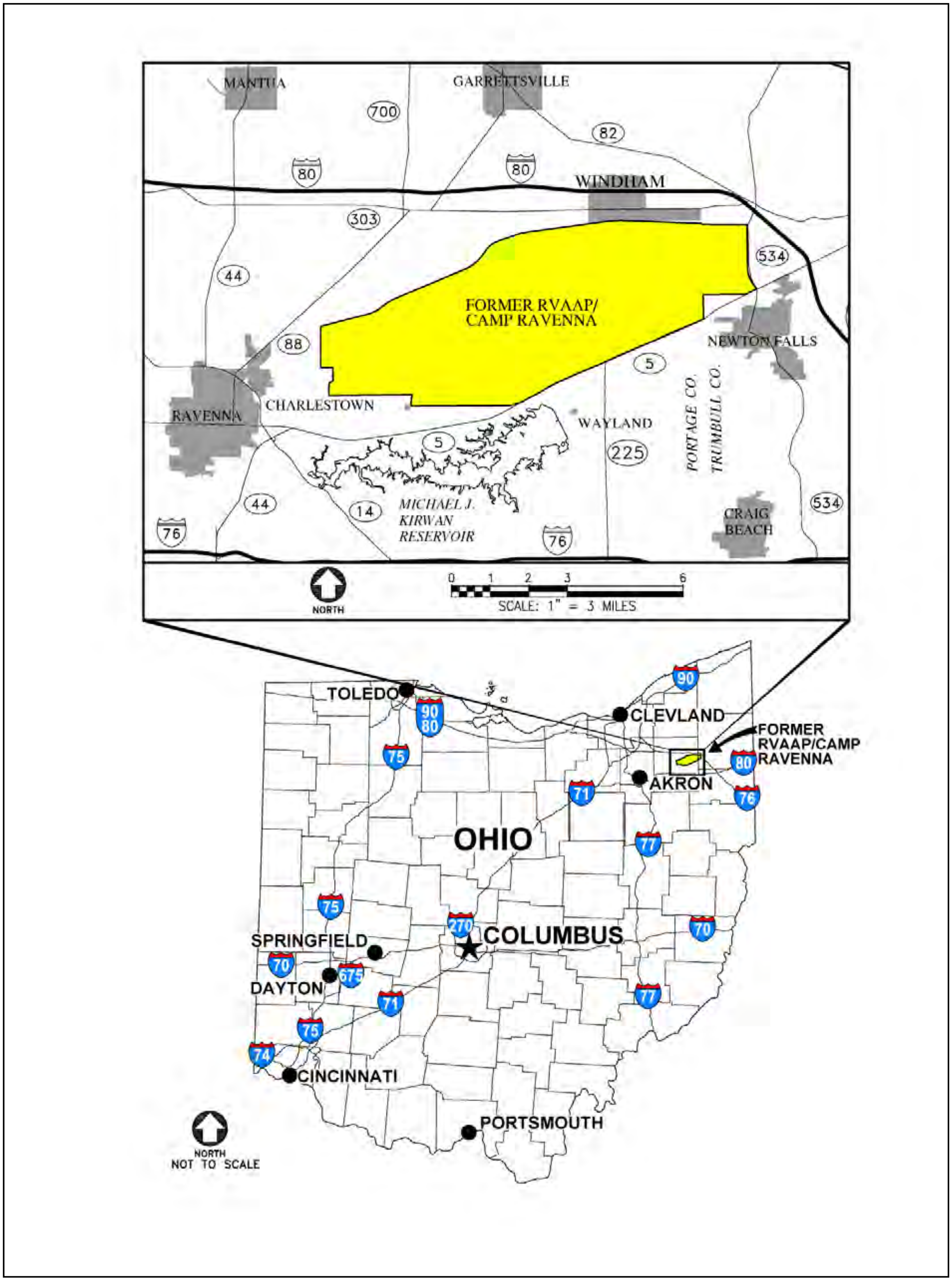


Figure 1-1. General Location and Orientation of Camp Ravenna

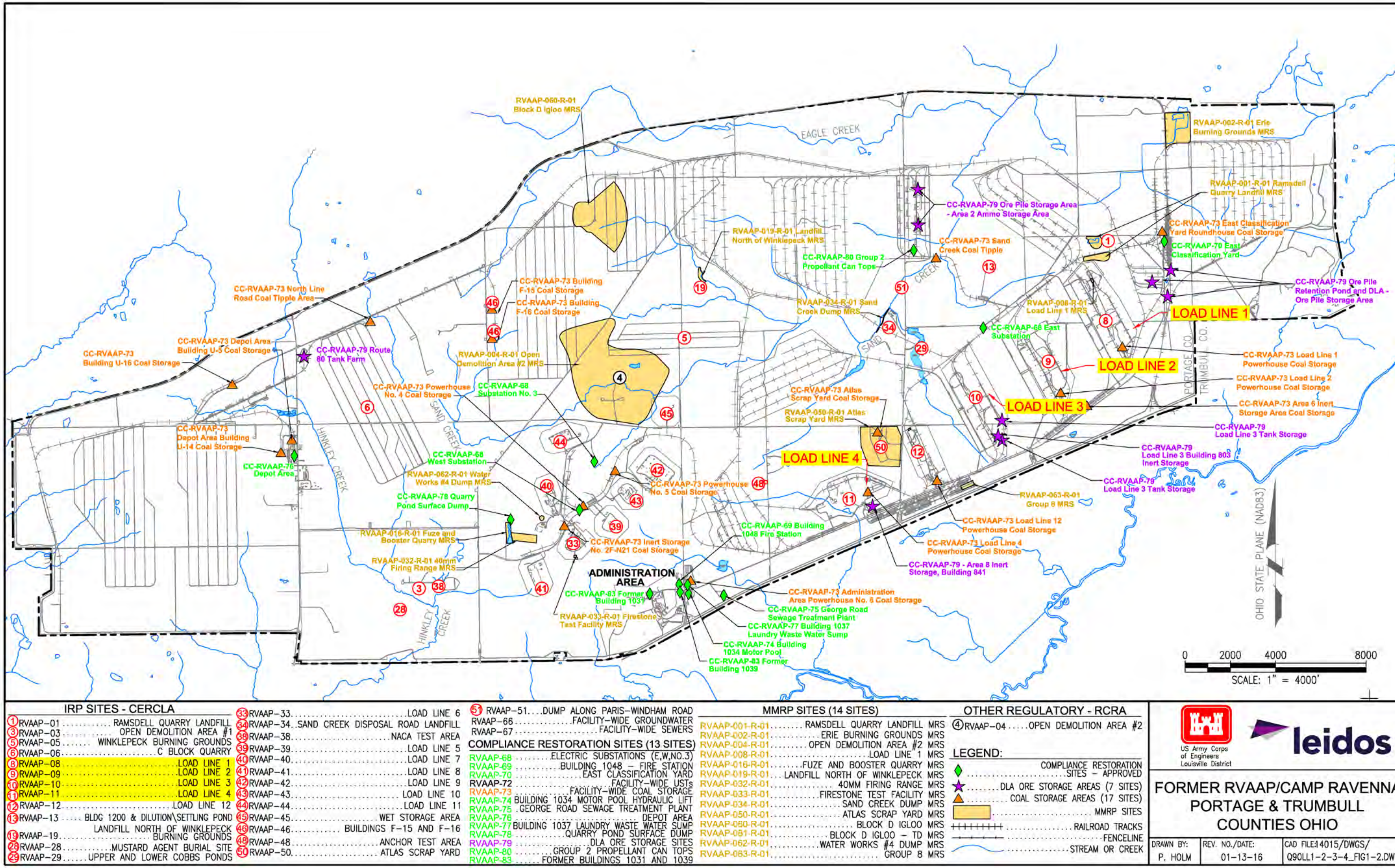


Figure 1-2. Location of Four RVAAP AOCs

THIS PAGE INTENTIONALLY LEFT BLANK.

The first step in completing the FS Addendum is the development of this SAP Addendum, which is composed of the following:

- Part I: Field Sampling Plan (FSP);
- Part II: Site Safety and Health Plan (SSHP); and
- Part III: Quality Assurance Project Plan (QAPP).

This FSP (Part I) contains the project-specific scope and objectives, sampling rationale, and proposed sample locations for each of the four AOCs being investigated. The SSHP (Part II) presents the potential hazards, project-specific staff organization, qualifications, responsibilities, training requirements, activity hazard analyses (AHAs), and monitoring requirements that may be encountered during the implementation of the SAP Addendum. The QAPP (Part III) presents the data quality objectives (DQOs) for field sampling, laboratory analysis, and reporting, which will provide results to be used in risk assessments presented in the FS Addendum Report. AOC-specific details are provided in Appendices A through D of this FSP.

1.2 FACILITY DESCRIPTION AND HISTORY

The facility, consisting of 21,683 acres, is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 kilometers (3 miles) east/northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (Figure 1-1). The facility, previously known as RVAAP, was formerly used as a load, assemble, and pack facility for munitions production. As of September 2013, administrative accountability for the entire acreage of the facility has been transferred to the U.S. Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site (Camp Ravenna). References in this document to RVAAP relate to previous activities at the facility as related to former munitions production activities or to activities being conducted under the restoration/cleanup program.

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 Line 12 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.

Other facilities at the former RVAAP include 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. Other types of AOCs present at the former RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

The former RVAAP received bulk TNT product during operational activities and did not manufacture/produce dinitrotoluene (DNT) or TNT. A facility where DNT is manufactured will have the following isomers of DNT in the finished product: 2,4-DNT; 2,6-DNT; 2,5-DNT; 3,4-DNT; 2,3-DNT; and 3,5-DNT. This is not applicable to the former RVAAP. Degradation of TNT to 2,4-DNT occurs in soil; however, 2,4-DNT and 2,6-DNT do not degrade to the lesser isomers. It is the Army's position that testing DNT isomers other than 2,4- and 2,6-DNT is unnecessary and has no additional value of being protective to human health and the environment at the former RVAAP (RVAAP 2013).

1.3 AREA OF CONCERN DESCRIPTION AND HISTORY

A detailed description of historical operations, potential contamination sources, and previous investigations and remediations for each AOC (Load Lines 1 through 4), along with a timeline that illustrates associated remedial and demolition activities, is presented in Appendices A through D.

2.0 PROJECT ORGANIZATION

The overall project organization and responsibilities for the RVAAP 2013 PBA for Environmental Investigation are presented in the Project Management Plan (Leidos 2014). Key personnel and subcontractors implementing this SAP Addendum are listed in Table 2-1. The functional responsibilities of these key personnel are described in Section 3.0 of the FWSAP.

Table 2-1. Project Organization for SAP Addendum

Position	Personnel
Leidos Project Manager	Vasu Peterson, P.E., PMP
Leidos Safety & Health Officer	Steve Lowery, CIH
Leidos QA/QC Officer	Kimberly Murphree
Leidos Field Operations Manager	Heather Adams, P.G.
Leidos Laboratory Coordinator	Rita Schmon-Stasik
Leidos Field Personnel	Rich Sprinzl Ryan Laurich Mike Reilly
Analytical Laboratory Services	Empirical Laboratories
Subcontractor Laboratory QA/QC Manager	Marcia McGinnity
Waste Disposal Services	EQ

CIH = Certified Industrial Hygienist
P.E. = Professional Engineer
P.G. = Professional Geologist
PMP = Project Management Professional
QA/QC = Quality Assurance/Quality Control
SAP = Sampling and Analysis Plan
Note: Subcontractors are subject to change if delays occur prior to field mobilization

THIS PAGE INTENTIONALLY LEFT BLANK.

3.0 SCOPE AND OBJECTIVES

The investigation-specific objectives have been developed using the DQO approach presented in the FWSAP. In addition, a meeting was held on January 5, 2016 with all stakeholders where the DQOs and scope for this project were finalized. Soil at Load Lines 1 through 4 and 12 will be addressed in an FS using existing data and all remaining data gaps for surface water and sediment at Load Lines 1 through 4 will be addressed through the project scope and objectives presented in Section 3.1. The general decision rules and DQOs for the data gap analysis are discussed in Section 3.2; AOC-specific sampling objectives and designs are presented in Appendices A through D for each AOC, detailing the numbers, types, and locations of samples to be collected to accomplish these objectives.

3.1 PROJECT SCOPE AND OBJECTIVES

The primary scope and objectives of this project are to:

- Complete a SAP Addendum that includes SSHP and QAPP Addendums and provides a data gap analysis and recommendations for additional sediment and surface water sampling;
- Present sampling procedures and locations for additional samples to be collected in support of the FS; and
- Conduct surface water and sediment sampling as needed at Load Lines 1 through 4 to fill data gaps required for the FS Addendum for each AOC.

Each AOC has previously undergone several investigations and remedial action decisions to characterize the nature and extent of contamination, as well as evaluate human and ecological health risks. Previous remediation activities, summarized in Appendices A through D, focused on addressing contamination for only the National Guard Trainee receptor. Two land uses and representative receptors to be considered during the FS include:

1. Unrestricted (Residential) Land Use – Resident Receptor (Adult and Child) [formerly called Resident Farmer]; and
2. Commercial/Industrial Land Use – Industrial Receptor [U.S. Environmental Protection Agency’s (USEPA) Composite Worker].

If an AOC fails to meet the Unrestricted (Residential) Land Use, then an FS will be completed that evaluates cleanup options for Unrestricted Land Use and Commercial/Industrial Land Use. Remedial alternatives for meeting each Land Use are to be evaluated per the current guidelines for selecting a remedy for the AOC.

The scope of this SAP Addendum includes human health and ecological screening evaluations and sampling activities to fully characterize and define the nature and extent of contamination in surface water and sediment at four AOCs listed in Section 1.1.

3.2 DATA GAP EVALUATION

The general decision rules that applied to the data gap evaluation for all AOCs are presented in the following section. Each AOC is proceeding through the CERCLA process individually and varies in regard to historical use, previous investigations, and data gaps. Therefore, the general decision rules are applied to each AOC individually to develop a specific sample design (provided in Appendices A through D for each AOC).

This section presents the procedure followed to complete the data gap analysis for surface water and sediment to determine areas that require additional evaluation to meet Unrestricted (Residential) Land Use criteria that will be presented in the FS Addendum Report. The following steps were followed in the data gap analysis procedure and are presented in detail below:

- Assemble all previously collected data stored in the RVAAP Environmental Information Management System (REIMS);
- Perform a data use assessment by reviewing all data to ensure that the medium sampled is still present and has not been impacted during remediation, and ensuring that the data approved for use meet the DQOs established for the data gap analysis;
- Identify AOC-specific chemicals of interest (COIs) that will be evaluated for this AOC, including the chemicals of concern (COCs) presented in the Interim Record of Decision (IROD) and historical Remedial Investigations (RIs) that evaluated the Residential Scenario;
- Perform the data screen on a sample-by-sample basis using the current residential remedial goal objectives (RGOs) (all media). The residential RGOs are the residential Facility-Wide Cleanup Goal (FWCUGs) at a target risk level of 1E-05 and a target hazard quotient (HQ) of 1;
- Perform a data screen on a sample-by-sample basis using the current ecological screening criteria followed by a weight-of-evidence (WOE) evaluation;
- Perform a detailed evaluation of each location that exceeds residential RGOs and/or ecological screening criteria to determine if nature and extent is defined to complete evaluation of land uses; and
- Recommend locations for additional sampling at locations where elimination of data gaps is required to complete development of remedial alternatives for the subsequent FS.

3.2.1 Data Assembly and Use Assessment

Data for characterizing the surface water and sediment for the FS Addendum were extracted from the REIMS database on May 5, 2014. Data were associated with a specific AOC by drawing a polygon around the AOC in a geographic information system (GIS) and selecting all points within the polygon. Data were selected spatially to ensure that all samples in the vicinity of the AOC were included regardless of the project for which they were collected. A list of all samples associated with each AOC was generated and the characteristics of each sample in the list were reviewed to determine if the sample was representative of that medium in the FS Addendum.

Sediment samples were categorized as wet or dry based on the following definition:

> *Unconsolidated inorganic and organic material on the surface of the ground that occasionally may be covered with water, usually following a precipitation event. Dry sediments are not covered with water for extended periods and typically are dry within seven days. Dry sediments do not function as permanent habitat for aquatic organisms although they may serve as a natural medium for the growth of terrestrial organisms. These sediments are essentially soil that due to its location may be covered with water occasionally.*

Based on this definition, dry sediment samples will be evaluated as "soil" samples and wet sediment samples will be evaluated as "sediment." Sediment and surface water samples associated with the Facility-Wide Sewer RI/FS were excluded from the dataset. However, sewer impacts to the surface water and sediment were evaluated as a potential source at Load Line 2, which was the only AOC with contamination requiring remediation for the Facility-Wide Sewer AOC.

Samples collected during the Phase I RI in 1996 were excluded due to the uncertainty in characterizing older samples subsequently supplemented with more robust investigations and characterization data. Only primary samples were used in the evaluation. Field duplicates and split samples were excluded from the evaluation as these samples were collected to satisfy the quality assurance (QA) requirements. Field screening results were excluded from the dataset because of the uncertainty associated with those results. The remaining data used for the evaluations in Appendices A through D are provided in the respective attachments to each AOC.

3.2.2 Determination of AOC-Specific Chemicals of Interest

The data gap analysis utilizes sample data for COIs only. COIs are defined in this report as the COCs identified in previous RIs or Records of Decision (RODs) for Unrestricted (Residential) Land Use.

3.2.2.1 Human Health COIs

The Phase II RIs completed for each of the four AOCs presented the results of human health screening evaluations that identified COCs exceeding residential screening criteria. These COCs were compiled for each medium under investigation in the FS Addendum and identified as COIs. The COIs selected for human health concern in the Phase II RIs to be further evaluated in this SAP Addendum are presented in Appendices A though D for each medium. Following screening, constituents exceeding criteria are carried through the data gap analysis as COIs requiring additional analysis.

Upon completion of data collection activities conducted as part of this SAP Addendum, all available chemical data, including newly acquired data, will be evaluated in the FS Addendum for each AOC.

3.2.2.2 Ecological COIs

The Phase II RIs completed for Load Lines 1 through 4 presented the results of ecological risk evaluations that identified chemical of ecological concern (COECs) or chemicals of potential ecological concern (COPECs). These COECs and COPECs were compiled for surface water and sediment and identified as COIs. The COIs selected for ecological concern in the Phase II RIs to be further evaluated in this SAP Addendum are presented in Appendices A though D for each medium. Following the ecological screening developed specifically to determine ecological data gaps (see Section 3.2.3.2), constituents exceeding criteria are carried through the data gap analysis as COIs requiring additional analysis.

Upon completion of data collection activities conducted as part of this SAP Addendum, all available chemical data, including newly acquired data, will be evaluated to determine COPECs in the FS Addendum for each AOC.

3.2.3 Data Screening

For this SAP Addendum, the determination of the nature and extent of contamination is accomplished by comparing existing analytical data for AOC-specific COIs to chemical-specific screening criteria. The screening criteria used in the data gap analysis for human health and ecological consideration are presented below.

3.2.3.1 Human Health Screening

The screening criteria used are the FWCUGs developed in the *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, RVAAP, Ravenna, Ohio* (USACE 2010a), herein referred to as the FWCUG Report. The chemical-specific FWCUGs at the 1E-05 cancer risk level and non-carcinogenic risk HQ using the 1.0 risk value are the specific screening criteria used in this SAP Addendum. The FWCUGs were used to determine which COIs and areas must be further evaluated to assess the nature and extent of contamination. The FWCUGs at these risk levels were developed in the FWCUG Report for multiple receptors. In order to ensure the nature and extent of contamination is defined to the most restrictive future receptor/land use, the screening criterion for each COI in each medium was the Resident (Adult and Child) FWCUG. It is assumed that the presence of concentrations at or less than their background value indicates the absence of contamination. If the screening criterion for an inorganic chemical was less than the background value, then the background value was used as the screening criterion for determining exceedances that need to be further investigated. In addition, if no FWCUG or background value was available, the USEPA Regional Screening Level (RSL) was used (USEPA 2014). The screening criteria values and their descriptions are presented in Appendices A through D.

In Appendices A through D, which detail the AOC-specific sampling approaches, all COIs detected in the existing data were compared to the screening criteria. If an existing sample result exceeds the screening criteria for any of the AOC-specific COIs and the exceedance is not currently bound (i.e., there is no sample less than the screening criteria to define the extent or source of contamination), then further extent delineation may be conducted during implementation of this SAP Addendum, as warranted. The use of the term “exceedance” within this SAP Addendum refers to a sample result that is greater than the screening criteria presented for one or more COIs. The human health screening results are presented in Appendices A through D.

3.2.3.2 Ecological Screening

In order to determine any potential data gaps from an ecological perspective for surface water and sediment at Load Lines 1 through 4, historical data were evaluated using the screening approach presented in this document. All detected concentrations of ecological COIs from applicable historical sediment samples were compared against sediment reference values (SRVs), background concentrations, and ecological screening values (ESVs) from the Guidance for Conducting Ecological Risk Assessments (Ohio EPA 2008). All detected surface water concentrations were compared against background concentrations and ESVs (i.e., the Outside Mixing Zone Average (OMZA) when available). Data from multiple samples collected over a 30-day period from a single location were not available to compare against the OMZA. It is assumed that the presence of concentrations at or less than their background value indicates the absence of contamination. If the screening criterion for an inorganic chemical was less than the background value (or SRV for sediment), then the background value (or SRV for sediment) was used as the screening criterion for determining exceedances that need to be further investigated. Those COIs with either exceedances or without any screening criteria were retained for further evaluation. Those COIs without any exceedances were eliminated from future sampling from an ecological perspective (note that this step in the Work Plan does not affect future COI screening in the ERA). Those COIs with exceedances were reviewed using the bullets below to make data gap sampling decisions:

- Compare maximum detected concentration and/or average detected concentration to SRVs (sediment only);
- Compared maximum detected concentration and/or average detected concentration to background (surface water and sediment);
- Eliminate essential nutrients;
- Eliminate non-toxic chemicals (i.e., nitrocellulose); and
- Evaluate magnitude of exceedances – those chemicals detected only slightly above screening values are not likely to trigger further sampling.

The ecological screening results are presented for each AOC in Appendices A through D.

3.2.4 Data Gap Analysis Media-Specific Decision Rules

The following section discusses the decision rules used in the data gap analysis of surface water and sediment. During previous investigations at Load Lines 1 through 4, surface water and sediment samples have been collected for characterization purposes. Since primarily discrete sediment samples have been collected, only discrete sediment samples are proposed as part of this SAP Addendum to support the human health and ecological evaluations identified from the human health and ecological screening completed in Appendices A through D.

The following general decision points and rationale were used to determine which AOCs required additional surface water or sediment sample collection in order to characterize the nature and extent of contamination to support the FS Addendum:

- The conceptual site models (CSMs) for each AOC were established for surface water and sediment in the historical RIs. The Phase II RI established aggregates and sample locations based on the ingress and egress points of the AOC (i.e., ditches or other runoff pathways) to characterize any potential migration of contaminants from the AOC. These same aggregates were used to evaluate media in this SAP Addendum.
- If a COI concentration exceeds the human health screening criteria, and a WOE could not be used to explain the exceedance, a new sample was proposed for only those COIs that exceeded the screening criteria.
- All COI concentrations that exceed the ecological screening criteria were assessed using a WOE evaluation. If WOE could not be used to explain the exceedance, a new sample was proposed for only those COIs that exceeded the screening criteria.
- All locations proposed for sampling will be evaluated for only the chemicals that exceeded the screening criteria.
- If no data are available, or existing data are deemed to be non-representative of current conditions, additional samples were proposed to be collected.
- At AOCs where a significant change (remediation or demolition) has occurred since the previous sampling, additional samples will not be collected because these actions are presumed to only improve the conditions.
- No new samples will be collected at AOCs where previous sampling satisfies data needs for definition of nature and extent.
- For AOCs without permanent water bodies, no surface water or sediment samples will be collected as there will not be adequate representative media. While ditches are present in these AOCs, they typically only contain water a small portion of the year and meet the definition of dry sediment. Samples collected within dry ditches are evaluated as soil.

Sediment and surface water sampling procedures are provided in Sections 4.1 and 4.2 respectively.

3.2.5 Chemical Parameters to Be Analyzed

The chemical parameters to be analyzed for each medium and individual samples are presented in the proposed sampling tables included in Appendices A through D. Parameters were chosen based on only those chemicals that exceeded the screening criteria. Proposed samples will be analyzed for only the chemicals summarized in Section 3.3 for each AOC. Full suite analysis will not be performed during the implementation of this SAP Addendum as each AOC has previously undergone full suite analyses under other investigations. AOC-specific COIs have been established and no new source areas are being investigated under these activities; therefore, the full suite evaluation is not warranted for this investigation.

3.3 PROPOSED SAMPLING SUMMARY

A summary of the proposed sampling presented in Appendices A through D is listed below for each AOC. Proposed sample location maps are located in each respective AOC appendix.

Load Line 1 Proposed Samples Summary:

- *Surface Water* – No additional surface water samples are recommended from a human health or ecological perspective.
- *Sediment* – Additional investigation is required at two aggregates, Outlet A & B Channel and Outlet C Channel and Charlie's Pond; a total of five discrete sediment samples are proposed. As specified in Table A-10 of Appendix A, the analyte list includes copper and lead.

Load Line 2 Proposed Samples Summary:

- *Surface Water* – No additional surface water samples are recommended from a human health or ecological perspective.
- *Sediment* – Additional investigation is required at two aggregates, Kelly's Pond and Exit Drainage; a total of three discrete sediment samples are proposed. As specified in Table B-10 of Appendix B, the analyte list includes 4-amino-2,6-DNT; beta-BHC; 2,4-DNT; endrin ketone; lead; polycyclic aromatic hydrocarbons (PAHs); silver; and 2,4,6-TNT. In addition, one sediment sample is proposed at the Kelly's Pond inlet to assess lead impacts from the upgradient Facility-wide Sewers source.

Load Line 3 Proposed Samples Summary:

- *Surface Water* – Additional investigation is required at Cobb's Pond Tributary. A total of two surface water samples are proposed with an analyte of manganese, as specified in Table C-9 of Appendix C.
- *Sediment* – Additional investigation is required at Cobb's Pond Tributary; a total of two discrete sediment samples are proposed. As specified in Table C-9 of Appendix C, the analyte list includes 4-amino-2,6-DNT; antimony; copper; iron; silver; 2,4,6-TNT; and zinc.

Load Line 4 Proposed Samples Summary:

- *Surface Water* – No additional surface water samples are recommended from a human health or ecological perspective.
- *Sediment* – No additional sediment samples are recommended from a human health or ecological perspective.

THIS PAGE INTENTIONALLY LEFT BLANK.

4.0 PROCEDURES AND METHODS

All field activities and sampling procedures will be accomplished in accordance with Section 5.0 of the FWSAP. Where changes or unique elements not addressed in the FWSAP have been identified, they are provided in this SAP Addendum. The general rationale for sample types, quantities, and locations is provided in Section 3.2; AOC-specific details (sample depths, location, and parameters to be analyzed) are presented in the proposed sample tables and figures in Appendices A through D.

4.1 SEDIMENT

Sediment samples will be collected as discrete samples using 10 aliquots per sample. Ten separate aliquots will be collected at random locations within an area with an approximate 5-ft radius to the same depth. These 10 aliquots will be composited in a stainless steel bowl using the same procedure as used to composite soil samples, then composited samples will be transferred to the appropriate sample container(s).

The aliquots for sediment samples will be collected using two possible methods. The trowel method (Section 5.6.2.2.1 of the FWSAP) will be used when the water depth above the sediment sample location is less than 6 inches. The hand core sampler method (Section 5.6.2.2.3 of the FWSAP) will be used when the depth of water above the sediment sample location is greater than 6 inches. In addition, at Load Line 2, the sample proposed for Kelly's Pond will be collected using a Ponar/Ekman Sampler from a boat, as presented in Section 5.6.2.2.2 of the FWSAP. Parameters to be analyzed vary by AOC (Appendices A through D). Duplicate QA and quality control (QC) split samples will be collected from the sample areas at the frequency listed in Section 4.5. No AOCs require volatile organic compounds (VOCs) analyses, so no special sample procedures for collecting VOCs apply to this investigation. Sediment samples will be collected after co-located surface water samples.

Equipment decontamination wash water will be stored in 55-gallon drums and managed as investigation-derived waste (IDW), as discussed in Section 7.0.

4.2 SURFACE WATER

Surface water samples will be collected in accordance with Section 5.7.2.1.1 of the FWSAP using the hand-held bottle method. Parameters to be analyzed vary by AOC (Appendices A through D). Field measurements will be performed in accordance with Section 5.4.3 of the FWSAP and will include the determination of pH, conductivity, dissolved oxygen, turbidity, and temperature. Surface water samples will be collected prior to co-located sediment samples. Duplicate QA and QC split samples will be collected from the sample areas at the frequency listed in Section 4.4.

4.3 SAMPLE COLLECTION FOR FIELD AND LABORATORY ANALYSIS

Sediment samples will be logged using the Unified Soil Classification System (USCS) classification.

4.3.1 Sampling for Chemical Analysis

Surface water and sediment samples will be analyzed only for those chemicals that exceeded screening criteria on an AOC-specific basis. Parameters are detailed for each AOC in the proposed sample tables in Appendices A through D. Samples will not be analyzed for the RVAAP full suite of parameters as these AOCs have previously undergone full suite analyses under other investigations. AOC-specific COCs have been established and no new source areas are being investigated under these activities; therefore, the full suite evaluation is not warranted for this investigation.

4.3.2 Sample Container Preservation Techniques

Sample container and preservation technique requirements will follow those prescribed in Table 5-1 of the QAPP Addendum.

4.4 FIELD QUALITY CONTROL SAMPLING PROCEDURES

QA/QC samples will be collected during the implementation of this SAP Addendum for the various AOCs. The field duplicate samples are to be submitted as "blind" to the laboratory and are used to determine whether the field sampling technique is reproducible and as an indicator of sample heterogeneity. Matrix spikes (MSs) and matrix spike duplicates (MSDs) will be used to verify the accuracy of the laboratory results. The QC sample will be sent to the laboratory under contract with Leidos. The QA split samples will be sent to an Army QA laboratory for independent analysis and evaluation of analytical results by the contracted laboratory. QC duplicate samples will be collected at a frequency of 10% (1 per 10 environmental samples) for each medium (surface water and sediment). MS/MSD samples will be collected at a rate of 5% (1 per 20) of the total samples per medium. QA split samples will be submitted to the USACE contract laboratory for independent analyses at a frequency of 10% (1 per 10). Duplicate and split samples will be collected from the same sampling station that equally represent the medium at a given time and location, selected on a random basis, and submitted for the same analyses as the environmental samples.

Different sampling equipment is anticipated for each medium proposed for sampling under this SAP Addendum. For each type of undedicated sampling equipment used, one rinsate blank will be collected per field cycle. A maximum of one rinsate blank sample will be collected per field cycle as indicated in the QAPP. Trip blanks will accompany all shipping containers containing aqueous VOC samples. The rinse blanks will be analyzed for the AOC-specific explosives, metals, pesticides, and PAHs that are being investigated.

One source blank will be collected from only the potable water source, which will be used for all potable wash and rinse water for equipment decontamination during the implementation of this SAP Addendum. Deionized/distilled (American Society for Testing and Materials [ASTM] Type I) water used for decontamination will not be sampled. The source blank will be analyzed for the AOC-specific explosives, metals, pesticides, and PAHs that are being investigated.

Section 4.0 of the Facility-wide QAPP summarizes QA/QC sampling requirements. Quantities of QA/QC samples to be collected for this investigation are presented in Table 2-1 of the QAPP Addendum.

4.5 DECONTAMINATION PROCEDURES

The decontamination procedure for non-dedicated sediment sampling equipment is described in Section 5.6.2.9 of the FWSAP. All non-dedicated equipment will be decontaminated at the completion of sampling activities at each sampling location. A final decontamination inspection of any equipment leaving Camp Ravenna at the end of field activities will be conducted to ensure proper decontamination.

4.6 SITE SURVEY

Following sampling activities, the horizontal coordinates of all sampling locations will be determined to within 0.3 m (1 ft). The ground elevations will be determined at the point of collection to within 0.06 m (0.2 ft). The coordinates and ground elevation for composited sediment sample areas will be determined from one point within the area.

All locations will be conveyed in Ohio State Plane Coordinates (North American Datum 1983 [NAD83]). The vertical datum for all elevations will be 1929 National Geodetic Vertical Datum (NGVD). All coordinates and elevations will be recorded on the boring logs upon receipt of QA survey results. In addition, electronic results will be provided to USACE and Camp Ravenna in ASCII format.

4.7 MUNITIONS AND EXPLOSIVES OF CONCERN CLEARANCE

Proposed sampling activities at Load Lines 1 through 4 are not located within munitions response sites (MRSs); therefore, munitions and explosives of concern (MEC) avoidance is not required for sediment and surface water sampling.

4.8 HUMAN HEALTH RISK ASSESSMENT

The FS Addendum Report will include an updated human health risk assessment (HHRA) for the COIs identified for each AOC in Appendices A through D (Load Lines 1 through 4). The HHRAs will be used to identify surface water and sediment COCs and locations recommended for further evaluation in the FS. The HHRAs will be conducted based on methods from the following guidance documents:

- Facility-Wide Human Health Risk Assessment Methodology (FWHHRAM) (USACE 2005b);
- FWCUG Report (USACE 2010a);
- Position Paper for Human Health Cleanup Goals (CUGs) (USACE 2012); and
- Technical Memorandum (ARNG 2014).

4.8.1 Data Use in the HHRA

The HHRAs will include both applicable historical data and data collected during this investigation. Exposure units (EUs) were identified under past efforts based on historic and current surface water flow directions and conveyances. The decision as to which samples to include in a specific exposure unit (EU) will be made in the FS (i.e., when demonstrating whether FWCUGs or other applicable standards are met in the EU). For example, if a more applicable sample is available to replace samples that were previously collected at a similar location, the more recent sample will be utilized.

4.8.2 Use of FWCUGs in the HHRA

The HHRA will utilize FWCUGs for the Resident and, if appropriate the National Guard Trainee, as revised by the Army using the most current toxicity values available at the time of FS. The HHRA also will utilize Commercial/Industrial RSLs for exposure to soil current at the time of the FS. RSLs are not available for a Commercial/Industrial receptor exposed to surface water and sediment. Commercial/Industrial screening levels will be calculated for these media using the RSL calculator assuming a nearby Commercial/Industrial receptor could be exposed to surface water and sediment at exposure rates similar to a recreator as defined in the RSL User's Guide current at the time of the FS. When residential FWCUGs at a target risk level of 1E-05 and target hazard index (HI) of 1 are used in the report, they will be referred to as RGOs.

4.9 ECOLOGICAL RISK ASSESSMENT

The FS Addendum Report will include an updated ecological risk assessment (ERA) for the COIs (identified as COPECs or COECs in previous ERAs) in surface water and sediment at each AOC in Appendices A through D (Load Lines 1 through 4).

The ERAs for surface water and sediment at Load Lines 1 through 4 will follow a unified approach of methods, integrating Army, Ohio EPA, and USEPA guidance. This ERA approach is consistent with the general approach by these agencies and primarily follows the Level I Scoping ERA, Level II Screening ERA, and Level III Baseline ERA outlined in the *Guidance for Conducting Ecological Risk Assessments* (Ohio EPA 2008), with specific application of components from the *RVAAP Facility Wide Ecological Risk Work Plan* (USACE 2003), *Risk Assessment Handbook Volume II: Environmental Evaluation* (USACE 2010b), and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997). The process that will be implemented in these ERAs combines these guidance documents to meet requirements of the Ohio EPA and Army, while following previously accepted methods established for RVAAP. This unified approach resulted from coordination between USACE and Ohio EPA during the summer of 2011 and follows that of the ERAs submitted for PBA08.

For applicable media (surface water and sediment) and COIs, a Level I Scoping ERA will be conducted for Load Lines 1 through 4. Level I will evaluate whether the AOC had past releases, the potential for current contamination, and if there are important ecological resources in or near the AOC. If an AOC has contaminants but lacks important ecological resources, the ERA process will stop at Level I. Contamination and important ecological resources must both be present to proceed to a Level II Screening ERA.

The Level II ERA will define habitats/environmental setting, suspected contaminants, possible pathways, and mechanisms for ecotoxicity and contaminant transport. A wetland evaluation will be conducted using the Ohio Rapid Assessment Method (ORAM; Ohio EPA 2001) for those AOCs requiring a Level II ERA. The Level II ERA will use both historical and new data to identify integrated COPECs, Step 3A will refine the list of integrated COPECs to determine if: 1) there are final COPECs requiring further evaluation in Level III or remediation to protect ecological receptors; or 2) integrated COPECs can be eliminated from further consideration. This section will apply and evaluate refinement factors to the integrated COPECs for the AOC. This evaluation is an important part of Level II and is adapted from USEPA Step 3A, outlined in the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997) and *Risk Assessment Handbook Volume II: Environmental Evaluation* (USACE 2010b). The evaluation and refinement factors used in Step 3A may include:

- Comparing the average (i.e., mean) concentration to the ESV;
- Comparing the mean concentration to the background concentration;
- Comparing the background concentration to the ESV;
- Evaluating the frequency of chemical occurrence relative to the ESV;
- Evaluating the magnitude of the ESV exceedance (ratio of ESV to chemical concentrations);
- Discussing Ohio EPA approved and preferred ESVs;
- Categorizing wetland quality inside the AOC;
- Evaluating geographical relationship of on-site wetlands to AOC exceedance area;
- Providing information about on-site migration of chemicals to on-site wetlands; and
- Evaluating off-site migration of chemicals at biological/water quality stations.

Various biological measurements of macroinvertebrates and fish, as well as chemical and physical measurements of surface water and sediment, were taken and assessed for evidence of upgradient and downgradient contamination at RVAAP from biological/water quality stations. These studies were published in the *RVAAP Facility-wide Biological and Water Quality Study* (USACE 2005a). The measurements taken at each station are sediment chemistry, surface water chemistry, fish community, benthic macroinvertebrate community, and habitat conditions. Applicable data from monitoring stations nearby the AOCs will be used.

THIS PAGE INTENTIONALLY LEFT BLANK.

5.0 SAMPLE CHAIN OF CUSTODY DOCUMENTATION

5.1 FIELD LOGBOOK

All field logbook information will follow structures identified in Section 6.1 of the FWSAP.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs during AOC-specific investigations is presented in Section 6.2 of the FWSAP. Representative photographs will be taken of the investigative measures during the fieldwork and any significant observations that are made during the field effort. Photographs will be suitable for presentation in a public forum, as well as for documenting scientific information. Attempts will be made when taking photographs to document sampling points to include two or more permanent reference points to facilitate relocating.

5.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the implementation of this SAP Addendum is outlined in Section 6.3 and Figure 6-3 of the FWSAP. Specific sample identifying information that will be used to implement the sampling scheme for this SAP Addendum is presented in Figure 5-1. Samples will be identified sequentially using the identification number system consistent with the RIs. If a sample is not collected or is reassigned to a different location, a specific reason and notation will be noted in the project field books.

5.4 SAMPLE DOCUMENTATION

All sample labels, logbook, field record, and field form information will follow structures identified in Section 6.0 of the FWSAP.

5.5 DOCUMENTATION PROCEDURES

Documentation and tracking of samples and field information will follow the series of steps identified in Section 6.5 of the FWSAP.

5.6 CORRECTIONS TO DOCUMENTATION

Any corrections to documentation will follow guidance established in Section 6.6 of the FWSAP.

Sample Station Location Identification: XXXmm-NNN(n)-####-tt

XXX = Area Designator
LL1 = Load Line 1
LL2 = Load Line 2
LL3 = Load Line 3
LL4 = Load Line 4

mm = Sample Location Type
sw = Surface Water sd = Sediment

NNN = Sequential Sample Location Number
Unique, sequential number for each sample location beginning with the following number from the last number used from previous investigation stations and extending into any subsequent investigative phases (i.e., 001-999)

(n) = Special Identifier
Optional use (as needed) to identify special sample matrices or sample location characteristics

= Sequential Sample Identification Number
Unique, sequential number for each sample at a sampling location (i.e., 0001-9999)

tt = Sample Type
SW = Surface Water
TB = Trip Blank SD = Sediment
FB = Field Blank
ER = Equipment Rinsate

Figure 5-1. Sample Identification System

6.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample packaging and shipping shall generally follow Section 7.0 of the FWSAP.

THIS PAGE INTENTIONALLY LEFT BLANK.

7.0 INVESTIGATION-DERIVED WASTE

All IDW, including personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids, will be properly handled, labeled, characterized, and managed in accordance with Section 8.0 of the FWSAP and waste guidance provided in the *Update to Procedures to Follow as Related to the RVAAP Restoration Program due to the Accountability Transfer of the Remaining Property from BRACD to the ARNG/OHARNG* letter dated 2 April 2014, included as Appendix E. At the conclusion of field activities for the project, a letter report will be submitted to USACE and the Army National Guard (ARNG)/OHARNG documenting the characterization and classification of the wastes. The Ohio EPA is no longer required to review and approve IDW reports prior to disposal, but information regarding IDW will be included in the monthly report required to be submitted under the DFFOs. Upon approval of the IDW classification report, all solid and liquid IDW will be removed from the site and disposed of by a licensed waste disposal contractor. All shipments of IDW off site will be coordinated through the OHARNG restoration representative.

The following two types and estimated quantities of IDW are anticipated:

- Decontamination fluids, including those derived from decontamination of sampling equipment (estimated one 55-gallon drum and two small containers of spent chemical rinse agents [e.g., acid, alcohol]); and
- Expendables/solid wastes, including PPE and disposable sampling equipment (estimated two 55-gallon drums).

Each of the types of IDW will be contained separately. Characterization and classification of the different types of IDW will be based on the specific protocols described below. Expendable solid waste will be not sampled for characterization purposes. Excess sediment is not anticipated.

Decontamination fluids will be placed in drums. Disposition of decontamination liquid will be based on the collection and analysis of toxicity characteristic leaching procedure (TCLP) liquid sample(s).

Decontamination fluids will be staged at the identified location within secondary containment structures. To avoid potential drum rupture due to freezing conditions, drums containing liquid will be filled only to 75% capacity.

THIS PAGE INTENTIONALLY LEFT BLANK.

8.0 REFERENCES

ARNG (Army National Guard-ILE Cleanup, U.S. Army) 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage /Trumbull Counties, Ohio (Tech Memo).* (Memorandum between ARNG-ILE Cleanup and the Ohio Environmental Protection Agency; dated 4 February 2014.)

Leidos 2014. *Final Project Management Plan for the 2013 Performance-Based Acquisition of Supplemental Remedial Investigation/Feasibility Studies for Multiple Areas of Concern, Ravenna Army Ammunition Plant, Ravenna, Ohio*. Prepared for the USACE, Louisville District. June 2014.

Ohio EPA (Ohio Environmental Protection Agency) 2001. Ohio Rapid Assessment Method for Wetlands v. 5.0, User's Manual and Scoring Forms. Division of Surface Water, 401/Wetland Ecology Unit. February 2001.

Ohio EPA 2004. Director's Final Findings and Orders (DFFO) for RVAAP, dated June 10, 2004.

Ohio EPA 2008. *Guidance for Conducting Ecological Risk Assessments.* Division of Emergency Response and Revitalization. Revised April 2008.

Ohio EPA 2014. *Difference Between Incremental or Multi-Increment (MI) Sampling and Composite Sampling*. Ohio EPA Technical Guidance Compendium VA30007.14.002. August 2014.

RVAAP (Ravenna Army Ammunition Plant) 2013. *DNT Isomers, RVAAP-66 Facility-wide Groundwater, Ravenna Army Ammunition Plant, Ravenna, Ohio.* Memorandum from Mark Patterson, RVAAP Facility Manager to Eileen Mohr, Ohio EPA. March 25, 2013.

USACE (U.S. Army Corps of Engineers) 2003. *RVAAP Facility Wide Ecological Risk Work Plan.* April 2003.

USACE 2005a. *Facility-Wide Biological and Water Quality Study*. November 2005.

USACE 2005b. *RVAAP Facility-Wide Human Health Risk Assessors Manual – Amendment 1*. December 2005.

USACE 2010a. *Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, RVAAP, Ravenna, Ohio*. March 2010.

USACE 2010b. *Risk Assessment Handbook Volume II: Environmental Evaluation. December 2010.*

USACE 2010c. *Final Work Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 and Other Areas of Concern at the Ravenna Army Ammunition Plant (RVAAP) Ravenna, Ohio.* July 2010.

USACE 2011a. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations, RVAAP, Ravenna, Ohio*. February 2011.

USACE 2011b. *Facility-Wide Safety and Health Plan for Environmental Investigations, RVAAP, Ravenna, Ohio*. February 2011.

USACE 2012. *Final (Revised) United States Army Corps of Engineers Ravenna Army Ammunition Plant (RVAAP) Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals.* February 2012.

USACE 2013. *Revised Performance Work Statement for USACE, Louisville District Contract No. W912QR-12-D-0020, Delivery Order No. 0008.* Issued to Leidos LLC on July 3, 2013

USACE 2014*. Performance-Based Acquisition 2013 Contract Modification 0001 Scope of Work. USACE,* Louisville District Contract No. W912QR-12-D-0020, Delivery Order No. 0008. Issued to Leidos LLC on February 21, 2014.

USEPA (U.S. Environmental Protection Agency) 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. Solid Waste and Emergency Response.* EPA 540-R-97-006. June 1997.

USEPA 2014. *Regional Screening Levels for Chemical Contaminants, Region 9.* http://www.epa.gov/region09/superfund/prg/. Last updated November 2014.

APPENDIX A
LOAD LINE 1 (RVAAP-08)

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
bgs	Below Ground Surface
BHHRA	Baseline Human Health Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOPC	Contaminant Migration Chemical of Potential Concern
COC	Chemical of Concern
COI	Chemical of Interest
CUG	Cleanup Goal
DNT	Dinitrotoluene
EPC	Exposure Point Concentration
ESV	Ecological Screening Value
FFS	Focused Feasibility Study
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
FWCUG	Facility-Wide Cleanup Goal
HI	Hazard Index
HMX	Octahydro-1,3,5,7-Tetranitroi-1,3,5,7-Tetrazocane
ISM	Incremental Sampling Method
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MI	Multi-Increment
mm	Millimeter
MRS	Munitions Response Site
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PBT	Persistent, Bioaccumulative, and Toxic
PCB	Polychlorinated Biphenyl
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SESOIL	Seasonal Soil Compartment Model

ACRONYMS AND ABBREVIATIONS (continued)

SRV	Sediment Reference Value
SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Compound
TNB	Trinitrobenzene
TNT	Trinitrotoluene
2,4,6-TNT	2,4,6-trinitrotoluene
TR	Target Risk
µg/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
WOE	Weight-of-Evidence

A.0 LOAD LINE 1 (RVAAP-08)

This appendix presents the information and data evaluated to identify data gaps in surface water and sediment that will require additional sampling at Load Line 1 to be performed under this Sampling and Analysis Plan (SAP) Addendum. New data generated from the proposed activities presented in this appendix will be incorporated into the Feasibility Study (FS) Addendum Report. This appendix describes the area of concern (AOC) and presents historical investigation summaries, data gap screening results for surface water and sediment for human health and ecological receptors, and recommendations for additional surface water and sediment sampling. Specific procedures to be followed to complete these assessments are included in the Field Sampling Plan (FSP) (Part I) of the SAP Addendum and are not repeated through this appendix.

A.1 AREA OF CONCERN DESCRIPTION

Load Line 1 is located in the southeastern portion of the facility and was in operation from 1941 until 1971. From 1941 through 1945 and from 1951 to 1957, Load Line 1 was used to melt and load trinitrotoluene (TNT) and Composition B explosives into large-caliber shells, which took place at the major melt pour buildings (CB-4 and CB-4A). From 1941 to 1945, Load Line 1 produced 26,770,822 ammunition shells and 2,536,950 projectiles, and from 1951 to 1957, Load Line 1 produced 7,642,166 cartridges, shells, and charges. From 1947 to 1949, demilitarization projects occurred at Load Line 1. In 1949, the TNT washout plant and debanding equipment were moved from Load Line 1 to Load Line 12.

From 1950 to 1952, Load Line 1 reclaimed cartridge bases for reuse. Sulfuric acid, sodium orthosilicate, chromic acid, and alkali were used in the annealing process. From 1961 to 1967, Load Line 1 was the site of munitions rehabilitation activities and the demilitarization of 500,000 90mm projectiles. During this time, Buildings CB-13 and CB-14 were used for activities such as dismantling, replacing components, and repainting mines. In 1965 and 1966, Load Line 1 was used for demilitarizing propellant charges and cartridges. In 1973 and 1974, demilitarization operations on 455,475 90mm cartridges occurred at the load line. The melt out operation for the cartridges was conducted at Load Line 12. Wash-down water and wastewater from the load line operations were collected in concrete sumps; pumped through sawdust filtration units; and discharged to the unlined settling ponds, Charlie’s Pond, and Criggy’s Pond. The Load Line 1 dilution/settling ponds were in operation from 1941 to 1971. Water from the settling ponds was discharged to a surface stream (Sand Creek) that exited the installation. Load Line 1 was rehabilitated in 1951 to remove and replace soils contaminated with accumulated explosives and to remove and replace waste water lines.

All buildings and structures at Load Line 1 have been demolished. The Power House No. 1 Facility-Wide Coal Storage (shown on Plate A-1) located at former Building CC-1 is covered under the Compliance Restoration Program as site CC-RVAAP-73 and the Military Munitions Response Program is covered under RVAAP-008-R-01. Both AOCs are currently undergoing separate investigation; therefore, they are not included in the SAP Addendum.

Each building formerly located at Load Line 1 is presented below with a summary of its historical use and potential contamination source description. Former production buildings are included in Table A-1, and the non-production buildings are listed in Table A-2.

Table A-1. Former Production Buildings at Load Line 1

Production Buildings		
Building ID	**Purpose**	**Description of Potential Sources**
CA-6	Explosive Preparation Building	Used to screen bulk TNT flake prior to transport to the melt pour building. A washout collection tank was located adjacent to building (west) for pinkwater collection.
CA-6A	Explosive Preparation Building	Used to screen bulk TNT flake prior to transport to the melt pour building. A washout collection tank located adjacent to building for pinkwater collection.
CA-28	Elevator Machine House	Takes screened TNT from Building CA-6 and transports to CB-4 for melt pour operations.
CA-28A	Elevator Machine House	Takes screened TNT from Building CA-6A and transports to CB-4A for melt pour operations.
CB-4	Melt Load Building	Located in the production area, this building was a primary melt pour building for explosives. Contamination was noted to be prevalent around doorways, drains, and vacuum pumps.
CB-4-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes pulled from the melt pour building.
CB-4-WN	Washout Annex	Concrete settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
CB-4-WS	Washout Annex	Concrete settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
CB-4A	Melt Load Building	Located in the production area, this primary melt pour building was for explosives. Contamination was noted to be prevalent around doorways, drains, and vacuum pumps.
CB-4A-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes pulled from the melt/pour building.
CB-4A-WN	Washout Annex	Concrete settling tanks adjacent to Building 4A to containerize explosives washout water (pinkwater).
CB-4A-WS	Washout Annex	Concrete settling tanks adjacent to Building 4A to containerize explosives washout water (pinkwater).
CB-10	Drilling and Assembly Building/Boostering Building	Utilized for booster installation and assembly during WWII. During the Vietnam War, this building was used for munitions rehabilitation, which included dismantling, replacing, and repairing munitions. Contamination, including explosives and propellants, was identified around this building.
CB-10-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes pulled from the boostering building (CB-10).
CB-10-VP2	Vacuum Pump House	The vacuum pump was associated with handling process wastes pulled from the boostering building (CB-10).
CB-10-VP3	Vacuum Pump House	The vacuum pump was associated with handling process wastes pulled from the boostering building (CB-10).

Table A-1. Former Production Buildings at Load Line 1 (continued)

Production Buildings		
Building ID	**Purpose**	**Description of Potential Sources**
CB-13	Packing and Shipping Building	During WWII, CB-13 was utilized as a booster installation building. From 1961-1967, it was utilized as a munitions rehabilitation building. During this time, it was used for demilitarizing primers. During the RIs, bulk propellant pellet contamination was observed adjacent to the building popping furnace at CB-13.
CA-14	Propellant Charge Building	During WWII, CA-14 was utilized for final stages of munitions work (load-assemble-pack operations). From 1961-1967, this building was utilized as a munitions rehabilitation building for the demilitarizing primers. During the RIs, bulk propellant pellet contamination was observed.
CA-17	Propellant Charge Receiving/Smokeless Powder Building	During WWII, CA-17 was utilized for the final stages of munitions work (load-assemble-pack operations) for propellant pellets into ammunition. It also was used as a munitions rehabilitation building/demilitarization processing area from 61-67.
CB-3	Shell Receiving and Painting Building	Used for munitions painting operations.
CB-2	Paint and Oil Storage Building	Utilized for solvent storage.
CB-801	Inert Storage Building	Utilized for storage, potentially vehicle maintenance.

ID = Identification.
RI = Remedial investigation.
TNT = Trinitrotoluene.
WWII = World War II.

Table A-2. Former Non-Production Buildings at Load Line 1

Non-Production Buildings	
Building ID	**Purpose**
CA-21	TNT Box Building
CA-16	Primer Service Building
CA-5	Ammonium Nitrate Service Building
CA-7	TNT Service Area
CB-11	Fuse Service Building
CB-13-A	Car Barricade
CB-13-B	Shipping Warehouse Annex
CB-19	Electric Locomotive Service Building
CB-20	Small Tool Storage Building
CB-25	Shell Carrier Washout Building
CB-4B	Conveyor Drive Building
CB-9	Booster Service Building
CC-1	Power House
SD-2	Sewage Ejector Station
T-4801	Boiler House
WH-25	Well House
WH-26	Well House
WH-27	Well House
WH-86	Well House
WH-87	Well House
WH-88	Well House

Table A-2. Former Non-Production Buildings at Load Line 1 (continued)

Non-Production Buildings	
Building ID	**Purpose**
WW-1	Pump and Filter Station
WW-1A	Filtered Water Reservoir
WW-21	Elevated Water Tank
1-51	Clock Alley
1-51-A	Load Line Office
CB-12	Change House
CB-8	Change House
CB-22	Change House
CB-23	Change House
CA-15	Change House

ID = Identification. TNT = Trinitrotoluene.

A.2 PREVIOUS INVESTIGATIONS, DECISIONS, AND ACTIONS

Since 1978, Load Line 1 has been the subject of multiple investigations and/or assessments leading to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decisions and/or remedial actions at the AOC. CERCLA activities completed at Load Line 1 are presented in the following report summaries and in the timeline illustrated on Figure A-1. These 18 reports present extensive evaluations and remedial activities performed to address contaminated media, including assessments at each of the former buildings listed in Tables A-1 and A-2.

A.2.1 Installation Assessment of Ravenna Army Ammunition Plant

In 1978, the *Installation Assessment of Ravenna Army Ammunition Plan* (USATHAMA 1978) incorporated a review of historical operational information and available environmental data to assess the potential for contaminant releases from operational facilities. The installation assessment presented quantities of munitions produced, amounts of chemicals utilized, and waste produced at each load line. No sampling, investigation, or actions were performed at Load Line 1 as part of the assessment. The assessment concluded that no sampling was presently required for AOC exit pathways or surface water bodies and additional action may be warranted.

A.2.2 Preliminary Assessment for the Characterization of Areas of Contamination

In 1996, the *Preliminary Assessment for the Characterization of Areas of Contamination* [herein referred to as the preliminary assessment (PA)] (USACE 1996) was developed following the requirements of CERCLA and provided information concerning conditions at CERCLA AOCs at the Ravenna Army Ammunition Plant (RVAAP) to assess potential contamination risks posed to human health and the environment. The assessment provided a narrative of the facility history and process operations and a description of activities conducted at each of the AOCs. According to the PA, waste constituents at Load Line 1 included TNT; octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocane; Composition B; lead; chromium; mercury; and arsenic. Primary contaminant release mechanisms were process effluent discharges to surface water and process building wastewater washout to surface soils.

Figure A-1. Timeline of Remedial Activities at Load Line 1

THIS PAGE INTENTIONALLY LEFT BLANK.

Characterization data from previously completed sampling for groundwater and sediment were included as part of the PA; no additional sampling or investigative actions were completed. Waste constituents TNT and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) were detected in sediments from the ditch receiving discharge from the pinkwater sawdust filtration units, and heavy metals were detected in groundwater.

The report provided a PA scoring, subsequent prioritization of AOCs through evaluation of exposure pathways, and a relative risk site evaluation model. Load Line 1 was ranked as a high-priority AOC for future environmental investigations due to the primary contaminant release mechanism from process effluent discharges to surface water and surface soil.

A.2.3 Phase I Remedial Investigation

A *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (herein referred to as the Phase I Remedial Investigation [RI]) (USACE 1998) was conducted at Load Line 1 from July through August 1996. During this investigation, surface soil and ditch sediment sampling was completed. A total of 51 surface soil samples were collected as part of the Phase I RI. Forty-eight surface soil samples were collected and analyzed for explosives. Fifty surface soil samples were analyzed for metals. Twelve of the surface soil samples were analyzed for RVAAP full suite analysis, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs). Twenty-two sediment samples were collected at Load Line 1 and analyzed for explosives and metals. A total of 3 of the 22 sediment samples also were analyzed for VOCs, SVOCs, pesticides, and PCBs. The conclusions of the Phase I RI categorized Load Line 1 as a “high-priority” AOC due to elevated concentrations of explosives, inorganic chemicals, and organic chemicals throughout soil and sediment at the AOC, and a Phase II RI was recommended (USACE 1998).

A.2.4 Sampling of Potential Disposal Areas at Load Line 1 and Load Line 2

Surface soil sampling was conducted in November 1999 to characterize potential demolition debris disposal areas and to evaluate their suitability for use as fill areas for clean, solid demolition debris from the load line (USACE 2000). Samples were collected at the four change-out buildings (CB-8, CB-12, CB-22, and CB-23) and analyzed for Target Analyte List metals and explosives. A total of 3 of the 17 samples collected also were analyzed for propellants, VOCs, SVOCs, pesticides, and PCBs. Depth to bedrock at Load Line 1 was very shallow, and most samples did not exceed 0.5 ft below ground surface (bgs) due to bedrock refusal. Results from sampling indicated 14 metals were detected above background at Load Line 1. In addition to inorganic chemicals, 11 SVOCs, two VOCs, two pesticides, and PBC-1254 were detected from the change-out buildings at Load Line 1.

A.2.5 Phase II Remedial Investigation

The *Phase II Remedial Investigation Report for the Load Line 1* (herein referred to as the Phase II RI) (USACE 2003) evaluated the nature and extent of process-related contaminants in surface and subsurface soil, sediment, surface water, and groundwater, and assessed the potential risk to human health and the environment resulting from former operations at Load Line 1.

A total of 324 environmental samples were collected to determine the nature and extent of surface soil contamination at Load Line 1. A total of 37 discrete subsurface soil samples were collected across the AOC to assess vertical migration. No explosives or propellants were detected in samples collected from the perimeter area of the AOC, indicating that there are no additional source areas exterior to the main production area and no significant migration of contamination from the major production areas to soil within the outlying areas of the load line. A total of 36 sediment samples were collected from six drainage channels that exit the AOC, Charlie's Pond, Criggy's Pond, the North Area Channel, and off-AOC locations. Metals, polycyclic aromatic hydrocarbons (PAHs), PCBs, and explosives were detected in sediment samples collected as part of the Phase II RI. Seven surface water samples within the AOC were collected as part of the investigation. Explosives and metals were detected in surface water samples at the AOC. No SVOCs, VOCs, PCBs, or pesticides were detected in surface water (USACE 2003). A baseline human health risk assessment (BHHRA) and screening ecological risk assessment were completed as part of the Phase II RI. Recommendations of the Phase II RI included completing an FS to evaluate possible remedial actions at Load Line 1.

Data from eight sediment samples and three surface water samples from the Phase II RI Report (USACE 2003) were incorporated into the FS Addendum dataset. Samples collected in the off-AOC channel were not included in this evaluation due to their location and potential to be impacted by other AOCs.

A.2.6 Supplemental Baseline Human Health Risk Assessment for Load Line 1 Alternative Receptors

The supplemental BHHRA (USACE 2004a) was conducted to evaluate and document risks and health hazards to humans associated with contaminated media at Load Line 1 for future use scenarios. The supplemental BHHRA was completed to supplement the BHHRA presented in the Phase II RI (USACE 2003) and reflects land use changes made by the Ohio Army National Guard (OHARNG) in 2004. No samples were collected as part of the assessment. The report identifies chemicals of potential concern, calculates risks and hazards, identifies chemicals of concern (COCs), and calculates remedial goal options (RGOs) to generate conclusions regarding human health risks and hazards associated with contaminated media at Load Line 1 for National Guard receptors, recreational receptors, and residential receptors (USACE 2004a).

A.2.7 Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4

The *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4* Report (USACE 2004b) documented the proposed land use and corresponding risk-based RGOs to support the remedial alternative selection process in the *Focused Feasibility Study for the Remediation of Soils at Load*

Lines 1 through 4 [herein referred to as the focused feasibility study (FFS)] (USACE 2005b). Environmental sample collection or remedial actions were not completed under this task.

A.2.8 Final November 2004 Sampling Completion Report

Sampling was completed in November and December 2004 for delineating the horizontal and vertical extent of contamination at the AOC. Some identified data gaps were not fully addressed as part of the additional data gap sampling due to manganese concentrations continuing to exceed the established RGO. As part of this data gap sampling event, sampling ceased following three step-outs of 10 ft per step-out, confirming that a COC was not a random detection or when manganese was detected in concentrations less than 2,000 mg/kg (USACE 2005a). Data from this report were incorporated into the FFS and are presented as Appendix B of the FFS.

A.2.9 Focused Feasibility Study for Soils at Load Lines 1, 2, 3, and 4

The FFS presented the remedial alternatives for surface soil, subsurface soil, and dry sediment at Load Lines 1 through 4. Additional data from the 2004 perceived data gap investigation (USACE 2005b) also were incorporated into the FFS. The recommended interim remedy, based on a detailed analysis of the feasible remedial alternatives to address surface soil, subsurface soil, and dry sediment contamination at Load Line 1, was excavation with off-site disposal. This alternative was recommended due to expediency, permanency, consistency with future land use, moderate relative cost, feasibility, and implementability (USACE 2005b). Environmental sampling and remedial actions were not completed as part of the FFS.

A.2.10 Interim Record of Decision for Soil at Load Lines 1, 2, 3, and 4

In 2007, the U.S. Army Corps of Engineers (USACE) developed the *Interim Record of Decision for the Remediation of Soils at Load Lines 1 through 4* (USACE 2007) to address chemical exposure in soil and dry sediment. The selected remedy was chosen in accordance with the requirements of CERCLA. The selected remedy for surface soil, subsurface soil, and dry sediment that were currently accessible at Load Lines 1 through 4 with concentrations of chemicals exceeding RGOs was excavation and off-site disposal. The selected remedy was recommended as part of the FFS, documented in the Proposed Plan, received public acceptance during the public comment period, and received state acceptance from the Ohio Environmental Protection Agency (Ohio EPA). The Interim Record of Decision (ROD) and selected remedy was jointly signed by the U.S. Army Division of Base Realignment and Closure (BRAC) and Ohio EPA in the summer of 2007.

A.2.11 Remedial Action Completion Report for Soils and Dry Sediments

Remedial action excavation activities occurred at Load Lines 1 through 4 from August to November 2007 (USACE 2008). A total of 539 tons of hazardous (PCB-contaminated) soils and 3,126 tons of non-hazardous soils were removed from Load Line 1. The maximum depth of the excavation was to 3 ft bgs; however, most excavations were typically to 2 ft bgs. A total of 51 discrete areas were excavated within Load Line 1. After the excavation was completed, 57 multi-increment (MI) samples, including quality assurance/quality control samples, were collected and analyzed for Load Line 1 COCs: PCB-1254, benzo(a)pyrene, TNT, RDX, propellants, aluminum, antimony, arsenic, hexavalent chromium, lead, and manganese.

As part of the planned remedial action, concrete slabs were to remain in place and periodic monitoring of the concrete slab integrity was to be completed. A post-ROD change to the concrete slab maintenance task for Load Lines 1 through 4 was initiated by USACE and BRAC in late 2007. BRAC commenced slab and foundation removal in March 2008 at Load Lines 1 through 4, eliminating the need for routine maintenance directed in the selected remedy.

After remedial activities were complete, the Ohio EPA also indicated that "the physical remedial action of soil and dry sediment removal has been completed in accordance with the intents and provisions of the Interim ROD for Load Lines 1-4" (Ohio EPA 2008).

A.2.12 Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers

The *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (herein referred to as the Facility-Wide Sewers RI/FS) (USACE 2012) evaluated the nature and extent of process-related contaminants in sewer sediment, surface water, and outfalls, and assessed the potential risk to human health and the environment resulting from former operations at Load Line 1. As part of the RI, field investigative activities included conducting visual survey inspections of sanitary and storm sewer structures (i.e., manholes, drop inlets, catch basins, and outfalls); performing video camera surveys of select sewer lines; and collecting sewer sediment, sewer water, pipe bedding, outfall sediment, and outfall water samples using discrete methods. No remedial actions were recommended for sewers and outfalls at Load Line 1.

Data collected during the Facility-Wide Sewers RI/FS activities are excluded from the FS Addendum data screen, as the sewers media data are currently being evaluated as part of the Facility-wide Sewers AOC.

A.2.13 Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations

Removal of buildings down to the floor slab at Load Line 1 was completed in 2007. Removal of the floor slab and associated foundation walls was completed in May 2009. Plastic covers were placed at select building footprints with high potential for contamination within two days of slab removal to minimize potential infiltration of water through exposed soil areas and the movement of potentially contaminated soil.

As part of this investigation, 486 field screening grab samples were collected beneath all building slabs at Load Line 1 and field-screened for the explosives TNT and RDX (USACE 2010a). The analytical data were compared to facility-wide cleanup goals utilized in the *Sampling and Analysis of*

Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations Report (USACE 2010a), and no additional areas for remediation were identified based on the results of the incremental sampling method (ISM) sampling.

A.2.14 Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4

The *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations* Report (USACE 2010a) analyzed soils to a maximum depth of 3.5 ft bgs. This study was performed to sample and characterize deeper subsurface soils beneath the former building slabs via subsurface soil ISM techniques. Additional surface soil ISM samples in the former coal storage area at Load Line 1 were collected and analyzed to provide preliminary data for future RIs. The Power House No. 1, Facility-Wide Coal Storage (CC-RVAAP-73), is located at the northeast corner of former Building CC-1 and is currently undergoing investigation; therefore, it is not included in the SAP Addendum.

Of the 30 total surface soil MI (or ISM) samples collected as part of the 2009 investigation at Load Line 1, 7 were analyzed for metals, 26 for explosives, 5 for SVOCs, 4 for pesticides and PCBs, and 3 for VOCs. Metals, explosives, propellants, pesticides, PCBs, and VOCs were not detected above the cleanup goals (CUGs) utilized in the *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4* (herein referred to as the 2011 Sampling Report) (USACE 2011a) in any of the samples collected from the buildings at Load Line 1. Some SVOCs were detected.

Of the 53 subsurface soil ISM samples collected as part of the 2010 investigation at Load Line 1, 24 were analyzed for metals, 38 for explosives, 11 for SVOCs, 12 for VOCs, and 6 for PCBs and pesticides. Metals, pesticides, PCBs, and VOCs were not detected above CUGs from the 2011 Sampling Report in any of the samples collected from the buildings at Load Line 1. Some explosives, SVOCs, and propellants were detected.

A.2.15 Remediation Completion Report for Sub-Slab Soils at RVAAP-08 Load Line 1

Based on the conclusions and recommendations of the *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations* Report (USACE 2010a), remedial activities consisting of excavation and off-site disposal of contaminated surface and subsurface soils were completed in 2010 at Buildings CB-4A/CB-4AWS and CB-4/CB-4WN. A removal area estimated to be 20x20x5 ft was removed at each building location. A total of 175 cubic yards of soil were removed at Building CB-4/CB-4WN and 184 cubic yards were removed at Building CB-4A/CB-4AWS.

Six ISM confirmation samples collected in 2010 at the buildings indicated that no further areas required remediation (USACE 2011b). All excavated areas were backfilled with clean fill and restored to OHARNG specifications.

A.2.16 Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12

Additional characterization sampling was completed at Load Line 1 to guide future soil remedial and administrative measures. The samples collected as part of this investigation helped eliminate soil data gaps recognized in the *Land Use Control Assessment Report* (USACE 2010b). A total of 15 subsurface soil horizontal ISM samples (five from each depth: 1–3, 3–5, and 5–7 ft bgs) were collected at Load Line 1 to further refine ISM sample areas that had levels of contamination above CUGs utilized as part of the *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12* [herein referred to as the Characterization Sampling Report (USACE 2013)], to conduct ISM sampling on soil where previous discrete samples exceeded these CUGs, and to provide approved analytical documentation for backfill sources.

Conclusions of this soil investigation indicated the area requiring remediation was reduced, several previous ISM areas exceeding CUGs identified in this report were further delineated, and one ISM area was not fully delineated for PCBs.

A.2.17 Final Construction Completion Report for Closure for Clean Hard-Fill Sites RVAAP-08 Site CB-23 and Site CB-22 on Load Line 1 and George Road

Three sites located within Load Line 1 at three former change house buildings (CB-12, CB-22, and CB-23) were utilized to store clean hard fill from Former RVAAP building demolition and removal operations at Load Line 12 and Load Line 1. The scope of this project was to close the CB-22 and CB-23 clean hard fill sites.CB-22 and CB-23 were constructed 15–20 ft below grade and were filled to surrounding grade with a mixture of brick and concrete clean hard fill materials. Each site is approximately 0.5 acres.

Closure of the sites commenced in June 2013 and included concrete processing, installing geo-textile fabric, and installing soil cover consisting of verified clean fill dirt and topsoil. Site restoration activities concluded in October 2013 (USACE 2014a).

A.2.18 Remedial Investigation Report for RVAAP-008-R-01 Load Line 1 Munitions Response Site

Results for the RI Report indicated no munitions and explosives of concern or munitions debris were found on the ground or within shallow soils at the Load Line 1 munitions response site (MRS) (USACE 2014b). No explosive hazard is anticipated to be present at the MRS. Munitions constituents, including lead and nitroguanidine, were identified as site-related contaminants in discrete and ISM samples collected from the MRS. These chemicals were not retained as chemicals of potential concern and, therefore, are not retained as COCs. Resident Receptor Unrestricted Land Use was achieved for munitions constituents. The RI determined that the Load Line 1 MRS has been adequately characterized and data quality objectives have been achieved. A no further action ROD is recommended as the next course of action.

A.3 DATA GAP ASSESSMENT

The rationale for developing and using the data gap analysis is presented in Section 3.2 of the SAP Addendum FSP. This section presents only information specific to Load Line 1 that was used in the data gap analysis of surface water and sediment. The conclusions of the data gap analysis present areas that require further investigation to define the nature and extent of contamination at source areas that will be evaluated in the FS Addendum. The following steps were used to generate the data and screening criteria for the data gap analysis.

A.3.1 Data Assembly and Use Assessment – Load Line 1

All data collected at Load Line 1 were extracted from the RVAAP Environmental Information Management System database. This includes data from investigations summarized in the *Phase II Remedial Investigation Report for the Load Line 1* (USACE 2003).

The surface water and sediment data from investigations summarized in the following reports were not used in the data gap analysis:

- *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (USACE 1998) – [These data are more than 16 years old and are no longer considered representative of the site (e.g., buildings and slabs have been removed and/or remediated)].
- *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (USACE 2012) – (The sewers are currently being evaluated under a separate RI).

Once the data were assembled and evaluated for use, they were screened for chemicals of interest (COIs) specific to Load Line 1 surface water and sediment.

A.3.2 Chemicals of Interest – Load Line 1

The rationale for developing and using COIs is presented in Section 3.2.2 of this SAP Addendum FSP. Load Line 1 COIs were developed from the chemicals identified as exceeding residential risk in the Phase II RI Report (USACE 2003) and *Supplemental Baseline Human Health Risk Assessment for Load Line 1 Alternative Receptors* (USACE 2004a). Load Line 1 COIs for exposure of Resident Receptor (Adult and Child) to sediment and surface water are shown in Table A-3. The COIs of potential ecological concern for surface water and sediment are listed in Table A-5.

Table A-3. COIs in Soil, Surface Water, and Sediment at Load Line 1

COI	Load Line 1	
	Surface Water	Sediment
Metals		
Antimony	X	X
Arsenic	X	X
Lead	X	X
Manganese	X	X
Explosives		
2,4,6-TNT	X	X
2,4-DNT	X	X
2,6-DNT	X	X
RDX	X	X
PCBs		
PCB-1254	X	X
Pesticides		
Dieldrin	X	X
PAHs		
Benz(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Dibenz(a,h)anthracene	X	X
Indeno(1,2,3-cd)pyrene	X	X

COI = Chemical of interest.
DNT = 2,4-Dinitrotoluene.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
2,4,6-TNT = 2,4,6-Trinitrotoluene.
X = COI present in medium.

A.3.3 Screening Criteria – Load Line 1

The residential screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.3 of the SAP Addendum FSP. The human health screening criteria [hazard index (HI) =1, target risk (TR) of 1E-05] values and sources are presented in Table A-4 for surface water and sediment specific to Load Line 1. The ecological screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2 of the SAP Addendum FSP. Table A-5 presents the ecological screening criteria used for surface water and sediment specific to Load Line 1.

Table A-4. Human Health Screening Criteria for Surface Water and Sediment at Load Line 1

Chemical[a] (mg/kg or mg/L)	Surface Water	Type[b]	Sediment	Type
Antimony	0.0491	RC	28.2	RC
Arsenic	0.011	RA	19.5	BKG
Lead	0.015	TB	400	RSL
Manganese	6.326	RC	2,927	RC
2,4,6-Trinitrotoluene	0.0782	RC	36.5	RC
2,4-Dinitrotoluene	0.0199	RA	7.53	RA
2,6-Dinitrotoluene	0.0213	RA	3.6	RSL
RDX	0.155	RA	80.3	RC
Benz(a)anthracene	0.000136	RA	2.21	RA
Benzo(a)pyrene	0.000008	RA	0.221	RA
Benzo(b)fluoranthene	0.000079	RA	2.21	RA
Dibenz(a,h)anthracene	0.000005	RA	0.221	RA
Indeno(1,2,3-cd)pyrene	0.000078	RA	2.21	RA
Dieldrin	0.000017	RSL	0.558	RC
PCB-1254	0.00313	RC	1.2	RC

[a] Chemicals listed are chemicals of concern for Resident (Adult and Child) Receptors in respective media.
[b] Type:

BKG = Background.
RA = Resident Adult Facility-Wide Cleanup Goal (FWCUG) for hazard quotient (HQ)=1 or Risk=10^{-5}.
RC = Resident Child FWCUG for HQ=1 or Risk=10^{-5}.
RSL = U.S. Environmental Protection Agency (USEPA) Residential Soil or Tap Water Screening Level for HQ=1 or Risk=10^{-5}.
TB = Technology-based screening level.

mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table A-5. Ecological Screening Criteria for Surface Water and Sediment at Load Line 1

Chemical[a]	Surface Water (mg/L)	Type[b]	Sediment (mg/kg)	Type[b]
Arsenic	NA		25	SRV
Cadmium	NA		0.99	MacDonald et al.
Chromium	NA		43.4	MacDonald et al.
Copper	NA		32	SRV
Iron	2.56	BKG	NA	
Lead	0.12	OMZM	47	SRV
	0.0064	OMZA		
Manganese	0.391	BKG	NA	
Mercury	NA		0.18	MacDonald et al.
Nickel	NA		33	SRV
Zinc	NA		532	BKG
1,3,5-Trinitrobenzene	NA			None
1,3-Dinitrobenzene	NA		0.00861	USEPA Reg 5
2,4-Dinitrotoluene	NA		0.0144	USEPA Reg 5
2,6-Dinitrotoluene	NA		0.0398	USEPA Reg 5
Acenaphthene	NA		0.00671	USEPA Reg 5
Anthracene	NA		0.0572	MacDonald et al.
Benz(a)anthracene	NA		0.108	MacDonald et al.
Benzo(a)pyrene	NA		0.15	MacDonald et al.
Benzo(b)fluoranthene	NA		10.4	USEPA Reg 5
Benzo(ghi)perylene	NA		0.17	USEPA Reg 5
Benzo(k)fluoranthene	NA		0.24	USEPA Reg 5
Bis(2-ethylhexyl)phthalate	1.1	OMZM	NA	
	0.0084	OMZA		
Chrysene	NA		0.166	MacDonald et al.
Di-n-butyl phthalate	NA		1.11	USEPA Reg 5
Dibenz(a,h)anthracene	NA		0.033	MacDonald et al.
Dibenzofuran	NA		0.449	USEPA Reg 5
Fluoranthene	NA		0.423	MacDonald et al.
Fluorene	NA		0.0774	MacDonald et al.
Indeno(1,2,3-cd)pyrene	NA		0.2	USEPA Reg 5
Naphthalene	NA		0.176	MacDonald et al.
Phenanthrene	NA		0.204	MacDonald et al.
Pyrene	NA		0.195	MacDonald et al.
4,4'-DDE	NA		0.00316	MacDonald et al.
Endrin	NA		0.00222	MacDonald et al.
PCB-1254	NA		0.0598	MacDonald et al.
gamma-Chlordane	NA			None

[a] Chemicals listed are chemicals of potential ecological concern in respective media.
[b] Type:
BKG = Background.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
None = No ecological screening value available.
SRV = Sediment reference value.
USEPA Reg 5 = USEPA 2003.

DDE = Dichlorodiphenyldichloroethylene.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable because the analyte was not a chemical of interest for that medium.
OMZA = Outside Mixing Zone Average.
OMZM = Outside Mixing Zone Maximum.
PCB = Polychlorinated biphenyl.

A.4 SURFACE WATER AND SEDIMENT EVALUATION

A.4.1 Surface Water and Sediment Screening Results

COI concentrations detected in surface water and sediment samples identified for use in the dataset were screened against the human health and ecological criteria presented in Section A.3.3 on a sample-by-sample basis. The results are presented in Attachment 1 of this appendix. Samples that exceeded the human health screening criteria are summarized in Tables A-6 and A-7 for surface water and sediment, respectively. Samples that exceeded the ecological screening criteria are summarized in Tables A-8 and A-9 for surface water and sediment, respectively. Locations where chemicals exceed screening criteria are shown in bold font. A detailed discussion of surface water and sediment exceedances is presented in Sections A.4.2.1 and A.4.2.2 for human health and ecological receptors, respectively, on a contaminant source-by-source basis.

Table A-6. Human Health Screening Exceedances for Surface Water at Load Line 1

	Chemical	**Arsenic**
	Screening Criteria	**0.011**
	Criteria Source	**RA**
Sample ID	**Date**	**Concentration (mg/L)**
LL1sw-059-1070-SW	09/15/2000	**0.031***

***Bold indicates sample exceeds screening criteria.**
ID = Identification.
mg/L = Milligrams per liter.
RA = Resident Adult.

Table A-7. Human Health Screening Exceedances for Sediment at Load Line 1

		Chemical	**Arsenic**
		Screening Criteria	**19.5**
		Criteria Source	**BKG**
Sample ID	**Date**	**Depth (ft)**	**Concentration (mg/kg)**
LL1sd-396-1049-SD	09/17/2000	0 - 0.5	**28.7***
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	**37.1***
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	**37.9***

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = Feet.
ID = Identification.
mg/kg = Milligrams per kilogram.

Table A-8. Ecological Screening Exceedances for Surface Water at Load Line 1

	Chemical	Iron	Manganese
	Screening Criteria	2.56	0.391
	Criteria Source	BKG	BKG
Sample ID	Date	Concentration (mg/L)	Concentration (mg/L)
LL1sw-059-1070-SW	09/15/2000	**10.4***	**0.51***
LL1sw-320-1074-SW	09/14/2000	**2.9***	**1.4***
LL1sw-320-1094-SW	11/06/2000	2.3	**1.1***

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ID = Identification.
mg/L = Milligrams per liter.

A.4.2 Characterization of Surface Water and Sediment

The Phase II RI Report (USACE 2003) established surface water and sediment data aggregates at Load Line 1 by evaluating historic and current surface water flow directions and conveyances. This data gap evaluation uses the same data aggregates that were presented and approved in the Phase II RI as follows:

- North Area Channel;
- Outlets A and B Channel;
- Outlet C Channel and Charlie's Pond;
- Outlets D, E, F Channels and Criggy's Pond; and
- Off-AOC Channel (not evaluated in this assessment).

Surface water and sediment aggregates are shown in Figure A-2. The Phase II RI established a complete evaluation of surface water and sediment based on historic receptors. These same data aggregates are revaluated in the SAP Addendum to establish any required action needed to meet the current receptors identified in the Technical Memorandum (ARNG 2014).

Historically, surface water has only been collected at the Outlet C Channel and Charlie's Pond and Outlet D, E, F, and Criggy's Pond aggregates. Therefore, surface water data for this evaluation are only available for these two aggregates. Sediment samples data are available for all the aggregates.

A.4.2.1 <u>Human Health, Surface Water, and Sediment Screening Evaluation</u>

For human health screening purposes, the surface water and sediment COI data are screened against the most conservative criteria presented in Table A-4 to identify any locations that may require additional investigation. Sample locations that had COIs exceeding screening criteria and the chemicals and concentrations that exceeded are shown on Figure A-3.

Table A-9. Ecological Screening Exceedances for Sediment at Load Line 1

		Chemical	Arsenic	Cadmium	Copper	Lead	Nickel
		Screening Criteria	25	0.99	32	47	33
		Criteria Source	SRV	MacDonald et al.	SRV	SRV	SRV
Sample ID	Date	Depth (ft)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	9.4	**1.1***	23.2	**50.1 J***	20.7
LL1sd-070-1054-SD	9/17/2000	0 - 0.5	11.1	**1.7***	30.1	**73.3***	17.3
LL1sd-396-1049-SD			**28.7***	<0.61 U	15.4	32.9	15.4
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	**37.1***	0.72 J	**227***	25	**53***
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	**37.9***	0.25 J	**63.5***	21.2	21.6

***Bold indicates sample exceeds screening criteria.**
ft = Feet.
ID = Identification.
J = Estimated.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
mg/kg = Milligrams per kilogram.
SRV = Sediment reference value.
U = Not detected.

THIS PAGE INTENTIONALLY LEFT BLANK.

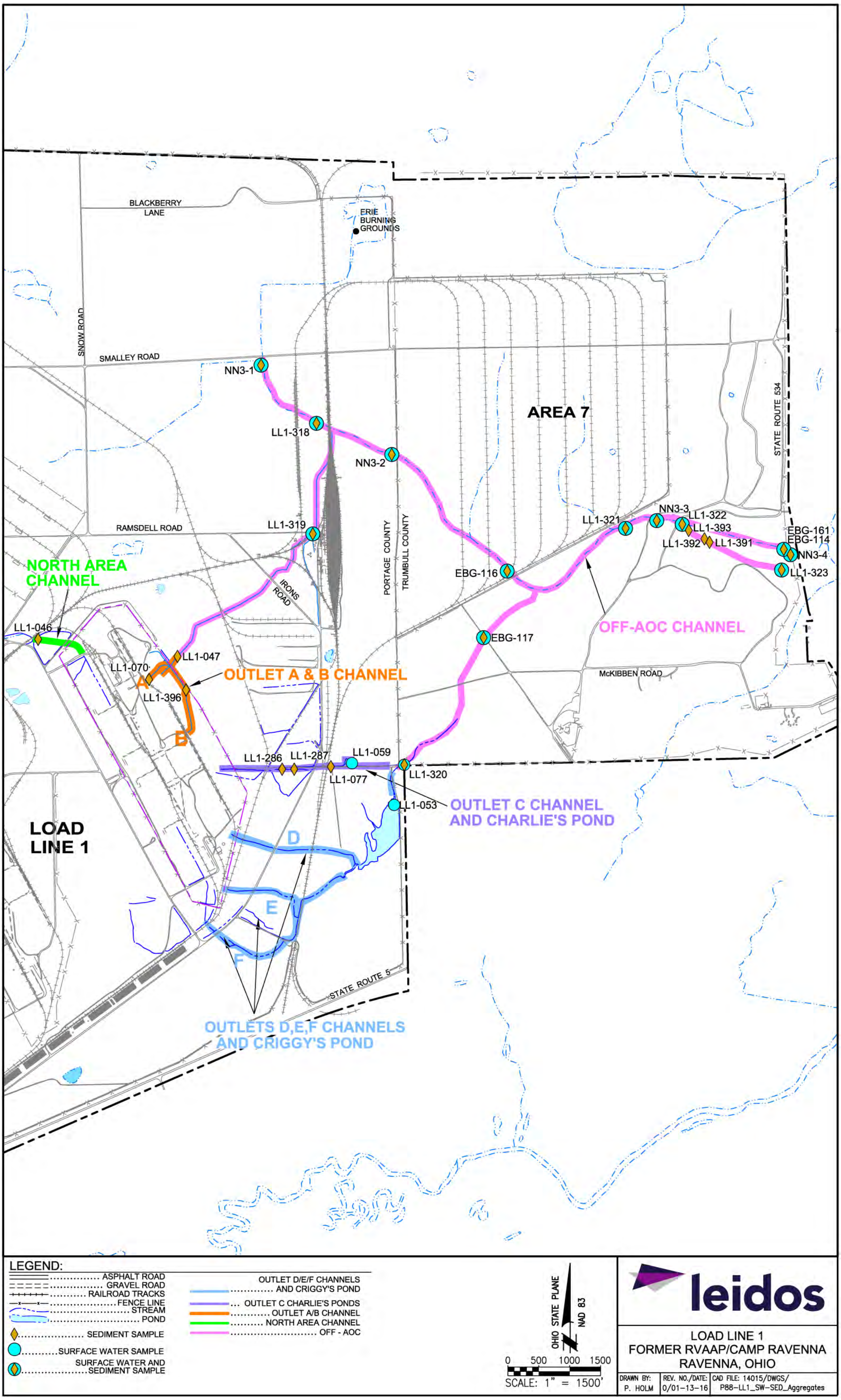


Figure A-2. Surface Water and Sediment Aggregates at Load Line 1

THIS PAGE INTENTIONALLY LEFT BLANK.

Only one surface water exceedance was observed for arsenic at one sample location within the Outlet C Channel and Charlie's Pond aggregate, just east of Charlie's Pond. All other surface water samples within the Load Line 1 aggregates are below screening criteria of HI=1, TR of 1E-05. Arsenic concentrations in source media at Load Line 1 (soil and sediment) are generally near and attributable to background. No source of arsenic has been identified at Load Line 1. Arsenic will be evaluated further using a qualitative weight-of-evidence (WOE) evaluation. Therefore, no new sample is recommended for evaluating human health impacts from arsenic in surface water at Load Line 1.

Sediment COI exceedances were only observed at two aggregates: Outlets A and B Channel, and Outlet C Channel and Charlie's Pond; arsenic is the only chemical that exceeds human health screening criteria. All other sediment samples within the Load Line 1 aggregates are below screening criteria of HI=1, TR of 1E-05. These arsenic sediment exceedances (28.7 mg/kg at the Outlets A and B Channel aggregate and 37.9 mg/kg at the Outlet C Channel and Charlie's Pond aggregate) indicate arsenic above screening criteria but near and attributable to background. Therefore, no new samples are recommended for evaluating human health impacts from arsenic in sediment at Load Line 1.

A.4.2.2 <u>Surface Water Ecological Screening Evaluation</u>

For ecological screening purposes, the surface water and sediment COI data were screened against criteria presented in Table A-5 to identify any locations that may require additional investigation. Sample locations that had COIs exceeding screening criteria and that were not eliminated through WOE evaluation are shown on Figure A-3 with chemical exceedance concentrations.

Outlet C Channel and Charlie's Pond – In surface water, only iron and manganese detections exceeded the ecological screening value (ESV) (Table A-8). However, the average iron concentration was only about twice the ESV (5.2 mg/L versus 2.56 mg/L). The average manganese concentration was slightly above background (1 mg/L versus 0.391 mg/L).

***Outlet D, E, F Channels and Criggy's Pond* –** There are no surface water exceedances in this aggregate (Attachment 1, Table 3).

Based on the surface water screening results above, collecting additional surface water samples is not warranted. There were no surface water exceedances in the Outlet D, E, F Channels or Criggy's Pond aggregate. The iron and manganese exceedances in the Outlet C Channel and Charlie's Pond aggregate were limited.

A.4.2.3 <u>Sediment Ecological Screening Evaluation</u>

***North Area Channel* –** In sediment, there were no exceedances (Figure A-3). The only persistent, bioaccumulative, and toxic (PBT) chemical detected was mercury but at a level below the Ohio sediment reference value (SRV) and its ESV.

THIS PAGE INTENTIONALLY LEFT BLANK.

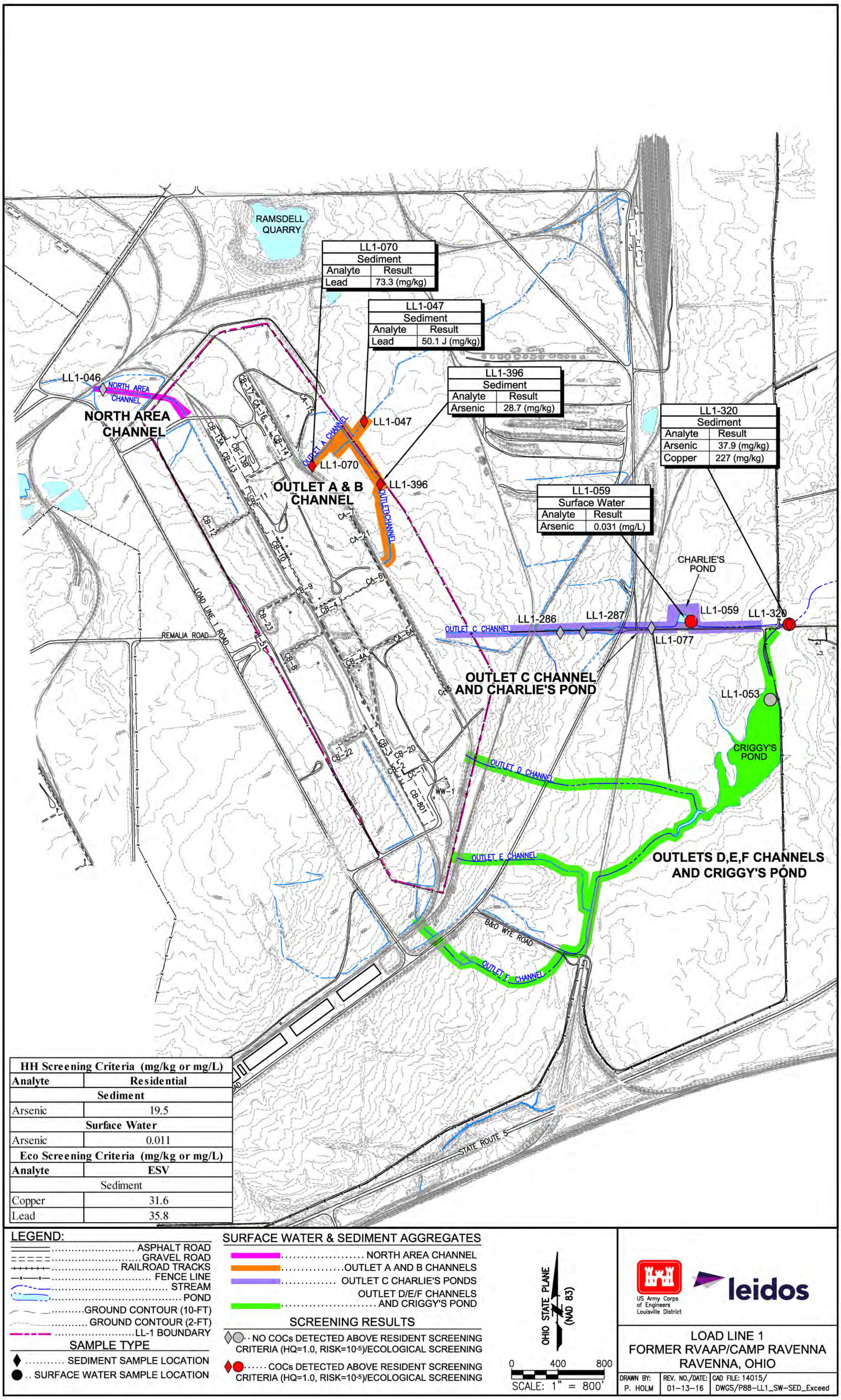


Figure A-3. Screening Results for Surface Water and Sediment at Load Line 1

THIS PAGE INTENTIONALLY LEFT BLANK.

Outlet C Channel and Charlie's Pond – Three metals (arsenic, copper, and nickel) had exceedances in sediment (Figure A-3). The average concentration of arsenic was below the Ohio SRV and just above background. The average nickel concentration was below the Ohio SRV and just above the ESV. The average copper concentration exceeded the Ohio SRV, background value, and ESV. The only PBT chemical detected was mercury but at an average concentration below the Ohio SRV, background value, and its ESV.

Outlets A and B Channel – Three metals (arsenic, cadmium, and lead) had exceedances in sediment. The average concentration of arsenic was below the Ohio SRV and background value but above the ESV. The average cadmium concentration (1.04 mg/kg) was just above the Ohio SRV (0.79 mg/kg) and the ESV (0.99 mg/kg). The average lead concentration exceeded the Ohio SRV, background value, and the ESV. The only PBT chemical detected was mercury but at an average concentration below the Ohio SRV and its ESV.

Based on the sediment screening results above, collecting additional sediment samples is not warranted in the North Area Channel aggregate. Additional sediment sampling is recommended for the other two aggregates to determine current levels of copper (Outlet C Channel and Charlie's Pond) and lead (Outlets A and B Channel) and whether soil remediation may have caused a decline in sediment concentrations.

A.4.3 Proposed Sediment Sample Locations for Load Line 1

Based on the human health and ecological screening evaluations, additional sediment sampling within Load Line 1 is only recommended for two aggregates (Outlets A and B Channel and Outlet C Channel and Charlie's Pond) to support the nature and extent evaluation of chemicals of ecological concern, as presented in Table A-10. This table presents the proposed sample identifications, type including sample depth intervals, coordinates for proposed sample locations, and the analytes collected for each sample. The locations may be altered during implementation of the SAP Addendum for various reasons. The final coordinates of the sample locations (including elevations) will be presented in the RI/FS Addendum Report. Figure A-4 illustrates the proposed sediment sample locations to be collected during implementation of the SAP Addendum. The general approach for investigation activities is presented in the SAP Addendum FSP.

Table A-10. Proposed Sediment Sampling Locations at Load Line 1

Aggregate	Sample ID	Sample Type (ft bgs)	Easting	Northing	Analytes
Outlets A and B Channel	LL1sd-731-0001-SD LL1sd-732-0001-SD LL1sd-733-0001-SD	Discrete Sediment (0-1)	2376797.68 2376957.58 2376544.90	564876.84 565045.78 564739.49	Lead
Outlet C Channel and Charlie's Pond	LL1sd-734-0001-SD LL1sd-735-0001-SD	Discrete Sediment (0-1)	2379778.19 2380380.79	563161.88 563182.23	Copper

bgs = Below ground surface.
ft = Feet.
ID = Identification.

THIS PAGE INTENTIONALLY LEFT BLANK.

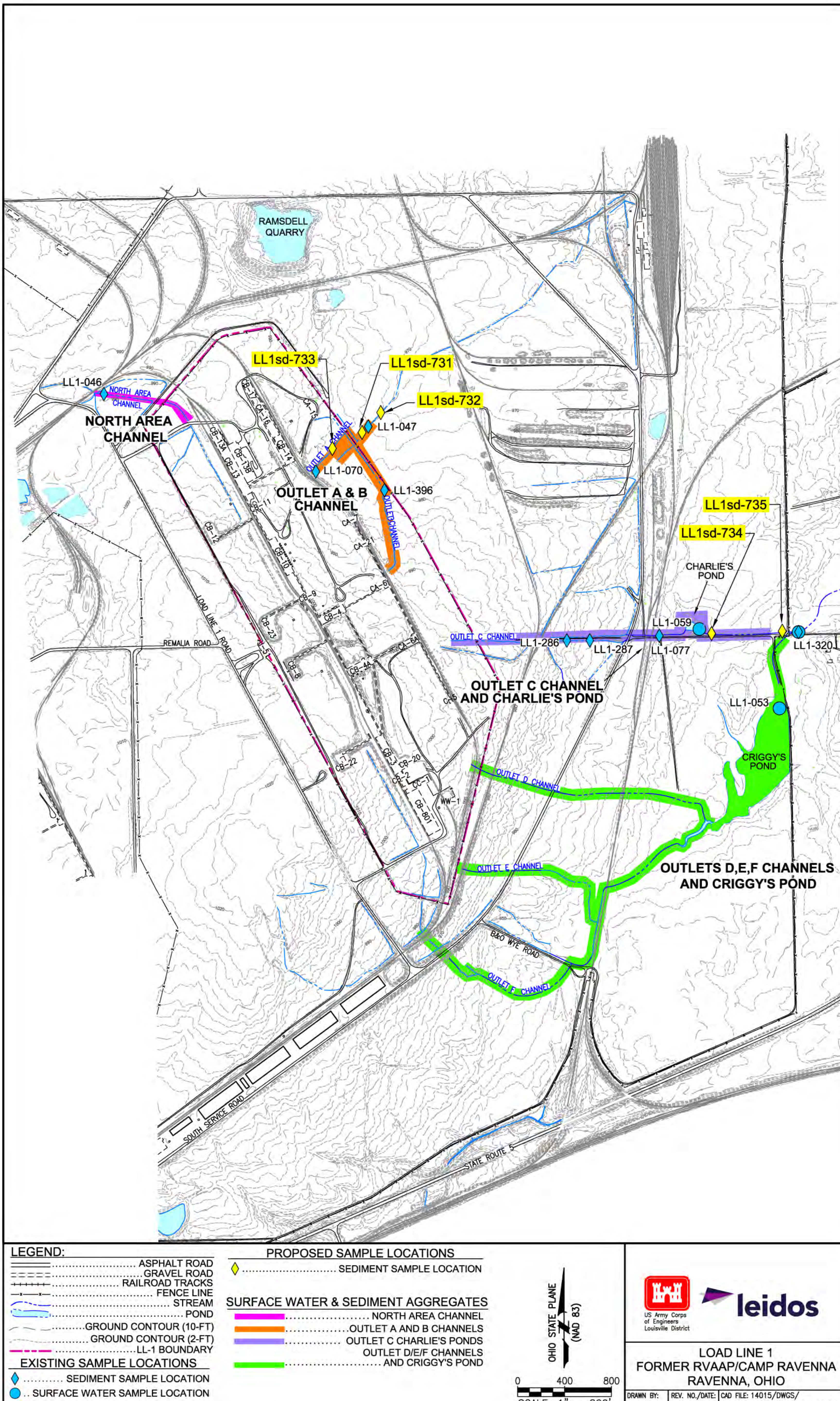


Figure A-4. Proposed Sediment Sample Locations at Load Line 1

THIS PAGE INTENTIONALLY LEFT BLANK.

A.5 REFERENCES

Army National Guard-ILE Cleanup, U.S. Army (ARNG) 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio*. Memorandum between ARNG-ILE Cleanup and the Ohio Environmental Protection Agency. Dated 4 February 2014.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger 2000. "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems." *Arch. Environ. Contam. Toxicol*. 39, 20-31. 2000.

Ohio Environmental Protection Agency (Ohio EPA) 2008. Email correspondence from Ms. Eileen T. Mohr, Ohio EPA Facility Coordinator, to Mr. Dave Cobb, Shaw Project Manager, dated April 14, 2008, regarding acceptance of LL1ss-29 excavation for PCBs. April 2008.

Ohio EPA 2014. Division of Surface Water. Ohio Administrative Code, Chapters 3745-1, 3745-2, (Ohio River Basin). Accessed November 2014.

U.S. Army Corps of Engineers (USACE) 1996. *Preliminary Assessment for the Characterization of Areas of Contamination Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 1996.

USACE 1998. *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern at the Ravenna Army Ammunition Plant*. February 1998.

USACE 2000. *Sampling of Potential Disposal Areas at Load Line 1 and Load Line 2*. January 2000.

USACE 2003. *Phase II Remedial Investigation Report for the Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. June 2003.

USACE 2004a. *Supplemental Baseline Human Health Risk Assessment for Load Line 1 Alternative Receptors at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. July 2004.

USACE 2004b. *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4*. September 2004.

USACE 2005a. *Final November 2004 Sampling Completion Report*. February 2005.

USACE 2005b. *Final Focused Feasibility Study for the Remediation of Soils at Load Lines 1 through 4*. May 2005.

USACE 2007. *Interim Record of Decision for the Remediation of Soils at Load Lines 1 through 4*. January 2007.

USACE 2008. *Remedial Action Completion Report for the Remediation of Soils and Dry Sediments at RVAAP 08-11 (Load Lines 1-4) Ravenna Army Ammunition Plant Ravenna, Ohio*. June 2008.

USACE 2010a. *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations.* September 2010.

USACE 2010b. *Draft Guidance Document of the Evaluation of Land Use Controls at Ravenna Army Ammunition Plant, Ravenna, Ohio.* October 2010.

USACE 2011a. *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4*. Volumes 1 and 2. March 2011.

USACE 2011b. *Remediation Completion Report for Sub-Slab Soils at RVAAP-08 Load Line 1*. March 2011.

USACE 2012. *Draft Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers*. September 2012.

USACE 2013. *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12*. March 2013.

USACE 2014a. *Final Construction Completion Report for Closure of Clean Hard Fill Sites, RVAAP-08 Site CB-23 and Site CB-22 on Load Line 1 and George Road*. February 2014.

USACE 2014b. *Remedial Investigation Report for RVAAP-008-R-01 Load Line 1 MRS*. March 2014.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) 1978*. Installation Assessment of Ravenna Army Ammunition Plant*. Report No. 132. November 1978.

U.S. Environmental Protection Agency (USEPA) 2003. *Ecological Screening Levels*. Region 5. 2003: http://www.epa.gov/reg5rcra/ca/edql.htm.

ATTACHMENT I
LOAD LINE 1 SCREENING RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT I: LOAD LINE 1 SCREENING RESULTS

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 1

Attachment Table 2. Human Health Screening Results for Discrete Sediment at Load Line 1

Attachment Table 3. Ecological Screening Results for Surface Water at Load Line 1

Attachment Table 4. Human Health Screening Results for Surface Water at Load Line 1

THIS PAGE INTENTIONALLY LEFT BLANK.

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 1

Sample ID	Date	Chemical	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	1,3,5-Trinitrobenzene
		Screening Criteria	25	0.99	43.4	32	47	0.18	33	532	
		Criteria Source	SRV	MacDonald et al.	MacDonald et al.	SRV	SRV	MacDonald et al.	SRV	BKG	None
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	8.5	0.44 J	16.4	18.3	27.7	0.09 J	24.8	220	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	9.4	**1.1 ***	12.9	23.2	**50.1 J***	0.11 J	20.7	250 J	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	11.1	**1.7 ***	15.3	30.1	**73.3 ***	0.086 J	17.3	213	NA
LL1sd-396-1049-SD			**28.7 ***	<0.61 U	12.2	15.4	32.9	0.033 J	15.4	247	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	12.2	0.14 J	11.9	14.6	18.3	0.031 J	16.5	117 J	<0.25 U
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	10.8	0.58 J	10.3	13.5 J	24.8	0.067 J	13.2	71.4	<0.25 U
LL1sd-287-1017-SD			10.3	<0.17 U	11	13.4	24.8	0.082 J	14.9	90	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	**37.1 ***	0.72 J	33.4	**227 ***	25	<0.14 U	**53 ***	303	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	**37.9 ***	0.25 J	17.8	**63.5 ***	21.2	0.035 J	21.6	88.2	NA

Sample ID	Date	Chemical	1,3-Dinitrobenzene	2,4-Dinitrotoluene	2,6-Dinitrotoluene	Acenaphthene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
		Screening Criteria	0.0086	0.0144	0.0398	0.0067	0.0572	0.108	0.15	10.4
		Criteria Source	USEPA Reg 5	USEPA Reg 5	USEPA Reg 5	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-396-1049-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	<0.25 U	<0.25 U	<0.25 U	<0.47 U	<0.47 U	0.056 J	0.056 J	0.071 J
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	<0.25 U	<0.25 U	<0.25 U	NA	NA	NA	NA	NA
LL1sd-287-1017-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 1 (continued)

		Chemical	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Di-n-butyl phthalate	Dibenz(a,h)anthracene	Dibenzofuran	Fluoranthene	Fluorene
		Screening Criteria	0.17	0.24	0.166	1.11	0.033	0.449	0.423	0.0774
		Criteria Source	USEPA Reg 5	USEPA Reg 5	MacDonald et al.	USEPA Reg 5	MacDonald et al.	USEPA Reg 5	MacDonald et al.	MacDonald et al.
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-396-1049-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	<0.47 U	<0.47 U	<0.47 U	<0.47 U	<0.47 U	<0.47 U	0.073 J	<0.47 U
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-287-1017-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA

		Chemical	Indeno(1,2,3-cd)pyren	Naphthalene	Phenanthrene	Pyrene	4,4'-DDE	Endrin	PCB-1254	gamma-Chlordane
		Screening Criteria	0.2	0.176	0.204	0.195	0.0032	0.0022	0.0598	
		Criteria Source	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	MacDonald et al.	MacDonald et al.	Total PCB-MacDonald et al.	None
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-396-1049-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	<0.47 U	<0.47 U	<0.47 U	<0.47 U	<0.0024 U	<0.0024 U	<0.047 U	<0.0024 U
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-287-1017-SD			NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	NA	NA	NA	NA	NA	NA	NA	NA

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
DDE = dichlorodiphenyldichloroethylene.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
SRV = Sediment Reference Value.
U = Not detected.
USEPA = United States Environmental Protection Agency.

Attachment Table 2. Human Health Screening Results for Discrete Sediment at Load Line 1

		Chemical	Antimony	Arsenic	Lead	Manganese	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	2,6-Dinitrotoluene	RDX	Benz(a)anthracene
		Screening Criteria	**28.2**	**19.5**	**400**	**2927**	**36.5**	**7.53**	**3.6**	**80.3**	**2.21**
		Criteria Source	**RC**	**BKG**	**RSL**	**RC**	**RC**	**RA**	**RSL**	**RC**	**RA**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	<1.9 UJ	8.5	27.7	755	NA	NA	NA	NA	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	1.2 J	9.4	50.1 J	1270	NA	NA	NA	NA	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	0.82 J	11.1	73.3	671	NA	NA	NA	NA	NA
LL1sd-396-1049-SD			<1.2 UJ	**28.7 ***	32.9	1300	NA	NA	NA	NA	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	<1.4 UJ	12.2	18.3	237 J	<0.25 U	<0.25 U	<0.25 U	<0.5 U	0.056 J
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	<1.4 UJ	10.8	24.8	494	<0.25 U	<0.25 U	<0.25 U	<0.5 U	NA
LL1sd-287-1017-SD			<1.4 UJ	10.3	24.8	921	NA	NA	NA	NA	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	<2.8 UJ	**37.1 ***	25	441	NA	NA	NA	NA	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	<1.6 UJ	**37.9 ***	21.2	329	NA	NA	NA	NA	NA

		Chemical	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyren	Dieldrin	PCB-1254
		Screening Criteria	**0.221**	**2.21**	**0.221**	**2.21**	**0.558**	**1.2**
		Criteria Source	**RA**	**RA**	**RA**	**RA**	**RC**	**RC**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL1sd-046-1048-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA
LL1sd-047-1270-SD	09/26/2000	0 - 0.5	NA	NA	NA	NA	NA	NA
LL1sd-070-1054-SD	09/17/2000	0 - 0.5	NA	NA	NA	NA	NA	NA
LL1sd-396-1049-SD			NA	NA	NA	NA	NA	NA
LL1sd-077-1015-SD	09/15/2000	0 - 0.5	0.056 J	0.071 J	<0.47 U	<0.47 U	<0.0024 U	<0.047 U
LL1sd-286-1016-SD	09/16/2000	0 - 0.5	NA	NA	NA	NA	NA	NA
LL1sd-287-1017-SD			NA	NA	NA	NA	NA	NA
LL1sd-320-1059-SD	09/14/2000	0 - 0.5	NA	NA	NA	NA	NA	NA
LL1sd-320-1100-SD	11/06/2000	0 - 0.5	NA	NA	NA	NA	NA	NA

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 3. Ecological Screening Results for Surface Water at Load Line 1

	Chemical	Iron	Lead	Manganese	Bis(2-ethylhexyl)phthalate
	Screening Criteria	2.56	0.0064	0.391	0.0084
	Criteria Source	BKG	OMZA	BKG	OMZA
Sample ID	Date	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)
LL1sw-059-1070-SW	09/15/2000	**10.4 ***	0.0031	**0.51 ***	NA
LL1sw-320-1074-SW	09/14/2000	**2.9 ***	<0.003 U	**1.4 ***	NA
LL1sw-320-1094-SW	11/06/2000	2.3	<0.003 U	**1.1 ***	NA
LL1sw-053-1071-SW	09/18/2000	0.32	<0.003 U	0.17	<0.01 U

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
OMZA = Outside Mixing Zone Average
U = Not detected.

Attachment Table 4. Human Health Screening Results for Surface Water at Load Line 1

	Chemical	Antimony	Arsenic	Lead	Manganese	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	2,6-Dinitrotoluene	RDX	Benz(a)anthracene	Benzo(a)pyrene
	Screening Criteria	**0.0491**	**0.011**	**0.015**	**6.326**	**0.0782**	**0.0199**	**0.0213**	**0.155**	**0.0001**	**8E-6**
	Criteria Source	**RC**	**RA**	**RSL**	**RC**	**RC**	**RA**	**RA**	**RA**	**RA**	**RA**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
LL1sw-059-1070-SW	09/15/2000	<0.005 U	**0.031 ***	0.0031	0.51	<0.0002 U	<0.00013 U	<0.00013 U	<0.0005 U	NA	NA
LL1sw-320-1074-SW	09/14/2000	<0.005 U	0.0072	<0.003 U	1.4	<0.0002 U	<0.00013 U	<0.00013 U	<0.0005 U	NA	NA
LL1sw-320-1094-SW	11/06/2000	<0.005 U	<0.005 U	<0.003 U	1.1	0.00007 J	0.00027	0.00011 J	<0.0005 U	NA	NA
LL1sw-053-1071-SW	09/18/2000	<0.005 U	0.0051	<0.003 U	0.17	<0.0002 U	<0.00013 U	<0.00013 U	<0.0005 U	<0.01 U	<0.01 U

	Chemical	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Dieldrin	PCB-1254
	Screening Criteria	**0.0001**	**5E-6**	**0.0001**	**17E-6**	**0.0031**
	Criteria Source	**RA**	**RA**	**RA**	**RSL**	**RC**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
LL1sw-059-1070-SW	09/15/2000	NA	NA	NA	NA	NA
LL1sw-320-1074-SW	09/14/2000	NA	NA	NA	NA	NA
LL1sw-320-1094-SW	11/06/2000	NA	NA	NA	NA	NA
LL1sw-053-1071-SW	09/18/2000	<0.01 U	<0.01 U	<0.01 U	<0.00005 U	<0.001 U

***Bold indicates sample exceeds screening criteria.**
J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX B
LOAD LINE 2 (RVAAP-09)

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
bgs	Below Ground Surface
BHC	Benzene Hexachloride
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOPC	Contaminant Migration Chemical of Potential Concern
COC	Chemical of Concern
COI	Chemical of Interest
CUG	Cleanup Goal
DDE	Dichlorodiphenyldichloroethylene
DNT	Dinitrotoluene
EE/CA	Engineering Evaluation/Cost Analysis
EPC	Exposure Point Concentration
ESV	Ecological Screening Value
FFS	Focused Feasibility Study
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
gal	Gallon
HI	Hazard Index
ISM	Incremental Sampling Method
kg	Kilogram
lb	Pound
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
MI	Multi-Increment
Ohio EPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RBC	Risk-Based Concentration
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SESOIL	Seasonal Soil Compartment Model
SRV	Sediment Reference Value
SVOC	Semi-Volatile Organic Compound

ACRONYMS AND ABBREVIATIONS (continued)

TNT	Trinitrotoluene
TR	Target Risk
µg/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

B.0 LOAD LINE 2 (RVAAP-09)

This appendix presents the information and data evaluated for Load Line 2 to identify data gaps in surface water and sediment that will require additional sampling to be performed under the Sampling and Analysis Plan (SAP) Addendum. New data generated from the proposed activities presented in this appendix will be incorporated into the Feasibility Study (FS) Addendum Report. This appendix describes the area of concern (AOC) and presents historical investigation summaries, , data gap screening results for surface water and sediment for human health and ecological receptors, and recommendations for additional surface water and sediment sampling. Specific procedures followed to complete these assessments are included in the Field Sampling Plan (FSP) (Part I) of the SAP Addendum and are not repeated through this appendix.

B.1 AREA OF CONCERN DESCRIPTION

Load Line 2 was located in the southeastern portion of the facility and was used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The line operated from 1941 through 1945, from 1951 to 1957 for munitions-demilitarization activities, and again from 1969 to 1971. Demilitarization projects also occurred at Load Line 2 from 1947 through 1949 when a washout plant was installed at Load Line 2. From 1950 to 1952, Load Line 2 reclaimed cartridge bases using an annealing process for reuse. During the entirety of its operational history, Load Line 2 produced about 10 million munitions, and approximately 1.8 million kg (4 million lb) of TNT was salvaged during demilitarization activities.

During its operational history, bulk TNT and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocane were offloaded at Buildings DA-6 and DA-6A for screening and preparation before being transported to the melt pour buildings (DA-4 and DA-4A) for processing and loading into shells. Upon completing primary charge loading, the shells were transported to Building DB-10 for drilling operations for booster charges or other preparation processes. Bulk explosive carrier washout activities were conducted in Building DB-25. When the facility was at full capacity, Load Line 2 generated approximately 842,700 gal of pinkwater per month from wash-down and steam decontamination of equipment. During melt pour operations, the floors and walls were washed down with water and the pinkwater was collected in settling tanks located throughout each load line building. The solids settled in the tank, and the wash water was pumped through sawdust filtration units and ultimately discharged to Kelly’s Pond, a 2-acre unlined, settling pond south of the AOC. Water from the settling pound was discharged to a surface stream (Sand Creek) that exited the installation. Chromic acid waste also was discharged from Building 802 into a ditch that emptied into the West Branch of the Mahoning River (USACE 1996). During 1951, the load line was rehabilitated, including the removal of explosive accumulations. All buildings and above-grade structures at the AOC have been demolished. All buildings and structures at Load Line 2 have been demolished. The Power House No. 2 Facility-Wide Coal Storage (shown on Plate B-1) located at former Building DC-1 is covered under the Compliance Restoration Program as site CC-RVAAP-73 and is currently undergoing separate investigation; therefore, it is not included in the SAP Addendum.

Each production building located at Load Line 2 is presented below with a summary of its historical use and potential contamination source description. Former productions buildings are included in Table B-1, and the non-production buildings are listed in Table B-2.

Table B-1. Former Production Buildings at Load Line 2

Building ID	Purpose	Description of Potential Sources
DA-6	Explosive Preparation Building	Used to screen bulk granular TNT or bulk RDX and HMX prior to transport to the melt pour building.
DA-6A	Explosive Preparation Building	Used to screen bulk granular TNT or bulk RDX and HMX prior to transport to the melt pour building.
DB-10	Drilling and Assembly Building	Location where booster charges were installed after primary charge loaded at DB-4/4A.
DB-10-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
DB-10-VP2	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
DB-13	Packing and Shipping Building	Packing and shipping operations for completed munitions.
DB-13A	Shell Storage Building/Assembling and Shipping Building	Packing and shipping operations for completed munitions.
DB-13B	Shipping Warehouse Annex	Packing and shipping operations for completed munitions.
DB-25	Shell Carrier Washout Building	Bulk explosives were washed out in this building. Effluent was directed to an above-grade concrete settling tank to the south of the building, which then discharged to an unlined drainage ditch.
DB-26	Radiographic Building	Radiographic equipment in this building was utilized to quality assurance check primary charges within munitions.
DB-27	Cyclic Heat Building No. 2	Built in the 1950s. Loaded shells were placed in the cyclic buildings to alternate heating and cooling cycles to recrystallize the primary explosive charge.
DB-27A	Cyclic Heat Building No. 1	Built in the 1950s. Loaded shells were placed in the cyclic buildings to alternate heating and cooling cycles to recrystallize the primary explosive charge.
DB-27B	Boiler Plant	Built in the 1950s. Provided HVAC for DB-27 and DB-27A.
DB-27C	Shipping Building	Built in the 1950s for packing and shipping operations for completed munitions.
DB-3	Shell Receiving and Painting Building	Shells were cleaned and painted in this building.
DB-4	Melt Load Building and SPCC	Located in the production area, this building was a primary melt pour building for explosives. Contamination was noted to be prevalent around doorways, drains, and vacuum pumps.
DB-4A	Melt Loading Building	Located in the production area, this building was a primary melt pour building for explosives.
DB-4-A-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.

Table B-1. Former Production Buildings at Load Line 2 (continued)

Building ID	Purpose	Description of Potential Sources
DB-4A-WN	Washout Annex	Settling tanks adjacent to Building 4 containerized explosives washout water (pinkwater).
DB-4A-WS	Washout Annex	Settling tanks adjacent to Building 4 containerized explosives washout water (pinkwater).
DB-4-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
DB-4-WN	Washout Annex	Settling tanks adjacent to Building 4 containerized explosives washout water (pinkwater).
DB-4-WS	Washout Annex	Settling tanks adjacent to Building 4 containerized explosives washout water (pinkwater).
DB-802	Inert Storage Building	Utilized for receiving, inert storage, and shell preparation at the load line.
DB-9	Booster Service Building	Physical plant service building.
DB-9A	Booster Service Building	Physical plant service building.
DA-28	Elevator Machine House	Takes screened explosives from Building DA-6/DA6A and transports to Building DB-4/DB-4A for melt pour operations.
DA-28A	Elevator Machinery House	Takes screened explosives from Building DA-6/DA6A and transports to Building DB-4/DB-4A for melt pour operations.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocane.
HVAC = Heating, ventilation, and air conditioning.
ID = Identification.
TNT = Trinitrotoluene.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table B-2. Former Non-Production Buildings Inventory at Load Line 2

Building ID	Purpose
DC-1	Power House No. 2 (steam plant and power house for the load line)
LL-2-CTank1	Concrete Settling Tank
LL-2-CTank2	Concrete Settling Tank
LL2-WST-1	Wooden Settling Tank
LL2-WST-2	Wooden Settling Tank
LL-DB-2	Paint and Oil Storage Building
DA-5	Ammonium Nitrate Service Building (physical plant service building)
DA-7	TNT Service Building (physical plant service building)
DB-11	Fuse Service Building (physical plant service building)
DB-19	Electric Locomotive Service Building (physical plant service building)
DB-20A	Meteorology Laboratory/Line Office (physical plant service building)
DB-8	Change House
DB-8A	Change House
DB-22	Change House
DA-21	TNT Box Building (physical plant service building)
DB-29	Elevator Machine House
2-51	Clock Alley
2-51A	Load Line Office
950-D	Gate House

ID = Identification.
TNT = Trinitrotoluene.

B.2 PREVIOUS INVESTIGATIONS, DECISIONS, AND ACTIONS

Since 1978, Load Line 2 has been the subject of multiple investigations and/or assessments leading to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decisions and/or remedial actions at the AOC. CERCLA activities completed at Load Line 2 are presented in the following report summaries and in the timeline illustrated on Figure B-1. These 18 reports present extensive evaluations and remedial activities performed to address contaminated media, including assessments at each of the former buildings listed in Tables B-1 and B-2.

B.2.1 Installation Assessment of Ravenna Army Ammunition Plant

In 1978, the *Installation Assessment of Ravenna Army Ammunition Plant* (USATHAMA 1978) incorporated a review of historical operational information and available environmental data to assess the potential for contaminant releases from operational facilities. The installation assessment presented quantities of munitions produced, amounts of chemicals utilized, and waste produced at each load line. No sampling, investigation, or actions were performed at Load Line 2 as part of the assessment. The assessment concluded that no sampling was presently required for AOC exit pathways or surface water bodies and additional action may be warranted.

B.2.2 Preliminary Assessment for the Characterization of Areas of Contamination

In 1996, the *Preliminary Assessment for the Characterization of Areas of Contamination* [herein referred to as the Preliminary Assessment (PA)] (USACE 1996) was developed following the requirements of CERCLA and provided information concerning conditions at CERCLA AOCs at the Ravenna Army Ammunition Plant (RVAAP) to assess potential contamination risks posed to human health and the environment. The assessment provided a narrative of the facility history and process operations and described activities conducted at each AOC. According to the PA, waste constituents at Load Line 2 included, but are not limited to, TNT, Composition B, smokeless powder, chromic acid, and lead. Primary contaminant release mechanisms were process effluent discharges to surface water and process building wastewater washout to surface soils and sediments.

Characterization data from previously completed sampling were included as part of the PA. No additional sampling or investigative actions were completed as part of the PA. Waste constituents TNT (0.6 µg/mL) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) (1.75 µg/mL) were detected in sediments from the drainage ditch receiving discharge from the pinkwater sawdust filtration units.

The report provided a PA scoring, subsequent prioritization of AOCs through evaluation of exposure pathways, and a relative risk site evaluation model. Load Line 2 was ranked as a high-priority AOC for future environmental investigations due to the primary contaminant release mechanism from process effluent discharges to surface water and surface soil.

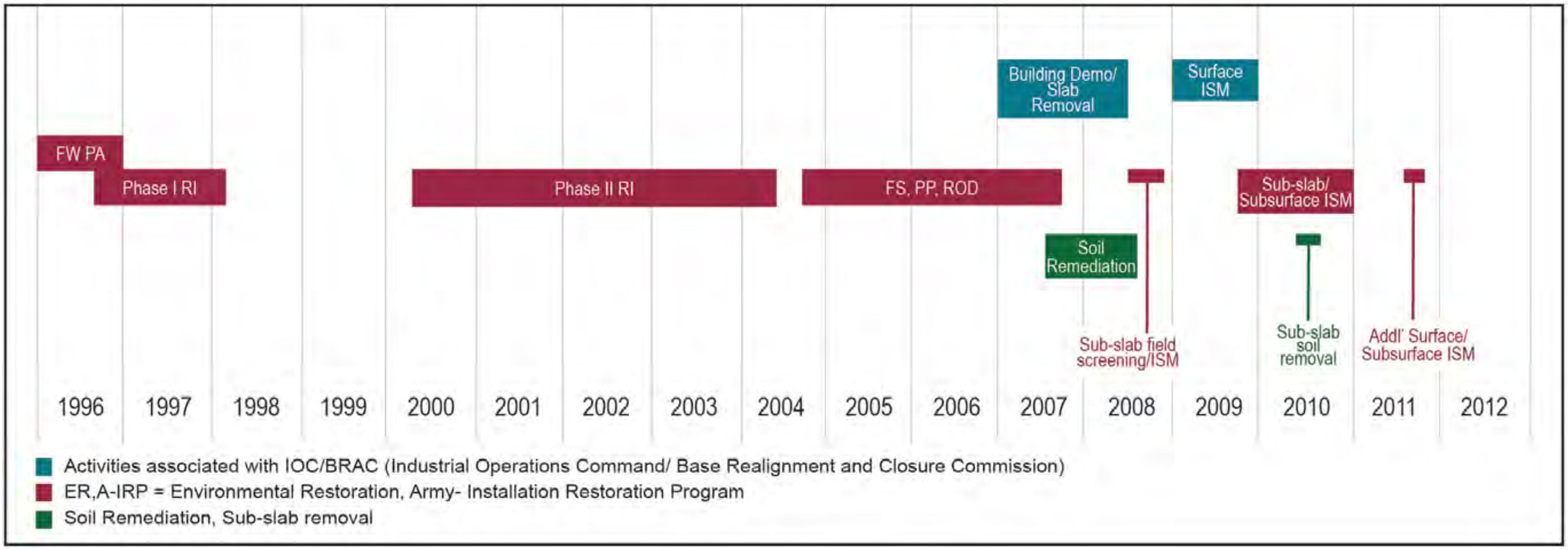


Figure B-1. Timeline of Remedial Activities at Load Line 2

THIS PAGE INTENTIONALLY LEFT BLANK.

B.2.3 Phase I Remedial Investigation

A *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (herein referred to as the Phase I Remedial Investigation [RI]) (USACE 1998) was conducted at Load Line 2 from July through August 1996. During this investigation, sampling activity at Load Line 2 included surface soil, ditch and pond sediment, and groundwater sample collection. Samples were analyzed for explosives, metals, cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and/or polychlorinated biphenyls (PCBs). Most occurrences and highest concentrations of explosive compounds, polycyclic aromatic hydrocarbons (PAHs), and inorganic chemicals in surface soils were associated with the melt pour buildings (DB-4 and DB-4A), explosive offloading areas (DA-6 and DA-6A), or with Building DB-10. A total of 11 ditch and pond sediment samples were collected at Load Line 2 for inorganics and explosives. A total of 3 of the 11 samples also were analyzed for VOCs, SVOCs, PCBs, and pesticides. Chemicals, including explosives, inorganics, PAHs, PCBs, and the pesticide endrin, were observed in the drainages leading to Kelly's Pond and/or in pond sediments but did not appear to be exiting Kelly's Pond. Drainages on the north and west sides of the load line were not impacted with explosive or inorganic chemicals.

The conclusions of the Phase I RI categorized Load Line 2 as a "high-priority" AOC due to elevated concentrations of explosives, inorganic chemicals, and organic chemicals throughout surface soil and sediment at the AOC, and a Phase II RI was recommended (USACE 1998).

B.2.4 Sampling of Potential Disposal Areas at Load Line 1 and Load Line 2

Surface soil sampling was conducted in November 1999 to characterize potential demolition debris disposal areas and to evaluate their suitability for use as fill areas for clean, solid demolition debris from the load line (SAIC 2000). Samples were collected from two change-out buildings (DB-8A and DB-22) and analyzed for Target Analyte List metals, explosives, propellants, VOCs, SVOCs, pesticides, PCBs, and/or cyanide. Depth to bedrock at Load Line 2 was very shallow, and samples did not exceed 1.0 ft below ground surface (bgs) due to bedrock refusal. Results from sampling indicated eight metals were detected above background at Load Line 2. In addition to inorganic chemicals, two VOCs were detected at concentrations less than residential risk screening criteria at DB-22-03. SVOCs, pesticides, and PCBs were only analyzed at station DB-22-03 and were not detected in collected samples (SAIC 2000).

B.2.5 Phase II Remedial Investigation

The *Phase II Remedial Investigation Report for the Load Line 2* (herein referred to as the Phase II RI) (USACE 2004a) evaluated the nature and extent of process-related contaminants in surface and subsurface soil, sediment, surface water, and groundwater, and assessed the potential risk to human health and the environment resulting from former operations at Load Line 2.

As part of the Phase II RI, the AOC was evaluated by dividing it into spatial aggregates based on former process operations and drainage areas. Surface and subsurface soil was separated into six aggregates (Explosive Handling Areas, Preparation and Receiving Areas, Packaging and Shipping Areas, Change House, Perimeter Area, and North Ditches). Sediment and surface water aggregates evaluated as part of the Phase II RI are Kelly's Pond and Exit Drainages (sediment and surface water), North Ponds (sediment), and Miscellaneous Water (surface water).

A total of 172 surface soil samples (including 17 sub-slab samples) were collected across the 6 aggregates to determine the nature and extent of surface soil contamination at Load Line 2. The Explosive Handling Areas aggregate contained the highest concentrations and frequency of detected chemicals in surface soil within Load Line 2. Explosives, propellants, and inorganic chemicals were commonly detected in surface soil, with the highest overall concentrations occurring near Buildings DB-4, DB-4A, DB-6, and DB-6A. SVOCs, PCBs, and pesticides were frequently detected within this aggregate, especially adjacent to former process buildings. Explosive and inorganic chemicals were detected at this aggregate. Explosives, inorganic chemicals, SVOCs (primarily PAHs), PCBs, and pesticides were detected in the Preparation and Receiving Areas aggregate and Packaging and Shipping Areas aggregate. VOCs were rarely detected within these aggregates. Explosives, propellants, inorganic chemicals, and PCBs were detected within the Perimeter Area aggregate, largely adjacent to buildings present within the aggregate (i.e., DA-21 and DB-3). SVOCs and pesticides were rarely detected within the Perimeter Area aggregate and VOCs were not detected. Explosives and inorganic chemicals were identified at the North Ditches aggregate. The Change House aggregate was relatively uncontaminated for surface soil.

A total of 29 discrete subsurface soil samples were collected across the AOC to assess vertical migration. Explosives and inorganic chemicals were detected at the Explosives Handling Areas, with the highest concentrations at process Buildings DB-4 and DA-6. Inorganic chemicals and a few, low estimated concentrations of SVOCs and VOCs were detected at the Preparation and Receiving Areas aggregate. Explosives were not detected in subsurface soils at this aggregate. Inorganic chemicals were the only chemicals identified in elevated concentrations at the Packaging and Shipping Areas aggregate. Explosives, SVOCs, PCBs, and pesticides were not detected in this aggregate. Explosives, two inorganic chemicals, and one PCB were detected in subsurface soil at the Perimeter Area aggregate.

A total of 23 sediment samples and five surface water samples were collected from streams, ponds, and drainage channels under the Load Line 2 Phase II RI. At the Kelly's Pond and Exit Drainage aggregate, explosives, inorganic chemicals, pesticides, and SVOCs were detected. PCBs and VOCs were not detected at this sediment aggregate. At the North Ponds aggregate, explosives and nitrocellulose and inorganic chemicals were detected in sediment. VOCs, SVOCs, PCBs, and pesticides were not detected in the North Ponds sediment aggregate. Explosive and inorganic chemicals were detected at the Kelly's Pond and Exit Drainages surface water aggregate. Only 11 inorganic chemicals were detected at the miscellaneous water samples surface water aggregate.

Recommendations of the Phase II RI included completing an FS to evaluate possible remedial actions at Load Line 2 to reduce or eliminate potential risks to human and/or ecological receptors (USACE 2004a).

Data from seven sediment samples and four surface water samples collected during the Phase II RI (USACE 2004a) are included in the FS Addendum dataset.

B.2.6 Facility-Wide Biological and Water Quality Study

In 2003, an assessment of 11 ponds at Camp Ravenna was completed. As part of the assessment, analytical samples were collected and macroinvertebrate and fish assessments were completed at each pond. Kelly's Pond, which receives exit drainage from the Load Line 2 AOC, was assessed during the study. One multi-increment (MI) [or incremental sampling method (ISM)] sediment sample and two surface water samples were collected from Kelly's Pond. The exact footprint or extent of the MI sample is unknown but is assumed to have included the entire footprint of Kelly's Pond. The samples were analyzed for explosives, inorganic chemicals, SVOCs, PCBs, and pesticides. Explosives, PAHs, and metals were detected in sediment and/or surface water from the pond. As part of the biological assessment, the physical habitat conditions in Kelly's Pond were rated as very poor quality based on the Lake/Lacustrine Qualitative Habitat Evaluation Index. Kelly's Pond was the lowest score of the ponds (20.5) evaluated at Camp Ravenna (USACE 2005c).

The MI sediment sample and two surface water samples collected from Kelly's Pond south of the Load Line 2 AOC during the 2003 investigation are included in the FS Addendum dataset.

B.2.7 Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4

The 2004 *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4* Report (USACE 2004b) documented the proposed land use and corresponding risk-based remedial goal options (RGOs) that were used to support the remedial alternative selection process in the *Focused Feasibility Study for the Remediation of Soils at Load Lines 1 Through 4* [herein referred to as the focused feasibility study (FFS)] (USACE 2005b). Environmental samples or remedial actions were not completed under this task.

B.2.8 Final November 2004 Sampling Completion Report

Sampling was completed in November and December 2004 for delineating the horizontal and vertical extents of contamination at the AOC (USACE 2005a). The majority of samples collected at Load Line 2 fully delineated the extent of contamination below RGOs. Two identified data gaps were not fully addressed as part of the additional data gap sampling due to manganese concentrations continuing to exceed the established RGO. As part of this data gap sampling event, sampling ceased following three step-outs of 10 ft per step-out, confirming that a chemical of concern (COC) was not a random detection or when manganese was detected in concentrations less than 2,000 mg/kg (USACE 2005a).

B.2.9 Focused Feasibility Study for the Remediation of Soils at Load Lines 1 Through 4

The FFS presented remedial alternatives for surface soil, subsurface soil, and dry sediment at Load Lines 1 through 4. As part of the FFS, data acquired in the Phase I and II RIs were evaluated against RGOs and considered during the evaluation of remedial alternatives. Additional data from the 2004 perceived data gap investigation (USACE 2005a) also were incorporated into the FFS.

The recommended interim remedy, based on a detailed analysis of the feasible remedial alternatives to address surface soil, subsurface soil, and dry sediment contamination at Load Line 2, was excavation with off-site disposal. This alternative was recommended due to expediency, permanency, consistency with future land use, moderate relative cost, feasibility, and implementability (USACE 2005b). Environmental sampling and remedial actions were not completed as part of the FFS.

B.2.10 Interim Record of Decision for the Remediation of Soils at Load Lines 1, 2, 3, and 4

In 2007, the U.S. Army Corps of Engineers (USACE) developed the *Interim Record of Decision for the Remediation of Soils at Load Lines 1 Through 4* to address chemical exposure in soil and dry sediment. The selected remedy was chosen in accordance with CERCLA requirements. The selected remedy for surface soil, subsurface soil, and dry sediment was excavation and off-site disposal for Load Lines 1 through 4 where concentrations of chemicals exceed RGOs. The selected remedy was recommended as part of the FFS, documented in the Proposed Plan, received public acceptance during the public comment period, and received state acceptance from the Ohio Environmental Protection Agency (Ohio EPA). The Interim Record of Decision (ROD) was jointly signed by the U.S. Army Division of Base Realignment and Closure (BRAC) and Ohio EPA in the summer of 2007.

B.2.11 Remedial Action Completion Report for the Remediation of Soils and Dry Sediments

Remedial action excavation activities occurred at Load Lines 1 through 4 from August to November 2007. A total of 320 tons of hazardous PCB-contaminated soils and 2,617 tons of non-hazardous soils were removed from Load Line 2. The maximum depth of the excavation was to 3 ft bgs; however, most excavations were typically to 2 ft bgs. A total of 24 discrete areas were excavated within Load Line 2. After completing the excavations, MI confirmation samples were collected and analyzed for Load Line 2 COCs: PCB-1254, TNT, RDX, aluminum, antimony, arsenic, hexavalent chromium, lead, and manganese. Laboratory results for the MI samples collected at Load Line 2 indicate that COCs were removed to below cleanup goals (CUGs) at all Load Line 2 excavation areas (USACE 2008b).

As part of the planned remedial action, concrete slabs were to remain in place and periodic monitoring of the concrete slab integrity was to be completed. A post-ROD change to the concrete slab maintenance task for Load Lines 1 through 4 was initiated by USACE and the U.S. Army Division of Base Realignment and Closure (BRAC) in late 2007. BRAC commenced slab and foundation removal in March 2008 at Load Lines 1 through 4, eliminating the need for routine maintenance as directed in the selected remedy.

The Ohio EPA indicated that "the physical remedial action of soil and dry sediment removal has been completed in accordance with the intents and provisions of the Interim ROD for Load Lines 1-4" (Ohio EPA 2008).

B.2.12 Preliminary Evaluation of Pre (Floor Slab Removal) Contamination for the Sampling of Soils Beneath Floor Slabs and Load Lines 2, 3, and 4 and Excavation and Transportation of Contaminated Soils to Load Line 4

Sampling was completed pre-removal below floor slabs of demolished buildings at Load Lines 2, 3, and 4. Sampling was conducted prior to floor slab removal through holes in building slabs from building demolition activities that allowed access to soil below the floor slabs. Field screening of 17 soil samples was completed at Building DB-4 at Load Line 2. Field screening results indicated concentrations of TNT or RDX were detected below CUGs in all samples from Load Line 2. Based on the field screening results, no samples were submitted for laboratory analysis (USACE 2008a).

B.2.13 Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

Floor slab removal was completed between March and June 2008. As part of the scope of this investigation, the following sampling activities were completed at Load Lines 2, 3, and 4: stockpile sampling, post-slab removal field screening, and final confirmatory sampling. The objective of the sampling was to determine if any areas required excavation to remove contaminated soils beneath former building slabs. The focus for the majority of the sampling completed at Load Line 2 involved buildings with the highest probability of contamination, including DB-4, DB-4A, DA-6, DA-6A, and DB-10. Core samples were collected to a maximum depth of 4 ft bgs at these locations for explosives field screening. Analytical and field screening results from these building slabs at Load Line 2 indicated there were no concentrations of explosives beneath former building slabs that exceeded CUGs (USACE 2009a).

Additional field investigation activities completed at Load Line 2 outside of investigation of soils beneath floor slabs included collecting a field screening sample from a visually impacted zone at Building DB-4 and collecting samples from outside the DB-4A building footprint in an area that visually appeared to be impacted with explosives and sampling around an area where approximately 1 lb of explosive product was removed at Building DB-10.

B.2.14 Multi-Increment Sampling and Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

MI (or ISM) sampling was completed in 2008 within building footprints following the removal of building slabs and any contaminated soils identified as part of the *Multi-Increment Sampling and Analysis of Soils Below Floor Slabs at RVAAP-09, 10, and 11* (USACE 2009b). The purpose of MI confirmatory sampling was to determine if any additional excavation was required at building locations beyond those determined by field screening. Each sample was analyzed for metals and explosives, with select locations also being analyzed for RVAAP full suite parameters (VOCs, SVOCs, PCBs, pesticides, and propellants). Areas selected for full suite analysis were based on actual operations at an individual building and whether operations would indicate contamination other than explosives and metals based on the historical process knowledge. MI samples were collected from 0-1 ft bgs across 46 building footprints. Explosives, propellants, SVOCs (primarily PAHs), PCBs, and metals were detected in MI samples collected at Load Line 2. VOCs and pesticides were not detected in samples collected at Load Line 2. This investigation concluded that there were no additional areas outside of those areas identified during the screening effort requiring remediation at Load Line 2 (USACE 2009b).

B.2.15 Remediation Completion Report Sub-Slab Soils at Load Lines 2, 3, and 4

As part of the remedial actions completed for sub-slab soils at Load Line 2, two distinct areas were excavated in June 2010. A total of 791 cubic yards of soil were excavated from the sumps at DB-4/DB-4-WN and 94 cubic yards were excavated from the bulk TNT area at DB-10/DB-10-VP-2 (USACE 2010b). Excavated soils were stockpiled temporarily at Load Line 2 prior to off-site disposal.

Following excavations and collecting field screening samples, confirmation MI (or ISM) samples were collected. A minimum of one MI sample was collected from the floor of the excavation and the side walls. Samples were analyzed for explosives, metals, SVOCs, and PCBs. The confirmatory MI sampling conducted at Load Line 2 indicated that the excavated areas have been successfully remediated to CUGs identified in the Interim ROD (USACE 2010b).

B.2.16 Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers

The *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (herein referred to as the Facility-Wide Sewers RI/FS) (USACE 2012) evaluated the nature and extent of process-related contaminants in sewer sediment, surface water, and outfalls and assessed the potential risk to human health and the environment resulting from former operations at Load Line 2. RI field investigative activities included visual survey inspections of sanitary and storm sewer structures (i.e., manholes, drop inlets, catch basins, and outfalls); video camera surveys of select sewer lines; and collecting sewer sediment, sewer water, pipe bedding, outfall sediment, and outfall water samples using discrete methods. The RI recommended proceeding to the FS phase to evaluate remedial alternatives to address lead in sewer sediment from one storm sewer segment at Load Line 2 (USACE 2012).

The FS recommended the excavation and off-site disposal of segments of pipes, inlets, and manholes that contain contaminated sewer sediment at Load Line 2. There is one isolated storm sewer sample location, LL2sd-615(st), that was recommended for excavation with off-site disposal at Load Line 2. to address lead contamination that will achieve unrestricted land use, is protective of human health and the environment, and is an implementable remedy. The Army will conduct an Engineering

Evaluation/Cost Analysis (EE/CA) and soil removal to remove the lead contamination within this segment of sewer line, including delineation of the extent of lead contamination at the outfall and ditch within Load Line 2.

Data collected during the Facility-Wide Sewers RI/FS activities are excluded from the FS Addendum data screen, as the sewers media data are currently being evaluated as part of the Facility-wide Sewers AOC.

B.2.17 Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4

The *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations* Report (USACE 2010a) analyzed soils to a maximum depth of 3.5 ft bgs. This study was performed to sample and characterize deeper subsurface soils beneath the former building slabs via subsurface soil ISM techniques that were not previously characterized. Additional surface soil ISM samples in the former coal storage area at Load Line 2 were collected and analyzed to provide preliminary data for future RIs of these AOCs. The Power House No. 2 Facility-Wide Coal Storage (CC-RVAAP-73) is located at the northern end of former Building DC-1 and is currently undergoing investigation; therefore, it is not included in the SAP Addendum.

In 2009, USACE collected 23 total surface soil MI (or ISM) samples at Load Line 2. Eight were analyzed for metals; 19 for explosives; 6 for SVOCs, pesticides, and PCBs; and 4 for VOCs. Metals, explosives, propellants, pesticides, and VOCs were not detected above the CUGs utilized in the *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4* (herein referred to as the 2011 Sampling Report) (USACE 2011) in any of the samples collected from the buildings at Load Line 2. PAHs and one PCB were detected.

Of the 37 subsurface soil ISM samples collected at Load Line 2 as part of the 2009 investigation, 23 were analyzed for metals; 28 for explosives; 9 for VOCs; and 6 for SVOCs, PCBs, and pesticides. Metals, SVOCs, pesticides, PCBs, and VOCs were not detected above CUGs identified in the 2011 Sampling Report in any of the samples collected from the buildings at Load Line 2. Explosives and propellants were detected (USACE 2011).

B.2.18 Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12

Additional characterization sampling was completed at Load Line 2 to guide future soil remedial and administrative measures. The samples collected as part of this investigation were to help eliminate soil data gaps recognized in the *Land Use Controls Assessment Report* (USACE 2010c). Five surface soil ISM samples and 12 subsurface soil horizontal ISM samples (4 from each depth: 1–3, 3–5, and 5–7 ft bgs) were collected at Load Line 2 to further refine ISM sample areas that had levels of PAH contamination above RVAAP CUGs identified in the *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12* (herein referred to as the Characterization Sampling Report) (USACE 2013).

Samples were collected at former Building DB-4, Building DB-4A, and discrete station LL2ss-165. Two PAHs [benzo(a)pyrene and dibenz(a,h)anthracene] were detected at concentrations exceeding CUGs utilized in the Characterization Sampling Report in surface and subsurface ISM samples. Conclusions of this investigation indicated that three of the six previous areas exceeding CUGs identified in the Characterization Sampling Report were further bound and delineated. The remaining three areas were not fully delineated for PAHs and RVAAP full suite chemicals (USACE 2013).

B.3 DATA GAP ASSESSMENT

The rationale for developing and using the data gap analysis is presented in Section 3.2 of the SAP Addendum FSP. This section presents only information specific to Load Line 2 used in the data gap analysis of surface water and sediment. Upgradient lead contamination from the sewers at Load Line 2 to Kelly's Pond are being evaluated under the facility-wide Sewers RI/FS and EE/CA. This will include the sewer outfall and downstream segment along the ditch prior to reaching Kelly's Pond.

The conclusions of the data gap analysis present areas that require further investigation to define the nature and extent of contamination at source areas that will be evaluated in the FS Addendum Report. The following steps were followed to generate the data and screening criteria for the data gap analysis.

B.3.1 Data Assembly and Use Assessment – Load Line 2

All data collected at Load Line 2 were extracted from the RVAAP Environmental Information Management System database. This includes data from investigations summarized in the following reports:

- *Phase II Remedial Investigation Report for the Load Line 2* (USACE 2004a).
- *Facility-Wide Biological and Water Quality Study* (USACE 2005c).

The data from investigations summarized in the following reports were not used in the data gap analysis:

- *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (USACE 1998) – [These data are more than 16 years old and are no longer considered representative of the site (e.g., buildings and slabs have been removed and/or remediated)].
- *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (USACE 2012) (The sewers are currently being evaluated under a separate RI and subsequent EE/CA).

Once the data were assembled and evaluated for use, they were screened for chemicals of interest (COIs) specific to Load Line 2 surface water and sediment.

B.3.2 Chemicals of Interest – Load Line 2

The rationale for developing and using COIs is presented in Section 3.2.2 of this SAP Addendum FSP. Load Line 2 COIs were developed from the chemicals identified as exceeding surface water and sediment residential risk in the Phase II RI (USACE 2004a). Load Line 2 COIs for exposure of Resident Receptor (Adult and Child) to surface water and sediment are shown in Table B-3. The COIs of potential ecological concern for surface water and sediment are listed in Table B-5.

Table B-3. COIs in Surface Water and Sediment at Load Line 2

COI	Load Line 2	
	Surface Water	**Sediment**
Metals		
Aluminum	X	X
Antimony	X	X
Arsenic	X	X
Cadmium	X	X
Copper	X	X
Chromium, hexavalent	X	X
Lead	X	X
Manganese	X	X
Thallium	X	X
Explosives		
2,4,6-TNT	X	X
2,4-DNT	X	X
RDX	X	X
PCBs		
PCB-1254	X	X
PCB-1260	X	X
Pesticides		
Dieldrin	X	X
PAHs		
Benz(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Dibenz(a,h)anthracene	X	X
Indeno(1,2,3-cd)pyrene	X	X

COI = Chemical of interest.
DNT = Dinitrotoluene.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
TNT = Trinitrotoluene.
X = COI present in medium.

B.3.3 Screening Criteria – Load Line 2

The residential screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.3 of the SAP Addendum FSP. The human health screening criteria [hazard index (HI)=1, target risk (TR) of 1E-05] values and sources are presented in Table B-4 for surface water and sediment specific to Load Line 2. The ecological screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.3 of the SAP Addendum FSP. Table B-5 presents the ecological screening criteria used for surface water and sediment specific to Load Line 2.

Table B-4. Human Health Screening Criteria for Surface Water and Sediment at Load Line 2

Chemical[a] (mg/kg or mg/L)	Surface Water	Type[b]	Sediment	Type[b]
Aluminum	148.274	RC	73,798	RC
Antimony	0.0491	RC	28.2	RC
Arsenic	0.011	RA	19.5	BKG
Cadmium	0.0505	RC	64.1	RC
Chromium, hexavalent	0.303	RC	199	RC
Copper	6.144	RC	3,106	RC
Lead	0.015	TB	400	RSL
Manganese	6.326	RC	2,927	RC
Thallium	0.0124	RC	6.12	RC
2,4,6-Trinitrotoluene	0.0782	RC	36.5	RC
2,4-Dinitrotoluene	0.0199	RA	7.53	RA
RDX	0.155	RA	80.3	RC
Benz(a)anthracene	0.000136	RA	2.21	RA
Benzo(a)pyrene	0.000008	RA	0.221	RA
Benzo(b)fluoranthene	0.000079	RA	2.21	RA
Dibenz(a,h)anthracene	0.000005	RA	0.221	RA
Indeno(1,2,3-cd)pyrene	0.000078	RA	2.21	RA
Dieldrin	0.000017	RSL	0.558	RC
PCB-1254	0.00313	RC	1.2	RC
PCB-1260	0.00039	RSL	2.03	RA

[a] Chemicals listed are chemicals of concern for Resident (Adult and Child) Receptors in respective media.
[b] Type:
BKG = Background.
RA = Resident Adult Facility-Wide Cleanup Goal (FWCUG) for hazard quotient (HQ)=1 or Target Risk=10-5.
RC = Resident Child FWCUG for HQ=1 or Risk=10-5.
RSL = U.S. Environmental Protection Agency Residential Soil or Tap Water Screening Level for HQ=1 or Target Risk=10-5.
TB = Technology-based screening level.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table B-5. Ecological Screening Criteria for Surface Water and Sediment at Load Line 2

Chemical[a]	Surface Water (mg/L)	Type[b]	Sediment (mg/kg)	Type[b]
Antimony	NA		1.3	SRV
Beryllium	NA		0.8	SRV
Cadmium	0.0045	OMZM	0.99	MacDonald et al.
	0.0025	OMZA		
Calcium	NA		21,000	SRV
Lead	NA		47	SRV
Magnesium	NA		7,100	SRV
Silver	NA		0.5	USEPA Reg 5
2,4,6-Trinitrotoluene	NA		None	
2,4-Dinitrotoluene	NA		0.0144	USEPA Reg 5
4-Amino-2,6-Dinitrotoluene	NA		None	
Nitrocellulose	NA		None	
Anthracene	NA		0.0572	MacDonald et al.
Benz(a)anthracene	NA		0.108	MacDonald et al.
Benzo(a)pyrene	NA		0.15	MacDonald et al.
Benzo(b)fluoranthene	NA		10.4	USEPA Reg 5
Benzo(ghi)perylene	NA		0.17	USEPA Reg 5
Benzo(k)fluoranthene	NA		0.24	USEPA Reg 5
Bis(2-ethylhexyl)phthalate	1.1	OMZM	0.182	USEPA Reg 5
	0.0084	OMZA		
Chrysene	NA		0.166	MacDonald et al.
Dibenz(a,h)anthracene	NA		0.033	MacDonald et al.
Fluoranthene	NA		0.423	MacDonald et al.
Indeno(1,2,3-cd)pyrene	NA		0.2	USEPA Reg 5
Phenanthrene	NA		0.204	MacDonald et al.
Pyrene	NA		0.195	MacDonald et al.
4,4'-DDE	NA		0.00316	MacDonald et al.
Endrin ketone	NA			None
beta-BHC	NA		0.005	USEPA Reg 5

[a] Chemicals listed are chemicals of potential ecological concern in respective media.
[b] Type:
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
None = No ecological screening value available.
SRV = Sediment reference value.
USEPA Reg 5 = USEPA 2003.
BHC = Benzene hexachloride.
DDE = Dichlorodiphenyldichloroethylene.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable because the analyte was not a contaminant of interest for that medium.
OMZA = Outside Mixing Zone Average.
OMZM = Outside Mixing Zone Maximum.

B.4 SURFACE WATER AND SEDIMENT EVALUATION

B.4.1 Surface Water and Sediment Screening Results

COI concentrations detected in surface water and sediment samples (discrete and ISM) identified for use in the dataset were screened against the human health and ecological criteria presented in Section B.3.3 on a sample-by-sample basis. The results are presented in Attachment 1 of this appendix. No surface water sample data exceeded the human health or ecological screening criteria at Load Line 2. Sediment samples that exceeded the human health screening criteria are summarized in Table B-6 for discrete samples and in Table B-7 for ISM samples. Sediment samples that exceeded the ecological screening criteria are summarized in Table B-8 for discrete samples and in Table B-9 for ISM samples. Concentrations of chemicals exceeding screening criteria are shown in bold font. Detailed discussions of results are presented in Sections B.5.2.1 and B.5.2.2 for human health and ecological receptors, respectively, on a contaminant source-by-source basis.

Table B-6. Human Health Screening Exceedances for Discrete Sediment Sample at Load Line 2

		Chemical	Benzo(a)pyrene
		Screening Criteria	0.221
		Criteria Source	RA
Sample ID	Date	Depth (ft)	Concentration (mg/kg)
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**0.55***

***Bold indicates sample exceeds screening criteria.**
ft = Feet.
ID = Identification.
mg/kg = Milligrams per kilogram.
RA = Resident Adult.

Table B-7. Human Health Screening Exceedances for ISM Sediment Sample at Load Line 2

		Chemical	Benzo(a)pyrene	Benzo(b)fluoranthene
		Screening Criteria	0.221	2.21
		Criteria Source	RA	RA
Sample ID	Date	Depth (ft)	Concentration (mg/kg)	Concentration (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	**1.4***	**2.3***

***Bold indicates sample exceeds screening criteria.**
ft = Feet.
ID = Identification.
ISM = Incremental sampling method.
mg/kg = Milligrams per kilogram.
RA = Resident Adult. .

Table B-8. Ecological Screening Exceedances for Discrete Sediment Samples at Load Line 2

		Chemical	Antimony	Calcium	Magnesium	Silver	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	4-Amino-2,6-Dinitrotoluene	Nitrocellulose	Anthracene	Benz(a)anthracene	Benzo(a)pyrene
		Screening Criteria	1.3	21,000	7,100	0.5		0.0144			0.0572	0.108	0.15
		Criteria Source	SRV	SRV	SRV	USEPA Reg 5	None	USEPA Reg 5	None	None	MacDonald et al.	MacDonald et al.	MacDonald et al.
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<1.1 UJ	**25,800***	**9,250***	<0.56 U	NA	NA	NA	NA	<0.37 U	<0.37 U	<0.37 U
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**1.8 J***	6,070	1,730	<0.55 U	**0.27***	**0.19 J***	**0.13 J***	NA	**0.12 J***	**0.6***	**0.55***
LL2sd-053-1129-SD	07/30/2001	0 - 0.5	0.85 J	1,060	2,400	<0.73 U	NA	NA	NA	NA	<0.48 U	**0.15 J***	**0.18 J***
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<1.3 UJ	834	1,330	**4.1***	NA	NA	NA	NA	<0.42 U	<0.42 U	<0.42 U
LL2sd-271-1076-SD			<1.3 UJ	713	1,850	<0.67 U	NA	NA	NA	**0.43 J***	<0.44 U	<0.44 U	<0.44 U

		Chemical	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene	4,4'-DDE	Endrin Ketone	beta-BHC
		Screening Criteria	0.17	0.24	0.166	0.033	0.423	0.2	0.204	0.195	0.0032		0.005
		Criteria Source	USEPA Reg 5	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	None	USEPA Reg 5
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<0.37 U	<0.37 U	<0.37 U	<0.37 U	0.072 J	<0.37 U	<0.37 U	0.06 J	**0.0056 J***	<0.0038 U	**0.0092 J***
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**0.2 J***	**0.36***	**0.69***	**0.082 J***	**0.94 J***	**0.22 J***	**0.5 J***	**0.84 J***	**0.021 J***	**0.01 J***	**0.079 J***
LL2sd-053-1129-SD	07/30/2001	0 - 0.5	0.11 J	0.14 J	**0.24 J***	<0.48 U	0.41 J	0.11 J	0.18 J	**0.34 J***	<0.0025 U	<0.0025 U	<0.0025 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<0.42 U	<0.42 U	0.061 J	<0.42 U	0.096 J	<0.42 U	<0.42 U	0.083 J	<0.0021 U	<0.0021 U	<0.0021 U
LL2sd-271-1076-SD			<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.0023 U	<0.0023 UJ	<0.0023 U

***Bold indicates sample exceeds screening criteria.**
BHC = Benzene hexachloride.
Conc. = Concentration.
DDE = Dichlorodiphenyldichloroethylene.
ft = Feet.
ID = Identification.
J = Estimated.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
None = No ecological screening value available.
SRV = Sediment reference value.
U = Not detected.
UJ = Not detected and reporting limit estimated.
USEPA = U.S. Environmental Protection Agency.

Table B-9. Ecological Screening Exceedances for ISM Sediment Samples at Load Line 2

		Chemical	Antimony	Beryllium	Lead	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(ghi)-perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h)-anthracene	Fluoranthene	Indeno(1,2,3cd) pyrene	Phenanthrene	Pyrene
		Screening Criteria	1.3	0.8	47	0.0572	0.108	0.15	0.17	0.24	0.166	0.033	0.423	0.2	0.204	0.195
		Criteria Source	SRV	SRV	SRV	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5	MacDonald et al.	MacDonald et al.
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc.(mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
FSW-SD-034-0000	06/23/2003	0 - 0.3	**9.5 ***	**0.96 ***	**80.5 ***	**0.245 J***	**1.25 ***	**1.4 ***	**1.2 ***	**0.73 J***	**1.55 ***	**0.135 J***	**3.05 ***	**1.045 ***	**1.25 ***	**2.3 ***

***Bold indicates sample exceeds screening criteria.**
Conc. = Concentration.
ft = Feet.
ID = Identification.
ISM = Incremental sampling method.
J = Estimated.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
mg/kg = Milligrams per kilogram.
SRV = Sediment reference value.
USEPA = U.S. Environmental Protection Agency.

B.4.2 Characterization of Surface Water and Sediment

The Phase II RI (USACE 2004a) established surface water and sediment data aggregates at Load Line 2 by evaluating historic and current surface water flow directions and conveyances. This data gap evaluation uses the same data aggregates that were presented and approved in the Phase II RI as follows:

- North Ponds, and
- Kelly's Pond and Exit Drainage.

Surface water and sediment aggregates are shown in Figure B-2. The Phase II RI established a complete evaluation of surface water and sediment based on historic receptors. These same data aggregates are re-evaluated in the SAP Addendum to establish any required action needed to meet the current receptors as identified in the Technical Memorandum (ARNG 2014).

Historically, surface water has only been collected at the Kelly's Pond and Exit Drainage aggregate. Therefore, surface water data for this evaluation are only available for this aggregate. Sediment sample data are available for both aggregates.

B.4.2.1 <u>Human Health, Surface Water, and Sediment Screening Evaluation</u>

For human health screening purposes, the surface water and sediment COI data are screened against the most conservative criteria presented in Table B-4 to identify any locations that may require additional investigation. Sample locations that had COIs that exceeded screening criteria and the chemicals and concentrations that exceeded are shown on Figure B-2.

All surface water detections are below screening criteria of HI=1, TR of 1E-05 at the Kelly's Pond and Exit Drainage aggregate, as presented in Attachment I. Therefore, no additional surface water sampling is recommended at Load Line 2 to address human health concerns.

No sediment exceedances were observed at the North Ponds aggregate, as presented in Attachment 1. Therefore, no additional sediment sampling is recommended at the North Ponds aggregate to address human health concerns.

Two sediment samples had exceedances in the Kelly's Pond and Exit Drainage aggregate, as presented in Tables B-6 and B-7. All other sediment samples within the aggregate are below screening criteria of HI=1, TR of 1E-05. The exceedance at LL2-182 for benzo(a)pyrene at a concentration of 0.55 mg/kg is only slightly above the screening criterion of 0.22 mg/kg, and the surrounding samples are all below screening criteria. This sample was collected along South Patrol Road; therefore, this low-level detection is attributed to roadside contamination (e.g., from runoff of road dust) and is not associated with a CERCLA release. Therefore, no additional sediment sampling is recommended in the Exit Drainage section of this aggregate to address human health concerns.

Based on the sediment screening results above, the Kelly's Pond sediment sample (FSW-SD-034-0000) exceeded screening criteria for two PAHs at concentrations of 1.4 mg/kg for benzo(a)pyrene and 2.3 mg/kg for benzo(b)fluoranthene. Additional sampling at Kelly's Pond is recommended to determine the extent of PAH contamination within the pond. The collection of one new sample at the center of the pond is recommended for analyzing PAHs to address potential human health concerns.

B.4.2.2 Surface Water Ecological Screening Evaluation

For ecological screening purposes, the surface water and sediment COI data were screened against the criteria presented in Table B-5 to identify any locations that may require additional investigation. Sample locations that had COIs that exceeded screening criteria and were not eliminated through the weight-of-evidence evaluation are shown on Figure B-2 with chemical exceedance concentrations.

***Kelly's Pond and Exit Drainages Aggregate* –** There are no surface water exceedances in this aggregate, as presented in Attachment I. As a result, no additional surface water samples are recommended from an ecological perspective.

B.4.2.3 Sediment Ecological Screening Evaluation

North Ponds Aggregate – There were no discrete exceedances in sediment. Nitrocellulose was detected, but this explosive is essentially non-toxic.

Kelly's Pond and Exit Drainages Aggregate – Three metals (antimony, beryllium, and lead) had ISM sample exceedances in sediment (Table B-9). The ISM sample concentration of antimony was above the Ohio sediment reference value (SRV). The ISM sample concentration of beryllium was just above the Ohio SRV and background value. The ISM sample concentration of lead exceeded the Ohio SRV, background value, and the ecological screening value (ESV). A total of 11 PAHs had ISM sample exceedances of the ESVs, typically by an order of magnitude. These PAHs included anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

Four metals (antimony, calcium, magnesium, and silver) had discrete exceedances in sediment (Table B-8). The average concentration of antimony was below the Ohio SRV. Calcium and magnesium are essential nutrients and were not evaluated further. The average silver concentration was above the Ohio SRV and ESV. The same 11 PAHs with ISM sample exceedances also had discrete exceedances of the ESVs, but to a lesser extent. These PAHs included anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. One explosive [2,4-dinitrotoluene (DNT)] was detected above its ESV, while two other detected explosives (2,4,6-TNT and 4-amino-2,6-DNT) did not have ESVs. Three polybutylene terephthalate chemicals [the pesticides 4,4'-dichlorodiphenyldichloroethylene (DDE); endrin ketone; and beta-benzene hexachloride (BHC)] were detected. The average concentration of 4,4'-DDE was below the ESV. Endrin ketone does not have an ESV, and the average concentration of beta-BHC was above the ESV.

Based on the sediment screening results above, collecting additional sediment samples is not warranted at the North Ponds aggregate because there were no exceedances. Three sediment samples are proposed for the Kelly's Pond and Exit Drainage aggregate to determine current concentrations and whether soil remediation may have caused a decline in sediment concentrations of lead; silver; PAHs; 2,4,6-TNT; 2,4-DNT; 4-amino-2,6-DNT; endrin ketone; and beta-BHC.

B.4.3 Proposed Sediment Sample Locations for Load Line 2

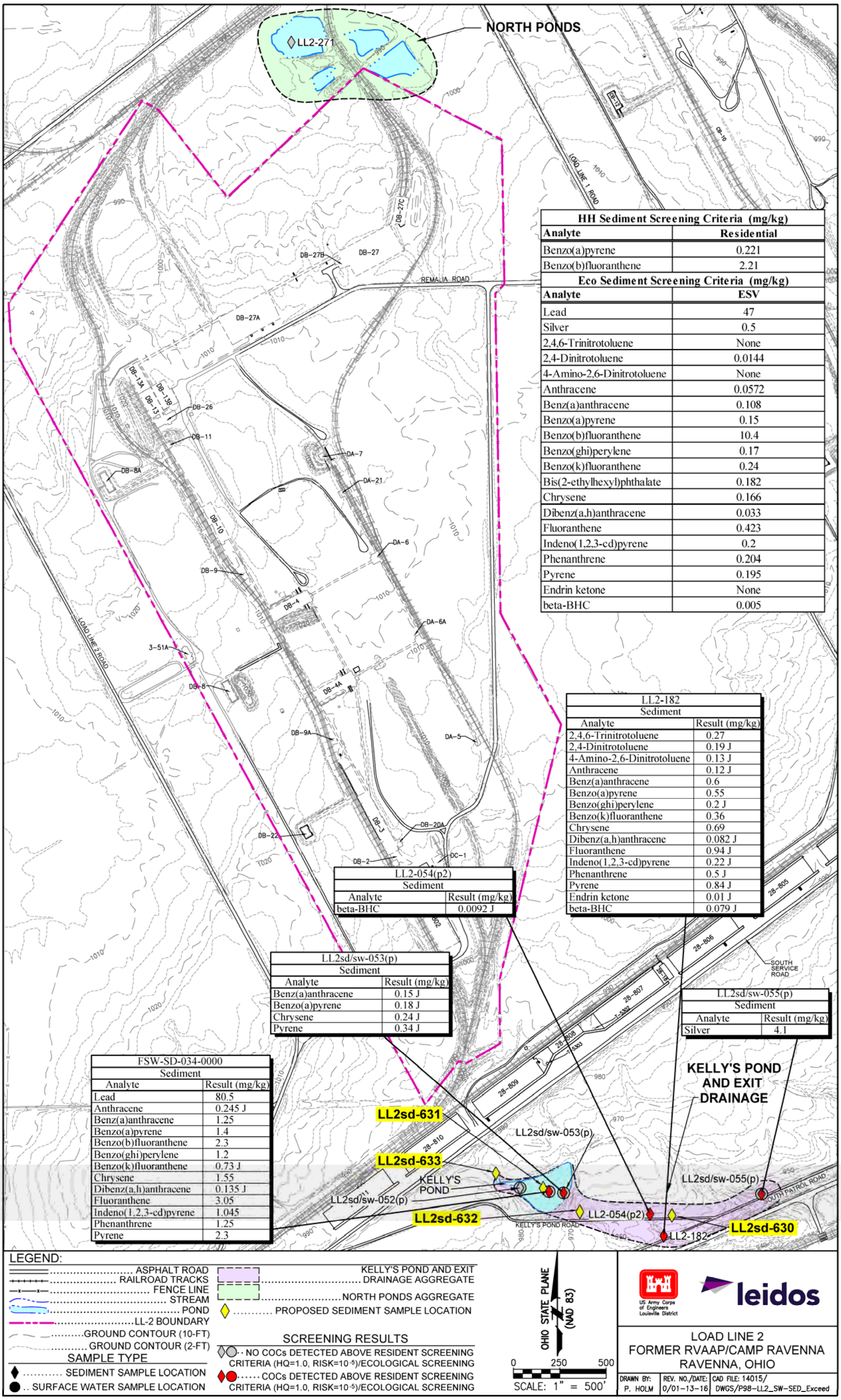
Based on the human health and ecological screening evaluations, additional sampling within Load Line 2 is recommended for the Kelly's Pond and Exit Drainage aggregate, as presented in Table B-10. Sampling within this aggregate has been designed to target the pond and exit drainage separately because the physical features are separate and the contamination appears to be different. Additionally, a sediment sample will be collected at the inlet of Kelly's Pond to asses if upgradient sources of lead have migrated from the sewers at Load Line 2 into Kelly's Pond. Table B-10 presents the proposed sample identifiers, sample type including sample depth intervals, coordinates for proposed sample locations, and the analytes that will be collected for each sample. The locations may be altered during implementation of the SAP Addendum for a variety of reasons. The final coordinates of the sample locations (including elevations) will be presented in the FS Addendum Report. Figure B-2 illustrates the proposed sediment sample locations to be collected during implementation of the SAP Addendum. The general approach for investigation activities is presented in the SAP Addendum FSP.

Table B-10. Proposed Sediment Sampling Locations at Load Line 2

Aggregate	Sample ID	Sample Type (ft bgs)	Easting	Northing	Analytes
Kelly's Pond	LL2sd-631-0001-SD LL2sd-633-0001-SD	Discrete Sediment (0-1)	2375131.49 2374877.24	558165.13 558244.84	Lead and PAHs
Exit Drainage	LL2sd-630-0001-SD LL2sd-632-0001-SD	Discrete Sediment (0-1)	2375826.03 2375329.86	558017.97 558037.65	Lead; silver; PAHs; 2,4,6-TNT; 2,4-DNT; 4-Amino-2,6-DNT; endrin ketone; and beta-BHC

bgs = Below ground surface.
ft = Feet.
BHC = Benzene hexachloride.
DNT = Dinitrotoluene.
ID = Identification.
PAH = Polycyclic aromatic hydrocarbon.
TNT = Trinitrotoluene.

THIS PAGE INTENTIONALLY LEFT BLANK.



HH Sediment Screening Criteria (mg/kg)	
Analyte	Residential
Benzo(a)pyrene	0.221
Benzo(b)fluoranthene	2.21

Eco Sediment Screening Criteria (mg/kg)	
Analyte	ESV
Lead	47
Silver	0.5
2,4,6-Trinitrotoluene	None
2,4-Dinitrotoluene	0.0144
4-Amino-2,6-Dinitrotoluene	None
Anthracene	0.0572
Benz(a)anthracene	0.108
Benzo(a)pyrene	0.15
Benzo(b)fluoranthene	10.4
Benzo(ghi)perylene	0.17
Benzo(k)fluoranthene	0.24
Bis(2-ethylhexyl)phthalate	0.182
Chrysene	0.166
Dibenz(a,h)anthracene	0.033
Fluoranthene	0.423
Indeno(1,2,3-cd)pyrene	0.2
Phenanthrene	0.204
Pyrene	0.195
Endrin ketone	None
beta-BHC	0.005

LL2-182 Sediment	
Analyte	Result (mg/kg)
2,4,6-Trinitrotoluene	0.27
2,4-Dinitrotoluene	0.19 J
4-Amino-2,6-Dinitrotoluene	0.13 J
Anthracene	0.12 J
Benz(a)anthracene	0.6
Benzo(a)pyrene	0.55
Benzo(ghi)perylene	0.2 J
Benzo(k)fluoranthene	0.36
Chrysene	0.69
Dibenz(a,h)anthracene	0.082 J
Fluoranthene	0.94 J
Indeno(1,2,3-cd)pyrene	0.22 J
Phenanthrene	0.5 J
Pyrene	0.84 J
Endrin ketone	0.01 J
beta-BHC	0.079 J

LL2-054(p2) Sediment	
Analyte	Result (mg/kg)
beta-BHC	0.0092 J

LL2sd/sw-053(p) Sediment	
Analyte	Result (mg/kg)
Benz(a)anthracene	0.15 J
Benzo(a)pyrene	0.18 J
Chrysene	0.24 J
Pyrene	0.34 J

LL2sd/sw-055(p) Sediment	
Analyte	Result (mg/kg)
Silver	4.1

FSW-SD-034-0000 Sediment	
Analyte	Result (mg/kg)
Lead	80.5
Anthracene	0.245 J
Benz(a)anthracene	1.25
Benzo(a)pyrene	1.4
Benzo(b)fluoranthene	2.3
Benzo(ghi)perylene	1.2
Benzo(k)fluoranthene	0.73 J
Chrysene	1.55
Dibenz(a,h)anthracene	0.135 J
Fluoranthene	3.05
Indeno(1,2,3-cd)pyrene	1.045
Phenanthrene	1.25
Pyrene	2.3

Figure B-2. Screening Results and Proposed Sample Locations for Sediment at Load Line 2

THIS PAGE INTENTIONALLY LEFT BLANK.

B.5 REFERENCES

Army National Guard-ILE Cleanup, U.S. Army (ARNG) 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio*. Memorandum between ARNG-ILE Cleanup and the Ohio Environmental Protection Agency. Dated February 2014.

Environmental Quality Management (EQM) 2014. *Final Facility-Wide Groundwater Monitoring Program - RVAAP-66 Facility-Wide Groundwater Report on the January 2014 Sampling Event*. August 2014.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger 2000. "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems." *Arch. Environ. Contam. Toxicol*. 39, 20-31. 2000.

Ohio Environmental Protection Agency (Ohio EPA) 2008. Email correspondence from Ms. Eileen T. Mohr, Ohio EPA Facility Coordinator, to Mr. Dave Cobb, Shaw Project Manager, dated April 14, 2008, regarding acceptance of LL1ss-29 excavation for PCBs. April 2008.

Ohio EPA 2014. Division of Surface Water. Ohio Administrative Code, Chapters 3745-1, 3745-2, (Ohio River Basin). Accessed November 2014.

Science Applications International Corporation (SAIC) 2000. *Sampling of Potential Disposal Areas at Load Line 1 and Load Line 2*. January 2000.

U.S. Army Corps of Engineers (USACE) 1996. *Preliminary Assessment for the Characterization of Areas of Contamination Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 1996.

USACE 1998. *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern at the Ravenna Army Ammunition Plant*. February 1998.

USACE 2004a. *Phase II Remedial Investigation Report for the Load Line 2 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. July 2004.

USACE 2004b. *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4*. September 2004.

USACE 2005a. *Final November 2004 Sampling Completion Report*. February 2005.

USACE 2005b. *Final Focused Feasibility Study for the Remediation of Soils at Load Lines 1 through 4*. May 2005.

USACE 2005c. *Facility-Wide Biological and Water Quality Study*. November 2005.

USACE 2007. *Interim Record of Decision for the Remediation of Soils at Load Lines 1 Through 4*. January 2007.

USACE 2008a. *Preliminary Evaluation of Pre (Floor Slab Removal) Contamination for the Sampling of Soils Beneath Floor Slabs and Load Lines 2, 3, and 4 and Excavation and Transportation of Contaminated Soils to Load Line 4*. April 2008.

USACE 2008b. *Remedial Action Completion Report for the Remediation of Soils and Dry Sediments at RVAAP 08-11 (Load Lines 1-4) Ravenna Army Ammunition Plant Ravenna, Ohio*. June 2008.

USACE 2009a. *Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, 10, and 11*. July 2009.

USACE 2009b. *Multi-Increment Sampling and Analysis of Soils Below Floor Sabs at RVAAP-09, 10, and 11*. December 2009.

USACE 2010a. *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations*. September 2010.

USACE 2010b. *Remediation Completion Report for Sub-Slab Soils at Load Lines 2, 3, and 4*. December 2010.

USACE 2010c. *Draft Guidance Document of the Evaluation of Land Use Controls at Ravenna Army Ammunition Plant, Ravenna, Ohio.* October 2010.

USACE 2011. *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4*. Volume 1 and 2. March 5, 2011.

USACE 2012. *Draft Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers*. September 2012.

USACE 2013. *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1,2,3,4, and 12*. March 2013.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) 1978. *Installation Assessment of Ravenna Army Ammunition Plant*. Report No. 132. November 1978.

U.S. Environmental Protection Agency (USEPA) 2003. *Ecological Screening Levels*. Region 5. 2003: http://www.epa.gov/reg5rcra/ca/edql.htm.

ATTACHMENT I
LOAD LINE 2 SCREENING RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK.

ATTACHMENT I: LOAD LINE 2 SCREENING RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK.

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 2

		Chemical	Antimony	Beryllium	Cadmium	Calcium	Lead	Magnesium	Silver	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene
		Screening Criteria	**1.3**	**0.8**	**0.99**	**21000**	**47**	**7100**	**0.5**		**0.0144**
		Criteria Source	**SRV**	**SRV**	**MacDonald et al.**	**SRV**	**SRV**	**SRV**	**USEPA Reg 5**	**None**	**USEPA Reg 5**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<1.1 UJ	0.52 J	<0.56 U	**25800 ***	12.2	**9250 ***	<0.56 U	NA	NA
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**1.8 J***	0.63	0.21 J	6070	31.2	1730	<0.55 U	**0.27 ***	**0.19 J***
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	<1.3 UJ	0.64 J	<0.67 U	1020	19	2380	<0.67 U	NA	NA
LL2sd-053-1129-SD			0.85 J	0.63 J	<0.73 U	1060	32.1	2400	<0.73 U	NA	NA
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<1.3 UJ	0.57 J	<0.63 U	834	19.6	1330	**4.1 ***	NA	NA
LL2sd-271-1076-SD			<1.3 UJ	0.38 J	0.25 J	713	28.5 J	1850	<0.67 U	NA	NA

		Chemical	4-Amino-2,6-Dinitroto	Nitrocellulose	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene
		Screening Criteria			**0.0572**	**0.108**	**0.15**	**10.4**	**0.17**	**0.24**
		Criteria Source	**None**	**None**	**MacDonald et al.**	**MacDonald et al.**	**MacDonald et al.**	**USEPA Reg 5**	**USEPA Reg 5**	**USEPA Reg 5**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	NA	NA	<0.37 U	<0.37 U	<0.37 U	<0.37 U	<0.37 U	<0.37 U
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**0.13 J***	NA	**0.12 J***	**0.6 ***	**0.55 ***	0.71	**0.2 J***	**0.36 ***
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	NA	NA	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U
LL2sd-053-1129-SD			NA	NA	<0.48 U	**0.15 J***	**0.18 J***	0.25 J	0.11 J	0.14 J
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	NA	NA	<0.42 U	<0.42 U	<0.42 U	0.074 J	<0.42 U	<0.42 U
LL2sd-271-1076-SD			NA	**0.43 J***	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U

		Chemical	Bis(2-ethylhexyl)phth	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyren	Phenanthrene	Pyrene	4,4'-DDE
		Screening Criteria	**0.182**	**0.166**	**0.033**	**0.423**	**0.2**	**0.204**	**0.195**	**0.0032**
		Criteria Source	**USEPA Reg 5**	**MacDonald et al.**	**MacDonald et al.**	**MacDonald et al.**	**USEPA Reg 5**	**MacDonald et al.**	**MacDonald et al.**	**MacDonald et al.**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<0.37 U	<0.37 U	<0.37 U	0.072 J	<0.37 U	<0.37 U	0.06 J	**0.0056 J***
LLsd-182-0998-SD	07/31/2001	0 - 0.5	0.12 J	**0.69 ***	**0.082 J***	**0.94 J***	**0.22 J***	**0.5 J***	**0.84 J***	**0.021 J***
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	<0.44 U	<0.44 U	<0.44 U	0.085 J	<0.44 U	<0.44 U	0.071 J	0.0026 J
LL2sd-053-1129-SD			<0.48 U	**0.24 J***	<0.48 U	0.41 J	0.11 J	0.18 J	**0.34 J***	<0.0025 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<0.42 U	0.061 J	<0.42 U	0.096 J	<0.42 U	<0.42 U	0.083 J	<0.0021 U
LL2sd-271-1076-SD			<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.44 U	<0.0023 U

		Chemical	Endrin ketone	beta-BHC
		Screening Criteria		**0.005**
		Criteria Source	**None**	**USEPA Reg 5**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<0.0038 U	**0.0092 J***
LLsd-182-0998-SD	07/31/2001	0 - 0.5	**0.01 J***	**0.079 J***
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	<0.0023 U	0.004 J
LL2sd-053-1129-SD			<0.0025 U	<0.0025 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<0.0021 U	<0.0021 U
LL2sd-271-1076-SD			<0.0023 UJ	<0.0023 U

***Bold indicates sample exceeds screening criteria.**
BHC = Benzenehexachloride.
DDE = dichlorodiphenyldichloroethylene.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
SRV = Sediment Reference Value.
U = Not detected.
UJ = Not detected and reporting limit estimated.
USEPA = United States Environmental Protection Agency.

Attachment Table 2. Ecological Screening Results for ISM Sediment at Load Line 2

		Chemical	Antimony	Beryllium	Cadmium	Calcium	Lead	Magnesium	Silver	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene
		Screening Criteria	1.3	0.8	0.99	21000	47	7100	0.5		0.0144
		Criteria Source	SRV	SRV	MacDonald et al.	SRV	SRV	SRV	USEPA Reg 5	None	USEPA Reg 5
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	**9.5 ***	**0.96 ***	0.79	3270	**80.5 ***	3220	<0.099 U	<0.1 U	<0.1 U

		Chemical	4-Amino-2,6-Dinitroto	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene
		Screening Criteria		0.0572	0.108	0.15	10.4	0.17	0.24
		Criteria Source	None	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5	USEPA Reg 5	USEPA Reg 5
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	<0.1 U	**0.245 J***	**1.25 ***	**1.4 ***	2.3	**1.2 ***	**0.73 J***

		Chemical	Bis(2-ethylhexyl)phth	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Indeno(1,2,3-cd)pyren	Phenanthrene	Pyrene
		Screening Criteria	0.182	0.166	0.033	0.423	0.2	0.204	0.195
		Criteria Source	USEPA Reg 5	MacDonald et al.	MacDonald et al.	MacDonald et al.	USEPA Reg 5	MacDonald et al.	MacDonald et al.
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	0.145 J	**1.55 ***	**0.135 J***	**3.05 ***	**1.045 ***	**1.25 ***	**2.3 ***

		Chemical	4,4'-DDE	Endrin ketone	beta-BHC
		Screening Criteria	0.0032		0.005
		Criteria Source	MacDonald et al.	None	USEPA Reg 5
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	<0.0054 UJ	<0.0054 UJ	<0.0054 UJ

***Bold indicates sample exceeds screening criteria.**
BHC = Benzenehexachloride.
DDE = dichlorodiphenyldichloroethylene.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
SRV = Sediment Reference Value.
U = Not detected.
UJ = Not detected and reporting limit estimated.
USEPA = United States Environmental Protection Agency.

Attachment Table 3. Human Health Screening Results for Discrete Sediment at Load Line 2

Sample ID	Date	Chemical	Aluminum	Antimony	Arsenic	Cadmium	Chromium, hexavalent	Copper	Lead	Manganese	Thallium
		Screening Criteria	**73798**	**28.2**	**19.5**	**64.1**	**199**	**3106**	**400**	**2927**	**6.12**
		Criteria Source	**RC**	**RC**	**BKG**	**RC**	**RC**	**RC**	**RSL**	**RC**	**RC**
		Depth (ft)	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	9320 J	<1.1 UJ	13.2	<0.56 U	<1.1 R	18.9	12.2	384	0.43
LLsd-182-0998-SD	07/31/2001	0 - 0.5	6860 J	1.8 J	18.7	0.21 J	<1.1 R	23.6	31.2	1150	<0.37 U
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	12400 J	<1.3 UJ	6.5	<0.67 U	<1.3 R	17.2	19	237	<0.46 U
LL2sd-053-1129-SD	07/30/2001	0 - 0.5	12400 J	0.85 J	8.2	<0.73 U	<1.5 R	28.8	32.1	246	<0.52 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	5670 J	<1.3 UJ	17.6	<0.63 U	<1.3 R	12.1	19.6	1030	<0.4 U
LL2sd-271-1076-SD	07/31/2001	0 - 0.5	6430	<1.3 UJ	18.5	0.25 J	NA	23.2	28.5 J	438 J	0.35

Sample ID	Date	Chemical	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	RDX	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene
		Screening Criteria	**36.5**	**7.53**	**80.3**	**2.21**	**0.221**	**2.21**	**0.221**
		Criteria Source	**RC**	**RA**	**RC**	**RA**	**RA**	**RA**	**RA**
		Depth (ft)	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	NA	NA	NA	<0.37 U	<0.37 U	<0.37 U	<0.37 U
LLsd-182-0998-SD	07/31/2001	0 - 0.5	0.27	0.19 J	<0.5 U	0.6	**0.55 ***	0.71	0.082 J
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	NA	NA	NA	<0.44 U	<0.44 U	<0.44 U	<0.44 U
LL2sd-053-1129-SD	07/30/2001	0 - 0.5	NA	NA	NA	0.15 J	0.18 J	0.25 J	<0.48 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	NA	NA	NA	<0.42 U	<0.42 U	0.074 J	<0.42 U
LL2sd-271-1076-SD	07/31/2001	0 - 0.5	NA	NA	NA	<0.44 U	<0.44 U	<0.44 U	<0.44 U

Sample ID	Date	Chemical	Indeno(1,2,3-cd)pyren	Dieldrin	PCB-1254	PCB-1260
		Screening Criteria	**2.21**	**0.558**	**1.2**	**2.03**
		Criteria Source	**RA**	**RC**	**RC**	**RA**
		Depth (ft)	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL2sd-054-1131-SD	07/30/2001	0 - 0.5	<0.37 U	<0.0038 U	<0.037 U	<0.037 U
LLsd-182-0998-SD	07/31/2001	0 - 0.5	0.22 J	<0.0037 U	<0.036 U	<0.036 U
LL2sd-052-1127-SD	07/30/2001	0 - 0.5	<0.44 U	<0.0023 U	<0.044 U	<0.044 U
LL2sd-053-1129-SD	07/30/2001	0 - 0.5	0.11 J	<0.0025 U	<0.048 U	<0.048 U
LL2sd-055-1133-SD	07/31/2001	0 - 0.5	<0.42 U	<0.0021 U	<0.042 U	<0.042 U
LL2sd-271-1076-SD	07/31/2001	0 - 0.5	<0.44 U	<0.0023 U	<0.044 U	<0.044 U

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
R = Rejected.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 4. Human Health Screening Results for ISM Sediment at Load Line 2

		Chemical	Aluminum	Antimony	Arsenic	Cadmium	Copper	Lead	Manganese	Thallium	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene
		Screening Criteria	73798	28.2	19.5	64.1	3106	400	2927	6.12	36.5	7.53
		Criteria Source	RC	RC	BKG	RC	RC	RSL	RC	RC	RC	RA
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	16400	9.5	7.8 J	0.79	87.5 R	80.5	309	<0.81 U	<0.1 U	<0.1 U

		Chemical	RDX	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyren	Dieldrin	PCB-1254	PCB-1260
		Screening Criteria	80.3	2.21	0.221	2.21	0.221	2.21	0.558	1.2	2.03
		Criteria Source	RC	RA	RA	RA	RA	RA	RC	RC	RA
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-034-0000	06/23/2003	0 - 0.3	<0.2 U	1.25	**1.4 ***	**2.3 ***	0.135 J	1.045	<0.0054 UJ	<0.11 U	<0.11 U

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
R = Rejected.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 5. Ecological Screening Results for Surface Water at Load Line 2

	Chemical	**Cadmium**	**Bis(2-ethylhexyl)phthalate**
	Screening Criteria	**0.0025**	**0.0084**
	Criteria Source	**OMZA--hardness dependent**	**OMZA**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-034-0000	06/23/2003	<0.0012 U	<0.011 U
FSW-SW-074-0000	08/06/2003	<0.0012 U	0.0013 J
LL2sw-052-1128-SW	07/30/2001	0.00028 J	0.0028 J
LL2sw-053-1130-SW		<0.005 U	NA
LL2sw-055-1134-SW		<0.005 U	<0.01 U

J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
OMZA = Outside Mixing Zone Average
U = Not detected.

Attachment Table 6. Human Health Screening Results for Surface Water at Load Line 2

	Chemical	Aluminum	Antimony	Arsenic	Cadmium	Chromium, hexavalent	Copper	Lead	Manganese	Thallium	2,4,6-Trinitrotoluene
	Screening Criteria	**148.27**	**0.0491**	**0.011**	**0.0505**	**0.303**	**6.144**	**0.015**	**6.326**	**0.0124**	**0.0782**
	Criteria Source	**RC**	**RC**	**RA**	**RC**	**RC**	**RC**	**RSL**	**RC**	**RC**	**RC**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-034-0000	06/23/2003	0.574	0.0065 J	<0.019 U	<0.0012 U	NA	0.0065	0.0034 J	0.0839	<0.0099 UJ	<0.00026 U
FSW-SW-074-0000	08/06/2003	1.3	0.008	<0.019 U	<0.0012 U	NA	0.007	0.0044 J	0.151	<0.02 U	0.0011
LL2sw-052-1128-SW	07/30/2001	0.51 J	0.014	<0.015 U	0.00028 J	<0.02 U	0.0042 J	<0.01 U	0.071	<0.002 UJ	<0.0002 U
LL2sw-053-1130-SW		0.27 J	0.015	<0.015 U	<0.005 U	<0.02 U	<0.015 U	<0.01 U	0.055	<0.002 UJ	<0.0002 U
LL2sw-055-1134-SW		0.42 J	<0.01 U	<0.015 U	<0.005 U	<0.02 U	<0.015 U	<0.01 U	0.097	<0.002 UJ	<0.0002 U

	Chemical	2,4-Dinitrotoluene	RDX	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Dieldrin
	Screening Criteria	**0.0199**	**0.155**	**0.0001**	**8E-6**	**0.0001**	**5E-6**	**0.0001**	**17E-6**
	Criteria Source	**RA**	**RA**	**RA**	**RA**	**RA**	**RA**	**RA**	**RSL**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-034-0000	06/23/2003	<0.00026 UJ	0.0056	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.00005 U
FSW-SW-074-0000	08/06/2003	<0.00026 U	0.012 J	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U	NA
LL2sw-052-1128-SW	07/30/2001	<0.00013 U	<0.0005 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.00005 U
LL2sw-053-1130-SW		<0.00013 U	<0.0005 U	NA	NA	NA	NA	NA	NA
LL2sw-055-1134-SW		<0.00013 U	0.0024	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.00005 U

	Chemical	PCB-1254	PCB-1260
	Screening Criteria	**0.0031**	**0.0004**
	Criteria Source	**RC**	**RSL**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-034-0000	06/23/2003	<0.0011 U	<0.0011 U
FSW-SW-074-0000	08/06/2003	NA	NA
LL2sw-052-1128-SW	07/30/2001	<0.0005 U	<0.0005 U
LL2sw-053-1130-SW		<0.0005 U	<0.0005 U
LL2sw-055-1134-SW		<0.0005 U	<0.0005 U

J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

APPENDIX C
LOAD LINE 3 (RVAAP-10)

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
bgs	Below Ground Surface
BHC	Benzene Hexachloride
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOPC	Contaminant Migration Chemical of Potential Concern
COC	Chemical of Concern
COI	Chemical of Interest
CUG	Cleanup Goal
DLA	Defense Logistics Agency
DNT	Dinitrotoluene
ESV	Ecological Screening Value
FFS	Focused Feasibility Study
FS	Feasibility Study
FSP	Field Sampling Plan
FWCUG	Facility-Wide Cleanup Goal
ft	Feet
gal	Gallon
HI	Hazard Index
HMX	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
ISM	Incremental Sampling Method
L	Liter
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MI	Multi-Increment
NFA	No Further Action
Ohio EPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RBC	Risk-Based Concentration
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SESOIL	Seasonal Soil Compartment Model
SRV	Sediment Reference Value

ACRONYMS AND ABBREVIATIONS (continued)

SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Compound
TNT	Trinitrotoluene
TR	Target Risk
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

C.0 LOAD LINE 3 (RVAAP-10)

This appendix presents the information and data evaluated for Load Line 3 to identify data gaps in surface water and sediment that will require additional sampling to be performed under the Sampling and Analysis Plan (SAP) Addendum. New data generated from the proposed activities presented in this appendix will be incorporated into the Feasibility Study (FS) Addendum Report. This appendix describes the area of concern (AOC) and presents historical investigation summaries, data gap screening results for surface water and sediment for human health and ecological receptors, and recommendations for additional surface water and sediment sampling. Specific procedures followed to complete these assessments are included in the Field Sampling Plan (FSP) (Part I) of the SAP Addendum and are not repeated through this appendix.

C.1 AREA OF CONCERN DESCRIPTION

Load Line 3 is located in the southeastern portion of the facility and was in operation from 1941-1945, from 1951–1957, and again from 1969–1971. Load Line 3 was primarily used to melt bulk explosives and load Composition B into large-caliber shells and bombs. During its operational history from 1941–1945, Load Line 3 produced approximately 6.5 million munitions. Demilitarization activities were conducted between 1951 and 1957; during which time, approximately 228,000 munitions were processed at the load line. During the operation of Load Line 3, bulk trinitrotoluene (TNT) and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) were offloaded at Buildings EA-6 and EA-6A for screening and preparation before being transported to melt pour Buildings EA-4 and EA-4A for processing and loading into shells. Bulk explosive carrier washout activities were conducted at Building EB-25. Building wash-down water and wastewater from the load line operations were collected in concrete sumps, pumped through sawdust filtration units, and ultimately discharged to a drainage ditch leading to a settling pond (Upper Cobbs Pond and, ultimately, Lower Cobbs Pond). During the operation of Load Line 3, approximately 304,800 L of pinkwater were generated each month (Jacobs Engineering 1989). All buildings and structures at Load Line 3 have been demolished.

Each building located at Load Line 3 is presented below with a summary of it historical use and potential contamination source description. Former production buildings are included in Table C-1, and the non-production buildings are listed in Table C-2.

Table C-1. Former Production Buildings at Load Line 3

Building ID	Purpose	Description of Potential Sources
EA-6	Explosive Preparation Building	Utilized to screen bulk granular TNT or bulk RDX and HMX prior to transport to the melt pour building.
EA-6A	Explosive Preparation Building	Utilized to screen bulk granular TNT or bulk RDX and HMX prior to transport to the melt pour building.
EA-28	Elevator Machine House	Took screened explosives from Building EA-6/EA6A and transported to Building EB-4/EB-4A for melt pour operations.
EA-28A	Elevator Machine House	Took screened explosives from Building EA-6/EA6A and transported to Building EB-4/EB-4A for melt pour operations.
EB-4	Melt Load Building	Located in the production area, this building was a primary melt pour building for explosives.
EB-4A	Melt Load Building	Located in the production area, this building was a primary melt pour building for explosives.
EB-4A-WN	Washout Annex	Settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
EB-4A-WS	Washout Annex	Settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
EB-4-WN	Washout Annex	Settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
EB-4-WS	Washout Annex	Settling tanks adjacent to Building 4 to containerize explosives washout water (pinkwater).
EB-4A-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
EB-4-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
EB-10-VP1	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
EB-10-VP2	Vacuum Pump House	The vacuum pump was associated with handling process wastes (explosives dust) pulled from the drilling and assembly building.
EB-10	Drilling and Assembly Building	Location where booster charges were installed after primary charge loaded at EB-4/4A.
EB-10A	Radiographic Building	Following loading of booster charges at EB-10, quality assurance of the primary charges was completed using the radiographic equipment in EB-10A.
EB-13	Packing and Shipping Building	Packing and shipping operations for completed munitions.
EB-13A	Shell Storage Building/Assembling and Shipping Building	Packing and shipping operations for completed munitions.
EB-13B	Shipping Warehouse Annex	Packing and shipping operations for completed munitions.
EB-25	Shell Carrier Washout Building	Bulk explosive carrier washout activities were completed in this building. Effluent was discharged to a concrete settling tank south of the building, which discharged to an unlined drainage ditch.

ID = Identification.
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocane.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
TNT = Trinitrotoluene.

Table C-2. Former Non-Production Buildings Inventory at Load Line 3

Building ID	Purpose
EA-7	TNT Service Building
EB-11	Fuse Service Building
EB-19	Electric Locomotive Service Building
EB-2	Paint and Oil Storage Building
EB-3	Shell Receiving and Painting Building
EB-803	Inert Storage Building - receiving area for the load line and inert storage prior to completion within the production area.
EB-9	Service Building
EB-9A	Service Building
LL3-CST-1	Concrete Settling Tanks
LL3-CST-2	Concrete Settling Tank
EA-21	TNT Box Building
EA-5	AN Service Building
EB-22	Change House
EB-8	Change House
EB-8A	Change House
3-51A	Load Line Office
3-51	Clock Alley
EB-20	Line Office

ID = Identification.
TNT = Trinitrotoluene.

Beginning in the early 1950s, the Defense Logistics Agency (DLA) conducted a strategic materials storage mission at Load Line 3. One hundred above-grade storage tanks (Tanks 1401 through 1500), having a capacity of 500 barrels (21,000 gal), were constructed to store strategic materials. Tanks 1401 through 1476 were used to store silica carbide. The remainder was used to store various other strategic solid materials. The DLA Tank Storage Area (shown on Plate C-1) is covered under the Compliance Restoration Program as site CC-RVAAP-79 and is currently undergoing separate investigation; therefore, it is not included in the SAP Addendum.

Demolition Activities – By the late 1970s, all but 20 tanks had been removed; those remaining were used to store antimony, asbestos, and magnesium silicate (talc). All DLA storage tanks are now empty; the remaining materials were removed in approximately the year 2000.

C.2 PREVIOUS INVESTIGATIONS, DECISIONS, AND ACTIONS

Since 1978, Load Line 3 has been the subject of multiple investigations and/or assessments leading to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decisions and/or remedial actions at the AOC. CERCLA activities completed at Load Line 3 are presented in the following report summaries and in the timeline illustrated on Figure C-1. These 16 reports present extensive evaluations and remedial activities performed to address contaminated media, including assessments at each of the former buildings listed in Tables C-1 and C-2.

THIS PAGE INTENTIONALLY LEFT BLANK.

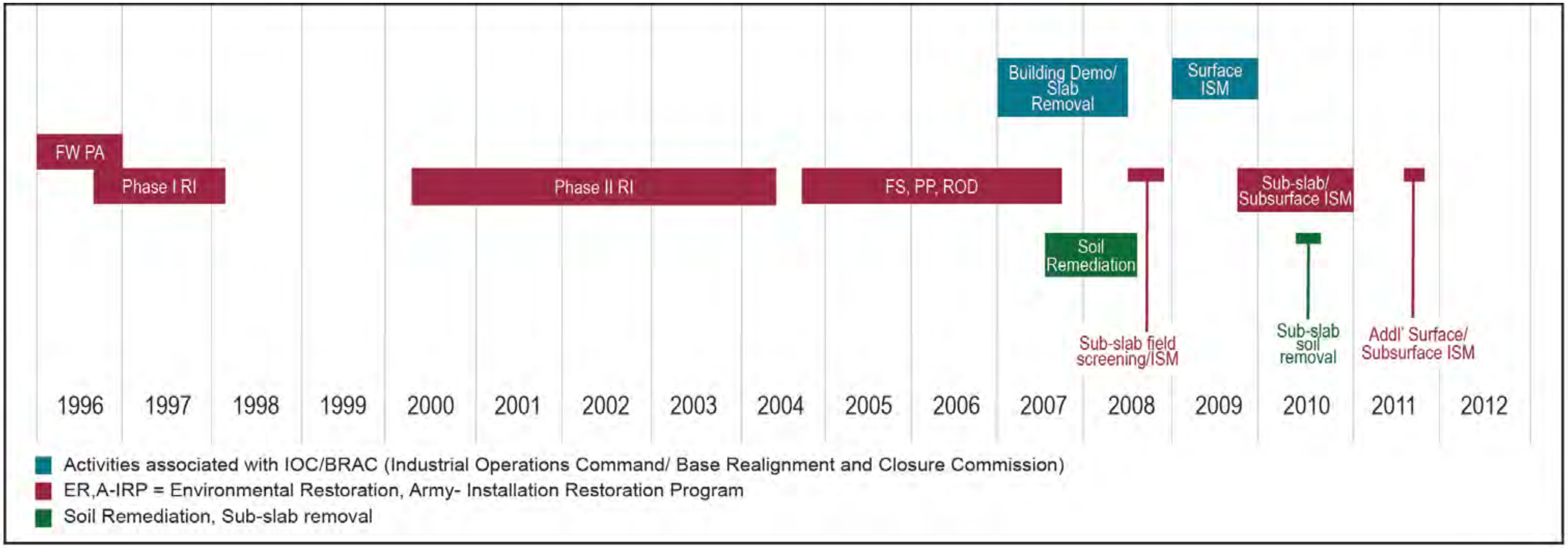


Figure C-1. Timeline of Remedial Activities at Load Line 3

THIS PAGE INTENTIONALLY LEFT BLANK.

C.2.1 Installation Assessment of Ravenna Army Ammunition Plant

In 1978, the *Installation Assessment of Ravenna Army Ammunition Plant* (USATHAMA 1978) incorporated a review of historical operational information and available environmental data to assess the potential for contaminant releases from operational facilities. The installation assessment presented quantities of munitions produced, amounts of chemicals utilized, and waste produced at each load line. No sampling, investigation, or actions were performed at Load Line 3 as part of the assessment. The assessment concluded that no sampling was presently required for AOC exit pathways or surface water bodies and additional action may be warranted.

C.2.2 Preliminary Assessment for the Characterization of Areas of Contamination

In 1996, the *Preliminary Assessment for the Characterization of Areas of Contamination* [herein referred to as the preliminary assessment (PA)] (USACE 1996) was developed following CERCLA requirements and provided information concerning conditions at CERCLA AOCs at the Ravenna Army Ammunition Plant (RVAAP) to assess potential contamination risks posed to human health and the environment. The PA provided a narrative of the facility history and process operations and a description of activities conducted at each AOC. According to the PA, waste constituents at Load Line 3 included, but are not limited to, TNT, HMX, Composition B, lead, chromium, mercury, and arsenic. Primary contaminant release mechanisms were process effluent discharges to surface water and process building wastewater washout to surface soils and sediments.

The report provided a PA scoring, subsequent prioritization of AOCs through evaluation of exposure pathways, and a relative risk site evaluation model. Load Line 3 was ranked as a high-priority AOC for future environmental investigations due to the primary contaminant release mechanism from process effluent discharges to surface water and surface soil.

C.2.3 Phase I Remedial Investigation

A *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (herein referred to as the Phase I Remedial Investigation [RI]) USACE 1998) was conducted at Load Line 3 from July through August 1996. During this investigation, sampling activity at Load Line 3 included surface soil and sediment sample collection across the AOC. Samples were analyzed for explosives, metals, cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and/or polychlorinated biphenyls (PCBs).

The explosive TNT was detected in samples at the highest concentration of any load line sample collected as part of the Phase I RI. Many of the occurrences and highest concentrations of TNT were located around melt pour Buildings EB-4 and EB-4A. The maximum concentration of TNT detected at Load Line 3 was 390,000 mg/kg at Building EB-10. Metals, SVOCs, pesticides, PCBs, and VOCs also were detected in surface soil samples collected at Load Line 3, primarily around Buildings EB-4, EB-4A, and EB-803.

Nine ditch sediment locations were sampled throughout the Load Line 3 AOC to characterize effluent that flows through ditches that exit the AOC to the west. Explosives were detected in sediment samples, although at lower concentrations (at least one order of magnitude) than observed in soil. The distribution and concentration of TNT in sediment was highest at Buildings EB-4 and EB-4A. Metals also were consistently detected in sediment at Load Line 3.

The conclusions of the Phase I RI categorized Load Line 3 as a "high-priority" AOC due to elevated concentrations of explosives, inorganic chemicals, and organic chemicals throughout surface soil and sediment at the AOC, and a Phase II RI was recommended (USACE 1998).

C.2.4 Phase II Remedial Investigation

The *Phase II Remedial Investigation Report for the Load Line 3* (herein referred to as the Phase II RI) (USACE 2004a) evaluated the nature and extent of process-related contaminants in surface and subsurface soil, sediment, surface water, and groundwater, and assessed the potential risk to human health and the environment resulting from former operations at Load Line 3.

As part of the Phase II RI, the AOC was evaluated by dividing it into spatial aggregates based on former process operations and drainage areas. Surface and subsurface soil were separated into seven aggregates (Explosive Handling Areas, Preparation and Receiving Areas, Packaging and Shipping Areas, Change House, Perimeter Area, DLA Storage Tanks, and West Ditches). The two sediment and surface water aggregates evaluated as part of the Phase II RI are Cobbs' Pond Tributary (sediment and surface water) and Miscellaneous Water (surface water).

A total of 159 surface soil samples were collected across the seven aggregates to determine the nature and extent of surface soil contamination at Load Line 3. The distribution and occurrence of contaminants in surface soil differ within each aggregate; however, the constituents (i.e., explosives and inorganics) are consistent throughout the AOC. The Explosive Handling Areas aggregate contained the highest concentrations and frequency of detected chemicals in surface soil within Load Line 3. Explosives, inorganic chemicals, and SVOCs were common in surface soil with the highest overall concentrations occurring near Buildings EB-4, EA-6, and EB-10.

A total of 28 discrete subsurface soil samples were collected across the AOC to assess vertical migration. Explosives and inorganic chemicals were detected at the Explosives Handling Areas with the highest concentrations at process Buildings EA-6 and EB-4.

A total of 20 sediment samples and 10 surface water samples were collected from drainage channels under the Load Line 3 Phase II RI. Explosive and inorganic chemicals were the most frequent chemicals identified in sediment. Inorganic chemicals were frequently detected in surface water. Explosive and inorganic chemicals were detected at low concentrations in surface water.

Recommendations of the Phase II RI included completing an FS to evaluate possible remedial actions at Load Line 3 to reduce or eliminate potential risks to human and/or ecological receptors (USACE 2004a).

Data from four sediment samples and two surface water samples from the Phase II RI (USACE 2004a) were incorporated into the FS Addendum dataset.

C.2.5 Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4

The *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4* Report (USACE 2004b) documented the proposed land use and corresponding risk-based remedial goal options (RGOs) that were used to support the remedial alternative selection process in the *Focused Feasibility Study for the Remediation of Soils at Load Lines 1 through 4* [herein referred to as the focused feasibility study (FFS)] (USACE 2005b). Environmental samples or remedial actions were not completed under this task.

C.2.6 Final November 2004 Sampling Completion Report

Sampling was completed in November and December 2004 for delineating the horizontal and vertical extents of contamination at the AOC (USACE 2005a). Some identified data gaps were not fully addressed as part of the additional data gap sampling due to manganese concentrations continuing to exceed the established RGO. As part of this data gap sampling event, sampling ceased following three step-outs of 10 ft per step-out, confirming that a chemical of concern (COC) was not a random detection or when manganese was detected at concentrations less than 2,000 mg/kg (USACE 2005a). Data from this report were incorporated into the FFS and are presented as Appendix B of the FFS.

C.2.7 Final Focused Feasibility Study for the Remediation of Soils at Load Lines 1, 2, 3, and 4

The FFS presented the remedial alternatives for surface soil, subsurface soil, and dry sediment at Load Lines 1 through 4. As part of the FFS, data acquired in the Phase I and II RIs were screened against RGOs and considered during the evaluation of remedial alternatives. Additional data from the 2004 perceived data gap investigation also were incorporated into the FFS (USACE 2005b).

The recommended interim remedy (excavation with off-site disposal) was based on a detailed analysis of the feasible remedial alternatives to address surface soil, subsurface soil, and dry sediment contamination at Load Line 3. This alternative was recommended due to expediency, permanency, consistency with future land use, moderate relative cost, feasibility, and implementability (USACE 2005b). Environmental sampling and remedial actions were not completed as part of the FFS.

C.2.8 Interim Record of Decision for the Remediation of Soils at Load Lines 1, 2, 3, and 4

In 2007, the U.S. Army Corps of Engineers (USACE) developed the *Interim Record of Decision for the Remediation of Soils at Load Lines 1 through 4* (USACE 2007) to address chemical exposure in soil and dry sediment. The selected remedy was chosen in accordance with CERCLA requirements. The selected remedy for surface soil, subsurface soil, and dry sediment that were currently accessible at Load Lines 1 through 4 with concentrations of chemicals exceeding RGOs was excavation and off-site disposal. The selected remedy was recommended as part of the FFS, documented in the Proposed Plan, received public acceptance during the public comment period, and received state acceptance from the Ohio Environmental Protection Agency (Ohio EPA). The Interim Record of Decision (ROD) and selected remedy received acceptance from the U.S. Army Division of Base Realignment and Closure (BRAC) in the summer of 2007.

C.2.9 Remedial Action Completion Report for the Remediation of Soils and Dry Sediments

Remedial action excavation activities occurred at Load Lines 1 through 4 from August to November 2007. A total of 893 tons of hazardous (PCB-contaminated) soils and 2,538 tons of non-hazardous soils were removed from Load Line 3. The maximum depth of the excavation was to 3 ft below ground surface (bgs); however, most excavations were typically to 2 ft bgs. A total of 35 discrete areas were excavated within Load Line 3. After the excavations were completed, 31 multi-increment (MI), or incremental sampling method (ISM), confirmation samples were collected and analyzed for Load Line 3 COCs: PCB-1254, benzo(a)pyrene, TNT, aluminum, antimony, arsenic, hexavalent chromium, lead, and manganese. Laboratory results for the MI samples collected at Load Line 3 indicate that the COCs were removed to below cleanup goals (CUGs) at all Load Line 3 final excavation areas (USACE 2008b).

As part of the planned remedial action, concrete slabs were to remain in place and periodic monitoring of the concrete slab integrity was to be completed. A post-ROD change to the concrete slab maintenance task for Load Lines 1 through 4 was initiated by USACE and BRAC in late 2007. BRAC commenced slab and foundation removal in March 2008 at Load Lines 1 through 4, eliminating the need for routine maintenance as directed in the selected remedy.

After remedial activities were complete, the Ohio EPA also indicated that "the physical remedial action of soil and dry sediment removal has been completed in accordance with the intents and provisions of the Interim ROD for Load Lines 1-4" (Ohio EPA 2008).

C.2.10 Preliminary Evaluation of Pre (Floor Slab Removal) Contamination for the Sampling of Soils Beneath Floor Slabs and Load Lines 2, 3, and 4 and Excavation and Transportation of Contaminated Soils to Load Line 4

Sampling was completed pre-removal below floor slabs of demolished buildings at Load Lines 2, 3, and 4. Sampling was conducted prior to floor slab removal through holes in building slabs from building demolition activities that allowed access to soil below the floor slabs. Field screening of seven soil samples was completed at Building EB-10 at Load Line 3. Field screening results indicated concentrations of TNT or hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) were detected below CUGs in all samples from Load Line 3. Based on the field screening results, no samples were submitted for laboratory analysis (USACE 2008a).

C.2.11 Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

Floor slab removal was completed between March and June 2008. As part of the scope of this investigation, the following sampling activities were completed at Load Lines 2, 3, and 4: stockpile sampling, post-slab removal field screening, and final confirmatory sampling. The objective of the sampling was to determine if any areas required excavation to remove contaminated soils beneath former building slabs. A total of 720 field screening samples were screened from Load Lines 2, 3, and 4 in 2008. The focus for the majority of the sampling completed at Load Line 3 involved buildings with the highest probability of contamination, including Buildings EB-4, EB-4A, EA-6, EA-6A, and EB-10. Core samples were collected to a maximum depth of 4 ft bgs at these locations for explosives field screening. Analytical and field screening results from these building slabs at Load Line 3 indicated there were concentrations of the explosive TNT beneath former building slabs that exceeded CUGs at Buildings EB-4, EA-6 and EA-6A (USACE 2009a). Additional field investigation activities completed at Load Line 3 outside of investigation of soils beneath floor slabs included collecting a field screening sample from soils at Building EB-4A.

C.2.12 Multi-Increment Sampling and Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

MI (or ISM) sampling was completed in 2008 within building footprints following the removal of building slabs and any contaminated soils identified as part of the Sampling and Screening Analysis Report (USACE 2009a). The purpose of MI confirmatory sampling was to determine if any additional excavation was required at building locations beyond those determined by field screening. A total of 102 primary MI samples were collected between Load Lines 2, 3, and 4.

Each sample was analyzed for metals and explosives, with select locations also being analyzed for RVAAP full suite parameters (VOCs, SVOCs, PCBs, pesticides, and propellants). Areas selected for full suite analysis were based on actual operations at an individual building and whether operations would indicate contamination other than explosives and metals based on the historical process knowledge. MI samples were collected from 0–1 ft bgs across building footprints. Explosives, propellants, SVOCs [primarily polycyclic aromatic hydrocarbons (PAHs)], PCBs, and metals were detected in MI samples collected at Load Line 3. VOCs and pesticides were not detected in samples collected at Load Line 3.

C.2.13 Remediation Completion Report Sub-Slab Soils at Load Lines 2, 3, and 4

Based on the characterization and results provided as part of the Sampling and Screening Analysis Report (USACE 2009a) and *Multi-Increment Sampling and Analysis of Soils Below Floor Sabs at RVAAP-09, 10, and 11* Report (USACE 2009b), five distinct areas were identified for completing the remedial action at Load Line 3:

- Northeast corner of Building EB-4 and north sump area of Building EB-4-WN (40x80x4 ft),
- Northeast corner of Building EB-4A and sump area of Building EB-4A-WN (40x60x4 ft),
- Building EA-6 (20x20x5 ft),

- Building EA-6A (40x40x5 ft), and
- Building EB-25 (20x25x1 ft).

As part of the remedial actions completed for sub-slab soils at Load Line 3, the five areas were excavated in June 2010. A total of 1,602 cubic yards of soil were excavated from the five areas at Load Line 3. Excavated soils were stockpiled temporarily at Load Line 3 prior to off-site disposal (USACE 2010b). After the excavations were completed and the field screening samples were collected, confirmation MI (or ISM) samples were collected and analyzed for explosives, metals, SVOCs, and PCBs. The results of the MI samples indicated the excavated areas were successfully remediated to CUGs identified in the Interim ROD and no further remedial actions were needed for sub-slab soils (USACE 2010b).

C.2.14 Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers

The *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (herein referred to as the Facility-Wide Sewers RI/FS) (USACE 2012) evaluated the nature and extent of process-related contaminants in sewer sediment, surface water, and outfalls, and assessed the potential risk to human health and the environment resulting from former operations at Load Line 3. As part of this RI, field investigative activities included performing visual survey inspections of sanitary and storm sewer structures (i.e., manholes, drop inlets, catch basins, and outfalls); conducting video camera surveys of select sewer lines; and collecting sewer sediment, sewer water, pipe bedding, outfall sediment, and outfall water samples using discrete methods. The RI recommended no further action (NFA) for Load Line 3.

Data collected during the Facility-Wide Sewers RI/FS activities are excluded from the FS Addendum data screen, as the sewers media data are currently being evaluated as part of the Facility-wide Sewers AOC.

C.2.15 Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4

The *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations* (USACE 2010a) was performed to sample and characterize deeper subsurface soils beneath the former building slabs via subsurface soil ISM techniques. Additional surface soil ISM samples in ore storage areas at Load Line 3 also were collected and analyzed to provide preliminary data for future RIs of these AOCs. The ore storage areas are currently being evaluated under the investigation associated with the DLA, and associated samples are not included in the FS Addendum dataset.

In 2009, USACE collected 19 total surface soil MI (or ISM) samples at Load Line 3 from 0.0–0.5 ft bgs: six were analyzed for metals; 17 for explosives; four for SVOCs, pesticides, and PCBs; and two for VOCs. Metals, explosives, propellants, SVOCs, and VOCs were not detected above the CUGs utilized in the *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4* (herein referred to as the 2011 Sampling Report) in any of the samples collected from the buildings at Load Line 3. PCB-1254 was detected above the CUGs identified in the 2011 Sampling Report in one sample.

A total of 66 subsurface soil ISM samples were collected at Load Line 3 to a maximum depth of 7 ft bgs. A total of 54 of the subsurface soil ISM samples were analyzed for metals, 21 for explosives and propellants, 37 for SVOCs, 12 for VOCs, and nine for PCBs and pesticides. Explosives, propellants, pesticides, PCBs, and VOCs were not detected above the CUGs identified in the 2011 Sampling Report in any of the samples collected at Load Line 3 (USACE 2011). Arsenic and SVOCs were detected above the CUG utilized in the 2011 Sampling Report at limited locations.

C.2.16 Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12

Additional characterization sampling was completed at Load Line 3 to guide future soil remedial and administrative measures. The samples collected as part of this investigation helped eliminate soil data gaps recognized in the *Land Use Control Assessment Report* (USACE 2010c). Eight surface soil ISM samples and 13 subsurface soil horizontal ISM samples (2 from the 1–2 ft bgs interval, 4 from the 1–3 ft bgs interval, 4 from the 3–5 ft bgs interval, and 3 from the 5–7 ft bgs interval) were collected at Load Line 3 to further refine ISM sample areas that had concentrations of contaminants above the CUGs identified in the *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12* (herein referred to as the Characterization Sampling Report) (USACE 2013).

This investigation concluded that 5 of the 11 previous areas exceeding the CUGs utilized in the Characterization Sampling Report were further bound and delineated. The remaining six areas were not fully delineated (USACE 2013).

C.3 DATA GAP ASSESSMENT

The rationale for developing and using the data gap analysis is presented in Section 3.2 of the SAP Addendum FSP. This section presents information specific to Load Line 3 used in the data gap analysis for surface water and sediment. The conclusions of the data gap analysis present areas that require further investigation to define the nature and extent of contamination at source areas that will be evaluated in the FS Addendum Report. The following steps were followed to generate the data and screening criteria for the data gap analysis.

C.3.1 Data Assembly and Use Assessment – Load Line 3

All data collected at Load Line 3 were extracted from the RVAAP Environmental Information Management System database. This includes data from investigations summarized in the *Phase II Remedial Investigation Report for the Load Line 3* (USACE 2004a).

The surface water and sediment data from investigations summarized in the following reports were not used in the data gap analysis:

- *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (USACE 1998) – [These data are more than 16 years old and are no longer considered representative of the site (e.g., buildings and slabs have been removed and/or remediated)].

- *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (USACE 2012) (The sewers are currently being evaluated under a separate RI).

Once the data were assembled and evaluated for use, they were screened for chemicals of interest (COIs) specific to Load Line 3 surface water and sediment.

C.3.2 Chemicals of Interest – Load Line 3

The rationale for developing and using COIs is presented in Section 3.2.2 of this SAP Addendum FSP. Load Line 3 COIs were developed from the chemicals identified as exceeding residential risk for surface water and sediment in the Phase II RI (USACE 2004a). Load Line 3 COIs for exposure of Resident Receptor (Adult and Child) to sediment and surface water are shown in Table C-3. The COIs of potential ecological concern for surface water and sediment are listed in Table C-5.

Table C-3. COIs in Surface Water and Sediment at Load Line 3

COI	Load Line 3	
	Surface Water	Sediment
Metals		
Aluminum	X	X
Antimony	X	X
Arsenic	X	X
Barium	X	X
Cadmium	X	X
Lead	X	X
Manganese	X	X
Thallium	X	X
Explosives		
1,3-Dinitrobenzene	X	X
2,4,6-TNT	X	X
2,4-DNT	X	X
RDX	X	X
PCBs		
PCB-1254	X	X
PCB-1260	X	X
Pesticides		
4,4'-DDE	X	X
4,4'-DDT	X	
Dieldrin	X	X
Heptachlor	X	X

COI = Chemical of interest.
DDE = Dichlorodiphenyldichloroethylene.
DDT = Dichlorodiphenyltrichloroethane.
DNT = Dinitrotoluene.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
TNT = Trinitrotoluene.
X = COI present in medium.

C.3.3 Screening Criteria – Load Line 3

The residential screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.4 of the SAP Addendum FSP. The human health screening criteria [hazard index (HI)=1, target risk (TR) of 1E-05] values and sources are presented in Table C-4 for surface water and sediment specific to Load Line 3. The ecological screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2 of the SAP Addendum FSP. Table C-5 presents the ecological screening criteria used for surface water and sediment specific to Load Line 3.

Table C-4. Human Health Screening Criteria for Surface Water and Sediment at Load Line 3

Chemical[a] (mg/kg or mg/L)	Surface Water	Type[b]	Sediment	Type[b]
Aluminum	148.274	RC	73,798	RC
Antimony	0.0491	RC	28.2	RC
Arsenic	0.011	RA	19.5	BKG
Barium	29.007	RC	14,129	RC
Cadmium	0.0505	RC	64.1	RC
Lead	0.015	TB	400	RSL
Manganese	6.326	RC	2,927	RC
Thallium	0.0124	RC	6.12	RC
1,3-Dinitrobenzene	0.002	RSL	6.2	RSL
2,4,6-Trinitrotoluene	0.0782	RC	36.5	RC
2,4-Dinitrotoluene	0.0199	RA	7.53	RA
RDX	0.155	RA	80.3	RC
Benz(a)anthracene	0.000136	RA	2.21	RA
Benzo(a)pyrene	0.000008	RA	0.221	RA
Benzo(b)fluoranthene	0.000079	RA	2.21	RA
Dibenz(a,h)anthracene	0.000005	RA	0.221	RA
Indeno(1,2,3-cd)pyrene	0.000078	RA	2.21	RA
4,4'-DDE	0.0023	RSL	26.3	RC
4,4'-DDT	0.00102	RA	NA	NA
Dieldrin	0.000017	RSL	0.558	RC
Heptachlor	0.00002	RSL	1.98	RC
PCB-1254	0.00313	RC	1.2	RC
PCB-1260	0.00039	RSL	2.03	RA

[a] Chemicals listed are chemicals of concern for Resident (Adult and Child) Receptors in respective media.
[b] Type:
BKG = Background.
RA = Resident Adult Facility-Wide Cleanup Goal (FWCUG) for hazard quotient (HQ)=1 or Risk=10-5.
RC = Resident Child FWCUG for HQ=1 or Risk=10-5.
TB = Technology-based screening level.
RSL = U.S. Environmental Protection Agency Residential Soil or Tap Water Screening Level for HQ=1 or Risk=10-5.
DDE = Dichlorodiphenyldichloroethylene.
DDT = Dichlorodiphenyltrichloroethane.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
NA = Not applicable because the analyte was not a COI for that medium.

Table C-5. Ecological Screening Criteria for Surface Water and Sediment at Load Line 3

Chemical[a]	Surface Water (mg/L)	Type[b]	Sediment (mg/kg)	Type[b]
Antimony	NA		1.3	SRV
Beryllium	NA		0.8	SRV
Cadmium	NA		0.99	MacDonald et al.
Copper	NA		32	SRV
Iron	2.56	BKG	41,000	SRV
Lead	NA		47	SRV
Manganese	0.391	BKG	1,950	BKG
Nickel	NA		33	SRV
Potassium	3.17	BKG	6,800	SRV
Silver	NA		0.5	USEPA Reg 5
Zinc	NA		532	BKG
2,4,6-Trinitrotoluene	NA		None	
4-Amino-2,6-Dinitrotoluene	NA		None	
4,4'-DDE	NA		0.00316	MacDonald et al.
4,4'-DDT	NA		0.00416	MacDonald et al.
Endrin	NA		0.00222	MacDonald et al.
PCB-1254	NA		0.0598	Total PCB-MacDonald et al.

[a] Chemicals listed are chemicals of potential ecological concern in respective media.
[b] Type:
BKG = Background.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
None = No ecological screening value available.
SRV = Sediment reference value.
USEPA Reg 5 = USEPA 2003.
DDE = Dichlorodiphenyldichloroethylene.
DDT = Dichlorodiphenyltrichloroethane.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable because the analyte was not a chemical of interest for that media.
PCB = Polychlorinated biphenyl.

C.4 SURFACE WATER AND SEDIMENT EVALUATION

C.4.1 Surface Water and Sediment Screening Results

COI concentrations detected in surface water and sediment samples (discrete only) identified for use in the dataset were screened against the human health and ecological criteria presented in Section C.3.3 on a sample-by-sample basis. The results are presented in Attachment 1 of this appendix. The only sample that exceeded the human health screening criteria for surface water is listed in Table C-6. Samples that exceeded the ecological screening criteria are summarized in Tables C-7 and C-8 for surface water and sediment, respectively. Concentrations of chemicals exceeding screening criteria are shown in bold font. Detailed discussions for surface water and sediment exceedances are presented in Sections C.5.2.1 and C.5.2.2 for human health and ecological receptors, respectively, on a contaminant source-by-source basis.

Table C-6. Human Health Screening Exceedance for Surface Water at Load Line 3

	Chemical	**Manganese**
	Screening Criteria	**6.326**
	Criteria Source	**RC**
Sample ID	**Date**	**Concentration (mg/L)**
LL3sw-052-1072-SW	08/09/2001	**7.8 J***

***Bold indicates sample exceeds screening criteria.**
ID = Identification.
J = Estimated.
mg/L = Milligrams per liter.
RC = Resident Child.

Table C-7. Ecological Screening Exceedances for Surface Water at Load Line 3

	Chemical	**Iron**	**Manganese**
	Screening Criteria	**2.56**	**0.391**
	Criteria Source	**BKG**	**BKG**
Sample ID	**Date**	**Concentration (mg/L)**	**Concentration (mg/L)**
LL3sw-052-1072-SW	08/09/2001	**3.8 ***	**7.8 J***
LL3sw-053-1074-SW	08/08/2001	**2.7 ***	**3.5 J***

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ID = Identification.
J = Estimated.
mg/L = Milligrams per liter.

THIS PAGE INTENTIONALLY LEFT BLANK.

Table C-8. Ecological Screening Exceedances for Sediment at Load Line 3

		Chemical	Antimony	Cadmium	Copper	Iron	Lead	Nickel	Silver	Zinc	2,4,6-Trinitrotoluene	4-Amino-2,6-Dinitroto	PCB-1254
		Screening Criteria	1.3	0.99	32	41,000	47	33	0.5	532			0.0598
		Criteria Source	SRV	MacDonald et al.	SRV	SRV	SRV	SRV	USEPA Reg 5	BKG	None	None	Total PCB-MacDonald et al.
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc.(mg/kg)**
LL3sd-052-1071-SD	08/08/2001	0 - 0.5	<1.3 UJ	0.43 J	12.8 J	16,800	16.3 J	13.8	<0.65 U	67.8	NA	NA	**0.18 J***
LL3sd-053-1073-SD			<2.8 UJ	0.77 J	11.9 J	15,700	26.6 J	14.8	<0.97 U	122	**0.65 ***	**0.37 ***	<0.064 U
LL3sd-051-1079-SD			**18.2 J***	**3.5 ***	**222 J***	**124,000 ***	**91.6 J***	**42 ***	**10.5 ***	**2,190 ***	NA	NA	<0.047 U

***Bold indicates sample exceeds screening criteria.**

BKG = Background.
ft = Feet.
ID = Identification.
J = Estimated.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
None = No ecological screening value available
PCB = Polychlorinated biphenyl.
SRV = Sediment reference value.
U = Not detected.
UJ = Not detected and reporting limit estimated.
USEPA Reg 5 = USEPA 2003.

THIS PAGE INTENTIONALLY LEFT BLANK.

C.4.2 Characterization of Surface Water and Sediment

The Phase II RI (USACE 2004a) established the surface water and sediment data aggregate at Load Line 3 by evaluating historic and current surface water flow directions and conveyances. This data gap evaluation uses the Cobbs' Pond Tributary aggregate, which was the only data aggregate presented and approved in the Phase II RI, as shown in Figure C-2. The Phase II RI established a complete evaluation of surface water and sediment based on historic receptors. This same data aggregate is re-evaluated in the SAP Addendum to establish any required action needed to meet the current receptors identified in the Technical Memorandum (ARNG 2014).

C.4.2.1 <u>Human Health Surface Water and Sediment Screening Evaluation</u>

For human health screening purposes, the surface water and sediment COI data were screened against the most conservative criteria presented in Table C-4 to identify any locations that may require additional investigation. Sample locations that had COIs, chemical, and concentrations that exceeded screening criteria are shown on Figure C-2.

One surface water sample had detected concentrations above the screening criterion for manganese at a concentration of 7.8 mg/L within the Cobbs' Pond Tributary (Table C-6). All other surface water sample concentrations were below the human health screening criteria of HI=1, TR of 1E-05. Therefore, additional sampling for manganese to address human health concerns in surface water is recommended to assess the current conditions.

All detected concentrations in sediment are below the human health screening criteria of HI=1, TR of 1E-05. Therefore, no additional sediment sampling is recommended at Load Line 3 to address human health concerns.

C.4.2.2 <u>Surface Water Ecological Screening Evaluation</u>

For ecological screening purposes, the surface water and sediment COI data were screened against the criteria presented in Table C-5 to identify any locations that may require additional investigation. Sample locations that had COIs that exceeded screening criteria and were not eliminated through the weight-of-evidence evaluation are shown on Figure C-2 with their respective chemical exceedance concentrations.

In surface water, only iron and manganese detections exceeded the ecological screening value (ESV) (Table C-7). However, the average iron concentration only slightly exceeded background (3.25 versus 2.56 mg/L). Manganese was detected at an average concentration of 5.65 mg/L, above the background value (0.391 mg/L) and the ESV (0.12 mg/L). Because manganese levels were elevated at a similar level in the closest downstream water body (Cobbs' Pond Backwater aggregate), additional samples are proposed in the Cobbs' Pond Tributary to determine current levels and whether soil remediation may have caused a decline in surface water concentrations of manganese.

C.4.2.3 Sediment Ecological Screening Evaluation

In sediment, there were eight metals (antimony, cadmium, copper, iron, lead, nickel, silver, and zinc) with exceedances (Table C-8) above the ecological screening criteria. Average concentrations of cadmium, lead, and nickel were close to or below the Ohio sediment reference value. Average concentrations of antimony, copper, iron, silver, and zinc exceeded all available screening values. Two explosives [2,4,6-TNT and 4-amino-2,6-dinitrotoluene (DNT)] were detected but do not have ESVs. The polybutylene terephthalate chemical PCB-1254 was detected, but the average concentration was below the ESV. Two sediment samples are proposed in the Cobbs' Pond Tributary to determine current concentrations and whether soil remediation may have caused a decline in sediment concentrations of antimony; copper; iron; silver; zinc; 2,4,6-TNT; and 4-amino-2,6-DNT.

C.4.3 Proposed Surface Water and Sediment Sample Locations for Load Line 3

Based on the human health and ecological screening evaluations, additional co-located surface water and sediment sampling is recommended, as presented in Table C-9. Surface water samples will be collected for analyzing manganese only, while sediment samples will be collected for those chemicals (antimony; copper; iron; silver; zinc; 2,4,6-TNT; and 4-amino-2,6-DNT) required for further evaluation based on the ecological screening results. Table C-9 presents the proposed sample identifiers, type of sample including sample depth intervals, coordinates for proposed sample locations, and the analytes that will be collected for each sample. The locations may be altered during implementation of the SAP Addendum for a variety of reasons. The final coordinates of the sample locations (including elevations) will be presented in the FS Addendum Report. Figure C-2 illustrates the proposed surface water and sediment sample locations to be collected during implementation of the SAP Addendum. The general approach for investigation activities is presented in the SAP Addendum FSP.

Table C-9. Proposed Surface Water and Sediment Sampling Locations at Load Line 3

Aggregate	Sample ID	Sample Type (ft bgs)	Easting	Northing	Analytes
Cobbs' Pond Tributary	LL3sd/sw-553-0001-SD LL3sd/sw-553-0002-SW LL3sd/sw-554-0001-SD LL3sd/sw-554-0002-SW	Discrete Sediment (0-1) Surface Water Grab	2368825.97 2369828.14	559505.63 558832.04	Surface Water: Manganese Sediment: Antimony; copper; iron; silver; zinc; 2,4,6-TNT; 4-Amino-2,6-DNT

bgs = Below ground surface.
DNT = Dinitrotoluene.
ft = Feet.
ID = Identification.
TNT = Trinitrotoluene.

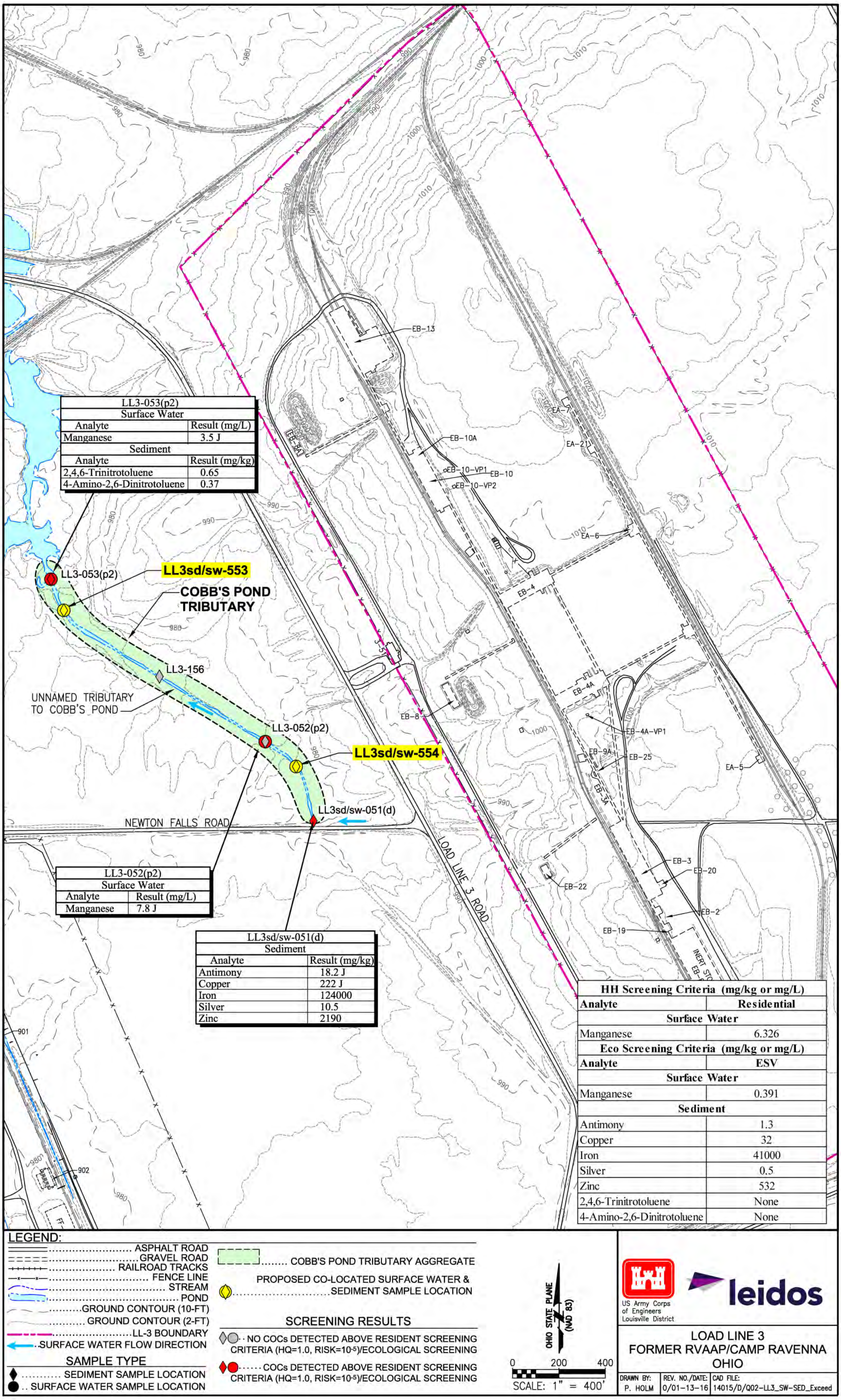


Figure C-2. Screening Results and Proposed Sample Locations for Surface Water and Sediment at Load Line 3

THIS PAGE INTENTIONALLY LEFT BLANK.

C.5 REFERENCES

Army National Guard-ILE Cleanup, U.S. Army (ARNG) 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio*. Memorandum between ARNG-ILE Cleanup and the Ohio Environmental Protection Agency. Dated February 2014.

Jacobs Engineering 1989. *RCRA Facility Assessment, Preliminary Review/Visual Site Inspection Ravenna Army Ammunition Plant, Ravenna, Ohio*. October 1989.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger 2000. "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems." *Arch. Environ. Contam. Toxicol*. 39, 20-31. 2000.

Ohio Environmental Protection Agency (Ohio EPA) 2008. Email correspondence from Ms. Eileen T. Mohr, Ohio EPA Facility Coordinator, to Mr. Dave Cobb, Shaw Project Manager, dated April 14, 2008, regarding acceptance of LL1ss-29 excavation for PCBs. April 2008.

U.S. Army Corps of Engineers (USACE) 1996. *Preliminary Assessment for the Characterization of Areas of Contamination Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 1996.

USACE 1998. *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern at the Ravenna Army Ammunition Plant*. February 1998.

USACE 2004a. *Phase II Remedial Investigation Report for the Load Line 3 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. July 2004.

USACE 2004b. *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4*. September 2004.

USACE 2005a. *Final November 2004 Sampling Completion Report*. February 2005.

USACE 2005b. *Final Focused Feasibility Study for the Remediation of Soils at Load Lines 1 Through 4*. May 2005.

USACE 2007. *Interim Record of Decision for the Remediation of Soils at Load Lines 1 Through 4*. January 2007.

USACE 2008a. *Preliminary Evaluation of Pre (Floor Slab Removal) Contamination for the Sampling of Soils Beneath Floor Slabs and Load Lines 2, 3, and 4 and Excavation and Transportation of Contaminated Soils to Load Line 4*. April 2008.

USACE 2008b. *Remedial Action Completion Report for the Remediation of Soils and Dry Sediments at RVAAP 08-11 (Load Lines 1-4) Ravenna Army Ammunition Plant Ravenna, Ohio*. June 2008.

USACE 2009a. *Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, 10, and 11*. July 2009.

USACE 2009b. *Multi-Increment Sampling and Analysis of Soils Below Floor Sabs at RVAAP-09, 10, and 11*. December 2009.

USACE 2010a. *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations*. September 2010.

USACE 2010b. *Remediation Completion Report for Sub-Slab Soils at Load Lines 2, 3, and 4*. December 2010.

USACE 2010c. *Draft Guidance Document of the Evaluation of Land Use Controls at Ravenna Army Ammunition Plant, Ravenna, Ohio.* October 2010.

USACE 2011. *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4*. Volumes 1 and 2. March 2011.

USACE 2012. *Draft Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers*. September 2012.

USACE 2013. *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12*. March 2013.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) 1978. *Installation Assessment of Ravenna Army Ammunition Plant*. Report No. 132. November 1978.

U.S. Environmental Protection Agency (USEPA) 2003. *Ecological Screening Levels*. Region 5. 2003: http://www.epa.gov/reg5rcra/ca/edql.htm.

ATTACHMENT I
LOAD LINE 3 SCREENING RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK.

ATTACHMENT I: LOAD LINE 3 SCREENING RESULTS

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 3

Attachment Table 2. Human Health Screening Results for Discrete Sediment at Load Line 3

Attachment Table 3. Ecological Screening Results for Surface Water at Load Line 3

Attachment Table 4. Human Health Screening Results for Surface Water at Load Line 3

THIS PAGE INTENTIONALLY LEFT BLANK.

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 3

Sample ID	Date	Chemical	Antimony	Beryllium	Cadmium	Copper	Iron	Lead	Manganese	Nickel	Potassium
		Screening Criteria	**1.3**	**0.8**	**0.99**	**32**	**41000**	**47**	**1950**	**33**	**6800**
		Criteria Source	SRV	SRV	MacDonald et al.	SRV	SRV	SRV	BKG	SRV	SRV
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL3sd-052-1071-SD	08/08/2001	0 - 0.5	<1.3 UJ	0.56 J	0.43 J	12.8 J	16800	16.3 J	374	13.8	441 J
LL3sd-053-1073-SD			<2.8 UJ	<0.57 U	0.77 J	11.9 J	15700	26.6 J	289	14.8	566 J
LL3sd-156-0960-SD	08/08/2001	0 - 1	<1 UJ	0.66	0.2 J	13.7 J	26400	16.4 J	468	13.1	634
LL3sd-051-1079-SD	08/08/2001	0 - 0.5	**18.2 J***	0.53 J	**3.5 ***	**222 J***	**124000 ***	**91.6 J***	692	**42 ***	450 J

Sample ID	Date	Chemical	Silver	Zinc	2,4,6-Trinitrotoluene	4-Amino-2,6-Dinitroto	PCB-1254
		Screening Criteria	**0.5**	**532**			**0.0598**
		Criteria Source	USEPA Reg 5	BKG	None	None	Total PCB-MacDonald et al.
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL3sd-052-1071-SD	08/08/2001	0 - 0.5	<0.65 U	67.8	NA	NA	**0.18 J***
LL3sd-053-1073-SD			<0.97 U	122	**0.65 ***	**0.37 ***	<0.064 U
LL3sd-156-0960-SD	08/08/2001	0 - 1	<0.63 U	45.8	NA	NA	<0.042 U
LL3sd-051-1079-SD	08/08/2001	0 - 0.5	**10.5 ***	**2190 ***	NA	NA	<0.047 U

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
SRV = Sediment Reference Value.
U = Not detected.
UJ = Not detected and reporting limit estimated.
USEPA = United States Environmental Protection Agency.

Attachment Table 2. Human Health Screening Results for Discrete Sediment at Load Line 3

Sample ID	Date	Chemical	Aluminum	Antimony	Arsenic	Barium	Cadmium	Lead	Manganese	Thallium	1,3-Dinitrobenzene
		Screening Criteria	73798	28.2	19.5	14129	64.1	400	2927	6.12	6.2
		Criteria Source	RC	RC	BKG	RC	RC	RSL	RC	RC	RSL
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL3sd-052-1071-SD	08/08/2001	0 - 0.5	7770	<1.3 UJ	8.1	58.3	0.43 J	16.3 J	374	0.25 J	NA
LL3sd-053-1073-SD	08/08/2001	0 - 0.5	9340	<2.8 UJ	5.7	87.2	0.77 J	26.6 J	289	0.31 J	<0.25 U
LL3sd-156-0960-SD	08/08/2001	0 - 1	11000	<1 UJ	11.1	51.7	0.2 J	16.4 J	468	0.3 J	NA
LL3sd-051-1079-SD	08/08/2001	0 - 0.5	6590	18.2 J	19	66	3.5	91.6 J	692	0.32 J	NA

Sample ID	Date	Chemical	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	RDX	PCB-1254	PCB-1260
		Screening Criteria	36.5	7.53	80.3	1.2	2.03
		Criteria Source	RC	RA	RC	RC	RA
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL3sd-052-1071-SD	08/08/2001	0 - 0.5	NA	NA	NA	0.18 J	<0.043 U
LL3sd-053-1073-SD	08/08/2001	0 - 0.5	0.65	<0.25 U	<0.5 U	<0.064 U	<0.064 U
LL3sd-156-0960-SD	08/08/2001	0 - 1	NA	NA	NA	<0.042 U	<0.042 U
LL3sd-051-1079-SD	08/08/2001	0 - 0.5	NA	NA	NA	<0.047 U	<0.047 U

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 3. Ecological Screening Results for Surface Water at Load Line 3

	Chemical	Iron	Manganese	Potassium
	Screening Criteria	2.56	0.391	3.17
	Criteria Source	BKG	BKG	BKG
Sample ID	Date	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)
LL3sw-052-1072-SW	08/09/2001	**3.8 ***	**7.8 J***	7.4
LL3sw-053-1074-SW	08/08/2001	**2.7 ***	**3.5 J***	4.3 J

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.

Attachment Table 4. Human Health Screening Results for Surface Water at Load Line 3

	Chemical	Aluminum	Antimony	Arsenic	Barium	Cadmium	Lead	Manganese	Thallium	1,3-Dinitrobenzene	2,4,6-Trinitrotoluene
	Screening Criteria	148.27	0.0491	0.011	29.007	0.0505	0.015	6.326	0.0124	0.002	0.0782
	Criteria Source	RC	RC	RA	RC	RC	RSL	RC	RC	RSL	RC
Sample ID	Date	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)
LL3sw-052-1072-SW	08/09/2001	0.68 J	0.0025 J	0.0043 J	0.08	<0.005 U	<0.01 U	**7.8 J***	<0.002 UJ	<0.0002 U	<0.0002 U
LL3sw-053-1074-SW	08/08/2001	0.23 J	<0.01 U	0.0047 J	0.054	<0.005 U	<0.01 U	3.5 J	<0.002 UJ	<0.00073 U	<0.0002 U

	Chemical	2,4-Dinitrotoluene	RDX	4,4'-DDE	4,4'-DDT	Dieldrin	Heptachlor	PCB-1254	PCB-1260
	Screening Criteria	0.0199	0.155	0.0023	0.001	17E-6	2E-5	0.0031	0.0004
	Criteria Source	RA	RA	RSL	RA	RSL	RSL	RC	RSL
Sample ID	Date	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)	Conc. (mg/L)
LL3sw-052-1072-SW	08/09/2001	<0.00013 U	<0.0005 U	NA	NA	NA	NA	<0.0005 U	<0.0005 U
LL3sw-053-1074-SW	08/08/2001	<0.00013 U	<0.0005 U	<0.0001 U	<0.0001 U	<0.0001 U	<0.0001 U	<0.0005 U	<0.0005 U

***Bold indicates sample exceeds screening criteria.**
DDT = dichlorodiphenyltrichloroethane.
DDE = dichlorodiphenyldichloroethylene.
J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

THIS PAGE INTENTIONALLY LEFT BLANK.

APPENDIX D
LOAD LINE 4 (RVAAP-11)

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOPC	Contaminant Migration Chemical of Potential Concern
COC	Chemical of Concern
COI	Chemical of Interest
CUG	Cleanup Goal
DDT	Dichlorodiphenyltrichloroethane
ESV	Ecological Screening Value
FFS	Focused Feasibility Study
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
gal	Gallon
HI	Hazard Index
in.	Inch
ISM	Incremental Sampling Method
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MI	Multi-Increment
Ohio EPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PBT	Persistent, Bioaccumulative, and Toxic
PCB	Polychlorinated Biphenyl
RBC	Risk-Based Concentration
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
RGO	Remedial Goal Option
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SESOIL	Seasonal Soil Compartment Model
SRV	Sediment Reference Value
SVOC	Semi-Volatile Organic Compound
TNT	Trinitrotoluene
TR	Target Risk
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

THIS PAGE INTENTIONALLY LEFT BLANK.

D.0 LOAD LINE 4 (RVAAP-11)

This appendix presents the information and data evaluated for Load Line 4 to identify data gaps in surface water and sediment that will require additional sampling to be performed under this Sampling and Analysis Plan (SAP) Addendum. New data generated from the proposed activities presented in this appendix will be incorporated into the Feasibility Study (FS) Addendum Report. This appendix describes the area of concern (AOC) and presents historical investigation summaries, data gap screening results for surface water and sediment for human health and ecological receptors and recommendations for additional surface water and sediment sampling. Specific procedures that were followed to complete these assessments are included in the Field Sampling Plan (FSP) (Part I) of the SAP Addendum and are not repeated in this appendix.

D.1 AREA OF CONCERN DESCRIPTION

Load Line 4 is located in the south central portion of the Ravenna Army Ammunition Plant (RVAAP). The load line operated from 1941–1945 to produce 91,970 projectiles and bombs and again from 1951–1957 to produce 1,269,262 mines. Load Line 4 was used to melt and load 2,4,6-trinitrotoluene (TNT) into large-caliber shells, bombs, and antitank mines. During its operational history, Load Line 4 produced about 1.2 million munitions. Pinkwater generated during operations was collected in concrete sumps and pumped via an overhead 6-in.-diameter cast iron flume to a settling basin and sawdust filtration unit located southwest of Building G-8. Effluent from the filtration unit was discharged to an unlined drainage ditch that flows into a 2-acre pond in the southwest portion of the AOC, which discharged to a surface stream that exits the facility at a point south of the load line. When the facility was at full capacity, Load Line 4 generated approximately 895,000 gal of pinkwater per month from wash-down and steam decontamination of equipment. All buildings and structures at Load Line 4 have been demolished. The Power House No. 7 Facility-Wide Coal Storage (shown on Figure D-1) located at former Building G-4 is covered under the Compliance Restoration Program as site CC-RVAAP-73 and is currently undergoing separate investigation; therefore, it is not included in the SAP Addendum.

Each former building located at Load Line 4 is presented below with a summary of its historical use and potential contamination source description. Former production buildings are included in Table D-1, and non-production buildings are listed in Table D-2.

D.2 PREVIOUS INVESTIGATIONS, DECISIONS, AND ACTIONS

Since 1978, Load Line 4 has been the subject of multiple investigations and/or assessments leading to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) decisions and/or remedial actions at the AOC. CERCLA activities completed at Load Line 4 are presented in the following report summaries and presented in the timeline illustrated on Figure D-1. These 17 reports present extensive evaluations and remedial activities performed to address contaminated media, including assessments at each of the former buildings listed in Tables D-1 and D-2.

Table D-1. Former Production Buildings at Load Line 4

Building ID	Purpose	Description of Potential Sources
G-11	Magazine/AN Service Building	TNT screening was completed at this building. After being screened, the TNT was transferred to G-10 or G-15.
G-12	Explosive Cooling Building	Following loading at Building G-8, shells were transferred to G-12/G-12A for cooling.
G-12A	Explosive Cooling Building	Following loading at Building G-8, shells were transferred to G-12/G-12A for cooling.
G-13	Funnel Removal and Face Off	Drilling operations for booster charges or other preparation steps depending on munition type were completed at G-13. These activities were completed after cooling at G-12/G-12A.
G-13A	X-Ray	Following loading of booster charges at G-13, a quality assurance check of the primary charges was completed using the radiographic equipment at this building.
G-15	Explosive Prep Building/TNT Screening Building	TNT was prepared and screened at this building.
G-16	TNT Receiving	Bulk TNT was offloaded at this building. Following receipt, it was transported to G-11.
G-18	Paint Storage/Component Service Building	Packing and shipping operations for completed munitions.
G-19	Packing and Shipping Building	Packing and shipping operations for completed munitions.
G-19A	Shipping Building	Packing and shipping operations for completed munitions.
G-8	Melt Pour Building	Following screening and preparation, the bulk TNT arrived at the melt pour building where it was loaded into shells.

ID = Identification.
TNT = 2,4,6-Trinitrotoluene.
X-Ray = X-ray fluorescence.

Table D-2. Former Non-Production Buildings at Load Line 4

Building ID	Purpose
LL4-CC-1	Construction Camp Fire House
LL4-CC-2	Hunkin Conkey Construction
Ll4-CC-3	Workmen's Sheds
LL4-CC-4	Garage
LL4-CC-5	Stock Rooms
LL4-CC-6	Communications Unit
LL4-G-2	Paint Storage
LL4-G-3	Shell Preparation and Painting Building
LL4-G-4	Power House No. 7
LL4-G-5	Line Office
LL4-G-6	Change House
G-6A	Change House
LL4-G-7	Booster Service Building
SD-5	Sewage Ejector Station
T-5201-LL4	Guard Post
G-20	Gate House
WW-23	Elevated Water Tank
G-9	Explosive Screening Building (used as a magazine and empty transport cart storage area)
G-1	Material Receiving/Inert Storage Warehouse (physical plant service building)
G-1A	Material Receiving/Truck Repair Shop (physical plant service building)
G-14	Booster Service Building (physical plant service building)
G-17	Supplementary Charges Magazine (physical plant service building)

ID = Identification.

THIS PAGE INTENTIONALLY LEFT BLANK.

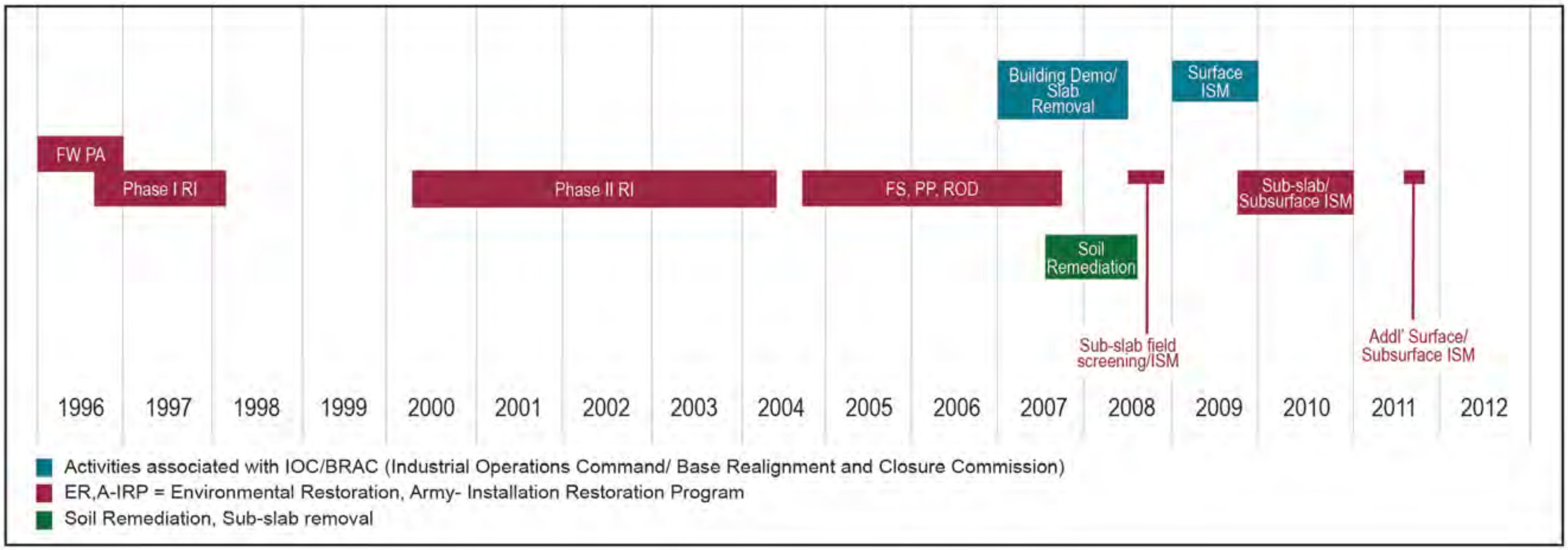


Figure D-1. Timeline of Remedial Activities at Load Line 4

THIS PAGE INTENTIONALLY LEFT BLANK.

D.2.1 Installation Assessment of Ravenna Army Ammunition Plant

In 1978, the *Installation Assessment of Ravenna Army Ammunition Plant* (USATHAMA 1978) incorporated a review of historical operational information and available environmental data to assess the potential for contaminant releases from operational facilities. The installation assessment presented quantities of munitions produced, amounts of chemicals utilized, and waste produced at each load line. No sampling, investigation, or actions were performed at Load Line 4 as part of the assessment. The assessment concluded that no sampling was presently required for AOC exit pathways or surface water bodies and that additional action may be warranted.

D.2.2 Preliminary Assessment for the Characterization of Areas of Contamination

In 1996, the *Preliminary Assessment for the Characterization of Areas of Contamination* [herein known as the Preliminary Assessment (PA)] (USACE 1996) was developed following CERCLA requirements and provided information concerning conditions at CERCLA AOCs at RVAAP to assess potential contamination risks posed to human health and the environment. The PA provided a narrative of the facility history and process operations and described activities conducted at each AOC. According to the PA, waste constituents at Load Line 4 included, but are not limited to, TNT; hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); Composition B; lead; chromium; mercury; and unknown constituents. Primary contaminant release mechanisms were process effluent discharges to surface water and process building wastewater washout to surface soils and sediments.

The report provided a PA scoring, subsequent prioritization of AOCs through evaluation of exposure pathways, and a relative risk site evaluation model. Load Line 4 was ranked as a high-priority AOC for future environmental investigations due to the primary contaminant release mechanism from process effluent discharges to surface water and surface soil.

D.2.3 Phase I Remedial Investigation

A *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (herein referred to as the Phase I Remedial Investigation [RI]) (USACE 1998) was conducted at Load Line 4 from July through August 1996. During this investigation, sampling activities at Load Line 4 included collecting surface soil, sediment, and groundwater samples across the AOC. Samples were analyzed for explosives, metals, cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and/or polychlorinated biphenyls (PCBs). Many of the occurrences and highest concentrations of chemicals detected were located and concentrated around the process buildings (G-12, G-12A, G-8, and G-13).

A total of 53 samples were collected from 50 surface soil locations across the AOC. Explosives were detected at nine locations, with the explosive TNT being detected at all locations with a maximum concentration of 2.2 mg/kg beside Building G-12A. TNT also was detected around Buildings G-8, G-12A, and G-13 and adjacent to the washout facility south of Building G-8. The highest concentrations of detected metals were observed around Buildings G-12 and G-12A. Metals were detected above background around Building G-8, its unnamed outbuilding, Building G-13, and Building G-17. SVOCs, pesticides, PCBs, and VOCs were detected in multiple samples analyzed at Load Line 4 primarily around process Buildings G-12, G-8, and G-17.

A total of 17 sediment samples were collected from 14 ditch, stream, or pond locations throughout the Load Line 4 AOC to characterize AOC drainage pathways. Explosives were detected in sediment samples, including in a ditch sample that contains influent that enters the load line from the east at 8.7 mg/kg for TNT. Explosives were not detected in the Load Line 4 settling pond sediment. Several metals were detected with their maximum concentration within the settling pond at Load Line 4. Ditch sediments also contained detected concentrations of metals but not in as high of concentrations compared to the pond. Low concentrations of three VOCs were measured in one sediment sample from the settling pond. SVOCs, pesticides, and PCBs were not detected in sediment.

The conclusions of the Phase I RI categorized Load Line 4 as a “high-priority” AOC due to elevated concentrations of explosives, inorganic chemicals, and organic chemicals throughout surface soil and sediment at the AOC, and a Phase II RI was recommended (USACE 1998).

D.2.4 Phase II Remedial Investigation

The *Phase II Remedial Investigation Report for the Load Line 4* (herein referred to as the Phase II RI) (USACE 2004a) evaluated the nature and extent of process-related contaminants in surface and subsurface soil, sediment, surface water, groundwater, sewers, and selected buildings/structures. It also assessed the potential risk to human health and the environment resulting from former operations at Load Line 4.

As part of the Phase II RI, the AOC was evaluated by dividing it into spatial aggregates based on former process operations and drainage areas. Surface and subsurface soil were separated into six aggregates (Explosive Handling Areas, Preparation and Receiving Areas, Packaging and Shipping Areas, Change House, Perimeter Area, and Melt Pour Drainage Ditches). The four sediment and surface water aggregates evaluated as part of the Phase II RI are Main Stream Segment Upstream of Perimeter Road, Main Stream Segment and Settling Pong, Exit Drainage, and Miscellaneous Surface Water.

A total of 100 surface soil samples were collected across the six aggregates for the purpose of determining nature and extent of surface soil contamination at Load Line 4. The extent of explosives and propellant compounds in soil is relatively few, and extent is limited to the immediate proximity of source areas. The Explosive Handling Areas aggregate contained the highest concentrations and frequency of detected chemicals in surface soil within Load Line 4. Explosives, inorganic chemicals, and SVOCs were common in surface soil with the highest overall concentrations occurring near Buildings G-8 and G-12.

A total of 13 discrete subsurface soil samples were collected across the AOC to assess vertical migration. Contamination in subsurface soil was primarily limited to inorganic chemicals. Explosives and propellants were not detected in surface soil. Metals were detected in highest concentrations above background near Building G-1A in the Preparation and Receiving Area aggregate and near Building G-9 in the Explosives Handling Areas aggregate.

A total of 30 sediment samples and 18 surface water samples were collected from drainage channels and the settling pond at Load Line 4. Explosive and inorganic chemicals were the most frequent chemicals identified in sediment. Inorganic chemicals were frequently detected in surface water. Explosives, SVOCs, and PCBS were not detected in surface water.

Recommendations from the Phase II RI included completing an FS to evaluate possible remedial actions at Load Line 4 to reduce or eliminate potential risks to human and/or ecological receptors (USACE 2004a).

Data from 10 sediment samples and 10 surface water samples from the Phase II RI (USACE 2004a) were incorporated into the FS Addendum dataset.

D.2.5 Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4

The *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4* Report (USACE 2004b) documented the proposed land use and corresponding risk-based remedial goal options (RGOs) that were used to support the remedial alternative selection process in the *Focused Feasibility Study for the Remediation of Soils at Load Lines 1 through 4* [herein referred to as the focused feasibility study (FFS)] (USACE 2005b). Environmental samples or remedial actions were not completed under this task.

D.2.6 Facility-Wide Biological and Water Quality Study

In 2003, an assessment of 11 ponds at Camp Ravenna was completed (USACE 2005c). As part of the assessment, analytical samples were collected and macroinvertebrate and fish assessments were completed at each pond. The Load Line 4 settling pond, which receives drainage from the Load Line 4 AOC, was assessed during the study. Three multi-increment (MI) [or incremental sampling method (ISM)] sediment samples and six surface water samples were collected from Load Line 4 pond and exit drainages. The samples were analyzed for explosives, inorganic chemicals, SVOCs, PCBs, and pesticides. Explosives, polycyclic aromatic hydrocarbons (PAHs), and metals were detected in sediment and/or surface water from the pond. Lead, zinc, and pH exhibited exceedances as part of this evaluation. As part of the biological assessment, the physical habitat conditions in Load Line 4 pond were rated as “fair” on the Lake/Lacustuary Qualitative Habitat Evaluation Index. The sufficient quality of the Load Line 4 pond does not adversely impact biological communities, and fauna did not differ from reference conditions.

Data from two sediment and four surface water samples collected from two locations at Load Line 4 settling pond and exit drainages as part of the 2003 investigation are included in the FS Addendum dataset.

D.2.7 Final November 2004 Sampling Completion Report

Sampling was completed in November and December 2004 for delineating the horizontal and vertical extents of contamination at the AOC (USACE 2005a). Five areas were sampled at Load Line 4 as part of the data gap analysis. Analytes of interest as part of the data gap sampling included manganese, aluminum, lead, RDX, and/or PCBs. All five areas fully delineated the extent of contamination below RGOs. Data from this report were incorporated into the FFS (USACE 2005b) and are presented as Appendix B of the FFS.

D.2.8 Focused Feasibility Study for Soils at Load Lines 1, 2, 3, and 4

The FFS presented remedial alternatives for surface soil, subsurface soil, and dry sediment at Load Lines 1 through 4 (USACE 2005b). As part of the FFS, data acquired in the Phase I and II RIs were screened against RGOs presented and considered during the evaluation of remedial alternatives. Additional data from the *November 2004 Sampling Completion Report* (USACE 2005a) were incorporated into the FFS.

The recommended interim remedy based on a detailed analysis of the feasible remedial alternatives to address surface soil, subsurface soil, and dry sediment contamination at Load Line 4 was excavation with off-site disposal. This alternative was recommended due to expediency, permanency, consistency with future land use, moderate relative cost, feasibility, and implementability. Environmental sampling and remedial actions were not completed as part of the FFS.

D.2.9 Interim Record of Decision for Soil at Load Lines 1, 2, 3, and 4

In 2007, the U.S. Army Corps of Engineers (USACE) developed the *Interim Record of Decision for the Remediation of Soils at Load Lines 1 Through 4* (USACE 2007) to address chemical exposure in soil and dry sediment. The selected remedy was chosen in accordance with CERCLA requirements. The selected remedy for surface soil, subsurface soil, and dry sediment was excavation and off-site disposal for Load Lines 1 through 4 where concentrations of chemicals exceeded RGOs. The selected remedy was recommended as part of the FFS (USACE 2005b), documented in the Proposed Plan, received public acceptance during the public comment period, and received state acceptance from the Ohio Environmental Protection Agency (Ohio EPA). The Interim Record of Decision (ROD) was jointly signed by the U.S. Army Division of Base Realignment and Closure (BRAC) and Ohio EPA in the summer of 2007.

D.2.10 Remedial Action Completion Report for Soils and Dry Sediments

Remedial action excavation activities occurred at Load Lines 1 through 4 from August to November 2007 (USACE 2008). A total of 1,208 tons of non-hazardous soils were removed from Load Line 4. The maximum depth of the excavations was to 3 ft below ground surface (bgs); however, most excavations were typically to 2 ft bgs. Nine discrete areas were excavated within Load Line 4. After completing the excavations, 11 MI (or ISM) confirmation samples were collected and analyzed for Load Line 4 chemicals of concern (COCs): PCB-1254, aluminum, lead, and manganese. Laboratory results for the MI samples collected at Load Line 4 indicate that the COCs were removed to below cleanup goals (CUGs) at all Load Line 4 final excavation areas.

As part of the planned remedial action, concrete slabs were to remain in place and periodic monitoring of the concrete slab integrity was to be completed. A post-ROD change to the concrete slab maintenance task for Load Lines 1 through 4 was initiated by USACE and the U.S. Army Division of Base Realignment and Closure (BRAC) in late 2007. BRAC commenced slab and foundation removal in March 2008 at Load Lines 1 through 4, eliminating the need for routine maintenance as directed in the selected remedy.

Ohio EPA indicated that "the physical remedial action of soil and dry sediment removal has been completed in accordance with the intents and provisions of the Interim ROD for Load Lines 1-4" (Ohio EPA 2008).

D.2.11 Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

Floor slab removal was completed between March and June 2008 (USACE 2009a). As part of the scope of this investigation, the following sampling activities were completed at Load Lines 2, 3, and 4: stockpile sampling, post-slab removal field screening, and final confirmatory sampling. The objective of the sampling was to determine if any areas required excavation to remove contaminated soils beneath former building slabs. A total of 720 field screening samples were screened from Load Lines 2, 3, and 4 in 2008. The focus for the majority of the sampling completed at Load Line 4 involved buildings with the highest probability of contamination, including: G-8, G-9, and G-15. Core samples were collected to a maximum depth of 4 ft bgs at these building locations for explosives field screening. Additional screening samples were collected from low- to medium-priority buildings at Load Line 4. Analytical and field screening results indicated there were no detections of either TNT or RDX at any of the low- or medium-potential buildings or at high-potential Building G-15 at Load Line 4. Concentrations of the explosives TNT and RDX were detected in five samples collected at Buildings G-8 and G-9; however, field screening results indicated that concentrations were at low levels (less than 2.6 mg/kg); below CUGs utilized in this report. Conclusions of the report indicated excavation was not required at Load Line 4 for TNT or RDX beneath building slabs.

D.2.12 Multi-Increment Sampling and Analysis of Soils Below Floor Slabs at RVAAP-09, -10, and -11

MI (or ISM) sampling was completed in 2008 within building footprints following the removal of building slabs and any contaminated soils identified as part of the *Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, 10, and 11* (herein referred to as the Sampling and Screening Analysis Report) (USACE 2009a). The purpose of MI confirmatory sampling was to determine if any additional excavation was required at building locations beyond those determined by field screening. A total of 102 primary MI samples were collected between the three load lines.

Each sample was analyzed for metals and explosives, with select locations also being analyzed for RVAAP full suite parameters (VOCs, SVOCs, PCBs, pesticides, and propellants). Areas selected for full suite analysis were based on actual operations at an individual building and whether operations would be indicative of contamination other than explosives and metals based on the historical process knowledge. MI samples were collected from 0–1 ft bgs across building footprints. Propellants, SVOCs (primarily PAHs), PCBs, pesticides, and metals were detected in MI samples collected at Load Line 4. VOCs and explosives were not detected in MI samples collected at Load Line 4 (USACE 2009b). No building footprints at Load Line 4 were identified for remediation in the conclusions of this report.

D.2.13 Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations

As part of this investigation, field screening and surface soil ISM sampling were completed at Buildings G-1, G-1A, and G-3 at Load Line 4. The three field screening samples collected at Load Line 4 were negative for explosives. The five ISM samples were collected for inorganic chemicals and explosives. Explosives were not detected in any of the ISM samples collected at Load Line 4 as part of this investigation (USACE 2010a). The analytical data were compared to CUGs identified in the interim ROD (USACE 2007), and no additional areas for remediation were identified based on ISM sampling.

D.2.14 Remediation Completion Report Sub-Slab Soils at Load Lines 2, 3, and 4

Based on the characterization and results provided as part of the Sampling and Screening Analysis Report (USACE 2009a) and MI Sampling and Analysis Report (USACE 2009b), areas at Load Lines 2 and 3 were identified for remediation. As part of the remedial action, five soil stockpiles were removed from Load Line 4 for off-site disposal. The stockpiles included three piles of soil, one pile of concrete at Building G-1, and one pile of soil located at Building G-3.

One MI (or ISM) sample was collected at each of the five piles at Buildings G-1 and G-3. These samples were analyzed by the disposal facility for waste characterization. A total of 501 tons of materials were removed from the Load Line 4 stockpiles.

After completing the excavations and collecting field screening samples, confirmation MI samples were collected and analyzed for explosives, metals, SVOCs, and PCBs. The results of the MI samples collected indicated the excavated areas were successfully remediated to CUGs identified in the Interim ROD (USACE 2007) and no further remedial actions were needed for sub-slab soils (USACE 2010b).

D.2.15 Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers

The *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (herein referred to as the Facility-Wide Sewers RI/FS) (USACE 2012) evaluated the nature and extent of process-related contaminants in sewer sediment, surface water, and outfalls and assessed the potential risk to human health and the environment resulting from former operations at Load Line 4. As part of the RI, field investigative activities included conducting visual survey inspections of sanitary and storm sewer structures (i.e., manholes, drop inlets, catch basins, and outfalls); conducting video camera surveys of select sewer lines; and collecting sewer sediment, sewer water, pipe bedding, outfall sediment, and outfall water samples using discrete methods. Based on the evaluation of nature and extent, fate and transport, and risk to human health and the environment, no further action was recommended for the sewers and outfalls at Load Line 4 functional area.

Data collected during the Facility-Wide Sewers RI/FS activities are excluded from the FS Addendum data screen, as the sewers media data are currently being evaluated as part of the Facility-wide Sewers AOC.

D.2.16 Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4

The *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations* (USACE 2010a) was performed to sample and characterize deeper subsurface soils beneath the former building slabs via subsurface soil ISM techniques. Additional surface soil ISM samples in the former coal storage area at Load Line 4 were collected and analyzed to provide preliminary data for future RIs. Power House No. 7, Facility-Wide Coal Storage (CC-RVAAP-73), is located on the north end of former Building G-4 and is currently undergoing investigation; therefore, it is not included in the SAP Addendum.

In 2009, USACE collected 11 total surface soil MI (or ISM) samples at Load Line 4 from 0.0–0.5 ft bgs. Three samples were analyzed for metals, nine for explosives, three for SVOCs, two for pesticides and PCBs, and one for VOCs. None of the chemicals were detected above the CUGs utilized in the *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4* (herein referred to as the 2011 Sampling Report) (USACE 2011) in any of the samples collected from the buildings or coal storage areas at Load Line 4.

A total of 40 subsurface soil ISM samples were collected at Load Line 4 to a maximum depth of 7 ft bgs. The subsurface soil ISM samples were analyzed for metals, explosives, propellants, SVOCs, VOCs, PCBs, and/or pesticides. Metals, explosives, propellants, pesticides, PCBs, and VOCs were not detected above the CUGs identified in the 2011 Sampling Report in any of the samples collected at Load Line 4. PAHs [benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected above CUGs at Building G-8 (USACE 2011).

D.2.17 Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12

Additional characterization sampling was completed at Load Line 4 to guide future remedial and administrative measures (USACE 2013). The samples collected as part of this investigation helped eliminate data gaps recognized in the *Land Use Control Assessment Report* (USACE 2010c). Eight surface soil ISM samples and 16 subsurface soil horizontal ISM samples (1 from 1–2, 5 from 1–3, 5 from 3–5, and 5 from 5–7 ft bgs) were collected at Load Line 4 to further refine ISM sample areas that had concentrations of contaminants above CUGs utilized in the *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12* (herein referred to as the Characterization Sampling Report) (USACE 2013).

Conclusions of this investigation indicated that 7 of the 10 previous areas exceeding the CUGs utilized in the Characterization Sampling Report were further bound and delineated. The remaining three areas were not fully delineated.

D.3 DATA GAP ASSESSMENT

The rationale for the surface water, and sediment data gap analyses is presented in Section 3.2 of the SAP Addendum FSP. This appendix only presents information specific to Load Line 4. The conclusions of the data gap analysis present areas that require further investigation to define nature and extent of contamination at source areas that will be evaluated in the FS Addendum Report. The following steps were followed to generate the data and screening criteria for the data gap analysis.

D.3.1 Data Assembly and Use Assessment – Load Line 4

All data collected at Load Line 4 were extracted from the RVAAP Environmental Information Management System database. This includes data from investigations summarized in the following reports:

- *Phase II Remedial Investigation Report for the Load Line 4* (USACE 2004a).
- *Facility-Wide Biological and Water Quality Study* (USACE 2005c).

The surface water and sediment data from investigations summarized in the following reports were not used in the data gap analysis:

- *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern* (USACE 1998) – [These data are more than 16 years old and are no longer considered representative of the site (e.g., buildings and slabs have been removed and/or remediated)].
- *Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers* (USACE 2012) (The sewers are currently being evaluated under a separate RI).

Once the data were assembled and evaluated for use, they were screened for chemicals of interest (COIs) specific to Load Line 4 surface water and sediment.

D.3.2 Chemicals of Interest – Load Line 4

The rationale for developing COIs is presented in Section 3.2.2 of this SAP Addendum FSP. Load Line 4 COIs were developed from the chemicals identified as exceeding residential risk in the Phase II RI (USACE 2004a). Load Line 4 COIs for exposure of Resident Receptor (Adult and Child) to soil, sediment, and surface water are shown in Table D-3. The COIs of potential ecological concern for surface water and sediment are listed in Table D-5.

Table D-3. COIs in Surface Water and Sediment at Load Line 4

COI	Load Line 4	
	Surface Water	Sediment
Metals		
Aluminum	X	X
Arsenic	X	X
Lead	X	X
Manganese	X	X
Thallium	X	X
PCBs		
PCB-1254	X	X
PCB-1260	X	X
PAHs		
Benz(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Dibenz(a,h)anthracene	X	X
Indeno(1,2,3-cd)pyrene	X	X

COI = Chemical of interest.
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
X = COI is present in medium.

D.3.3 Screening Criteria – Load Line 4

The residential screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.3 of the SAP Addendum FSP. The human health screening criteria [hazard index (HI)=1, target risk (TR) of 1E-05] values and sources are presented in Table D-4 for surface water and sediment specific to Load Line 4. The ecological screening criteria sources and rationale selected for the data gap analysis are presented in Section 3.2.3 of the SAP Addendum FSP. Table D-5 presents the ecological screening criteria used for surface water and sediment specific to Load Line 4.

Table D-4. Human Health Screening Criteria for Surface Water and Sediment at Load Line 4

Chemical[a] (mg/kg or mg/L)	Surface Water	Type	Sediment	Type
Aluminum	148.274	RC	73,798	RC
Arsenic	0.011	RA	19.5	BKG
Lead	0.015	TB	400	RSL
Manganese	6.326	RC	2,927	RC
Thallium	0.0124	RC	6.12	RC
Benz(a)anthracene	0.000136	RA	2.21	RA
Benzo(a)pyrene	0.000008	RA	0.221	RA
Benzo(b)fluoranthene	0.000079	RA	2.21	RA
Dibenz(a,h)anthracene	0.000005	RA	0.221	RA
Indeno(1,2,3-cd)pyrene	0.000078	RA	2.21	RA
PCB-1254	0.00313	RC	1.2	RC
PCB-1260	0.00039	RSL	2.03	RA

[a] Chemicals listed are chemicals of concern for Resident (Adult and Child) Receptors in respective media.
[b] Type:

BKG = Background.
RA = Resident Adult Facility-Wide Cleanup Goal (FWCUG) for hazard quotient (HQ)=1 or Risk=10-5.
RC = Resident Child FWCUG for HQ=1 or Risk=10-5.

RSL = U.S. Environmental Protection Agency Residential Soil or Tap Water Screening Level for HQ=1 or Risk=10-5.
TB = Technology-based screening level.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
PCB = Polychlorinated biphenyl.

Table D-5. Ecological Screening Criteria for Surface Water and Sediment at Load Line 4

Chemical[a]	Surface Water (mg/L)	Type[b]	Sediment (mg/kg)	Type[b]
Aluminum	NA		29,000	SRV
Barium	NA		190	SRV
Beryllium	NA		0.8	SRV
Cadmium	NA		0.99	MacDonald et al.
Calcium	41.4	BKG	21,000	SRV
Iron	2.56	BKG	41,000	SRV
Lead	NA		47	SRV
Magnesium	10.8	BKG	7,100	SRV
Manganese	0.391	BKG	NA	
Mercury	0.0017	OMZM	NA	
	0.00091	OMZA		
Nickel	NA		33	SRV
Potassium	3.17	BKG	NA	
Thallium	NA		4.7	SRV
Vanadium	NA		40	SRV
2,4,6-Trinitrotoluene	NA			None
4,4'-DDT	1.1×10^{-8}	OMZM	NA	
	1.1×10^{-8}	OMZA		
PCB-1248	NA		0.0598	Total PCB-MacDonald et al.

[a] Chemicals listed are chemicals of potential ecological concern in respective media.
[b] Type:
BKG = Background.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
None = No ESV available.
Ohio Administrative Code = Ohio EPA 2014.
SRV = Sediment reference value.
DDT = Dichlorodiphenyltrichloroethane.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable because the analyte was not a contaminant of interest for that medium.
OMZA = Outside Mixing Zone Average.
OMZM = Outside Mixing Zone Maximum.
PCB = Polychlorinated biphenyl.

D.4 SURFACE WATER AND SEDIMENT EVALUATION

D.4.1 Surface Water and Sediment Screening Results

COI concentrations detected in surface water and sediment samples identified for use in the FS Addendum dataset were screened against the human health and ecological criteria presented in Section D.3.3 on a sample-by-sample basis. The results are presented in Attachment 1 of this appendix. No samples exceeded the human health screening criteria for surface water and sediment. Samples that exceeded the ecological screening criteria are summarized in Tables D-6 and D-7 for surface water and sediment, respectively. Locations where chemicals exceed screening criteria are shown in bold font. A detailed discussion of surface water and sediment exceedances is presented in Sections D.5.2.1 and D.5.2.2 for human health and ecological receptors, respectively, on a contaminant source-by-source basis.

Table D-6. Ecological Screening Exceedances for Surface Water at Load Line 4

	Chemical	Iron	Manganese	DDT
	Screening Criteria	2.56	0.391	1.1×10^{-8}
	Criteria Source	BKG	BKG	OMZA
Sample ID	Date	Concentration (mg/L)	Concentration (mg/L)	Concentration (mg/L)
FSW-SW-025-0000	06/26/2003	1.42	**0.479 ***	<0.00005 U
LL4sw-056-0972-SW	08/13/2001	1.7	**0.43 ***	**NA**
LL4sw-048-0958-SW	08/20/2001	**4.6 ***	**3.2 ***	<0.00005 U
LL4sw-044-0956-SW	08/13/2001	1.2	**3.6 ***	**NA**
LL4sw-054-0968-SW	08/14/2001	1	**0.46 ***	**0.00031***
LL4sw-055-0970-SW	08/12/2001	1.1	**0.51 ***	**NA**

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
OMZA = Outside Mixing Zone Average.

Table D-7. Ecological Screening Exceedances for Discrete Sediment at Load Line 4

		Chemical	Cadmium	Nickel	PCB-1248
		Screening Criteria	0.99	33	0.0598
		Criteria Source	MacDonald et al.	SRV	Total PCB-MacDonald et al.
Sample ID	Date	Depth (ft)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
LL4sd-058-0975-SD	08/20/2001	0 - 0.5	<0.65 U	9.8 J	**0.09 ***
LL4sd-055-0969-SD	08/14/2001	0 - 0.5	**1 J***	**33.4 J***	<0.17 U

***Bold indicates sample exceeds screening criteria.**
ft = Feet.
ID = Identification.
J = Estimated.
MacDonald et al. = Consensus-based threshold effect concentrations (MacDonald et al. 2000).
mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
SRV = Sediment reference value.
U = Not detected.

THIS PAGE INTENTIONALLY LEFT BLANK.

D.4.2 Characterization of Surface Water and Sediment

The Phase II RI (USACE 2004a) established surface water and sediment data aggregates at Load Line 4 by evaluating historic and current surface water flow directions and conveyances. This data gap evaluation uses the same data aggregates that were presented and approved in the Phase II RI as follows:

- Main stream segment upstream of perimeter road,
- Main stream segment and settling pond, and
- Exit drainage.

Surface water and sediment aggregates are shown in Figure D-2. The Phase II RI established a complete evaluation of surface water and sediment based on historic receptors. These same data aggregates are re-evaluated in the SAP Addendum to establish any required action needed to meet the current receptors as identified in the Technical Memorandum (ARNG 2014).

D.4.2.1 Human Health Screening Evaluation

No sample locations had COIs that exceeded human health screening criteria of HI=1, TR of 1E-05 for surface water or sediment; therefore, no additional surface water or sediment sampling is recommended at Load Line 4 to address human health concerns.

D.4.2.2 Ecological Screening Evaluation

For ecological screening purposes, the surface water and sediment COI data are screened against the criteria presented in Table D-5 to identify any locations that may require additional investigation. Sample locations with COIs that exceeded screening criteria were evaluated with the weight-of-evidence presented below, and no chemicals were identified as needing further investigation for surface water or sediment at Load Line 4.

Main Stream Segment Upstream of Perimeter Road Aggregate – In surface water, only iron and manganese detections exceeded the ecological screening value (ESV) (Table D-6). However, the average iron concentration only slightly exceeded background (2.9 versus 2.56 mg/L). While manganese was detected at its highest concentrations in the AOC in this aggregate, the average concentrations in both downstream aggregates were below background. The only persistent, bioaccumulative, and toxic (PBT) chemical detected was mercury but at a level below its ESV. In sediment, there were no exceedances in the discrete samples (Table D-7).

THIS PAGE INTENTIONALLY LEFT BLANK.

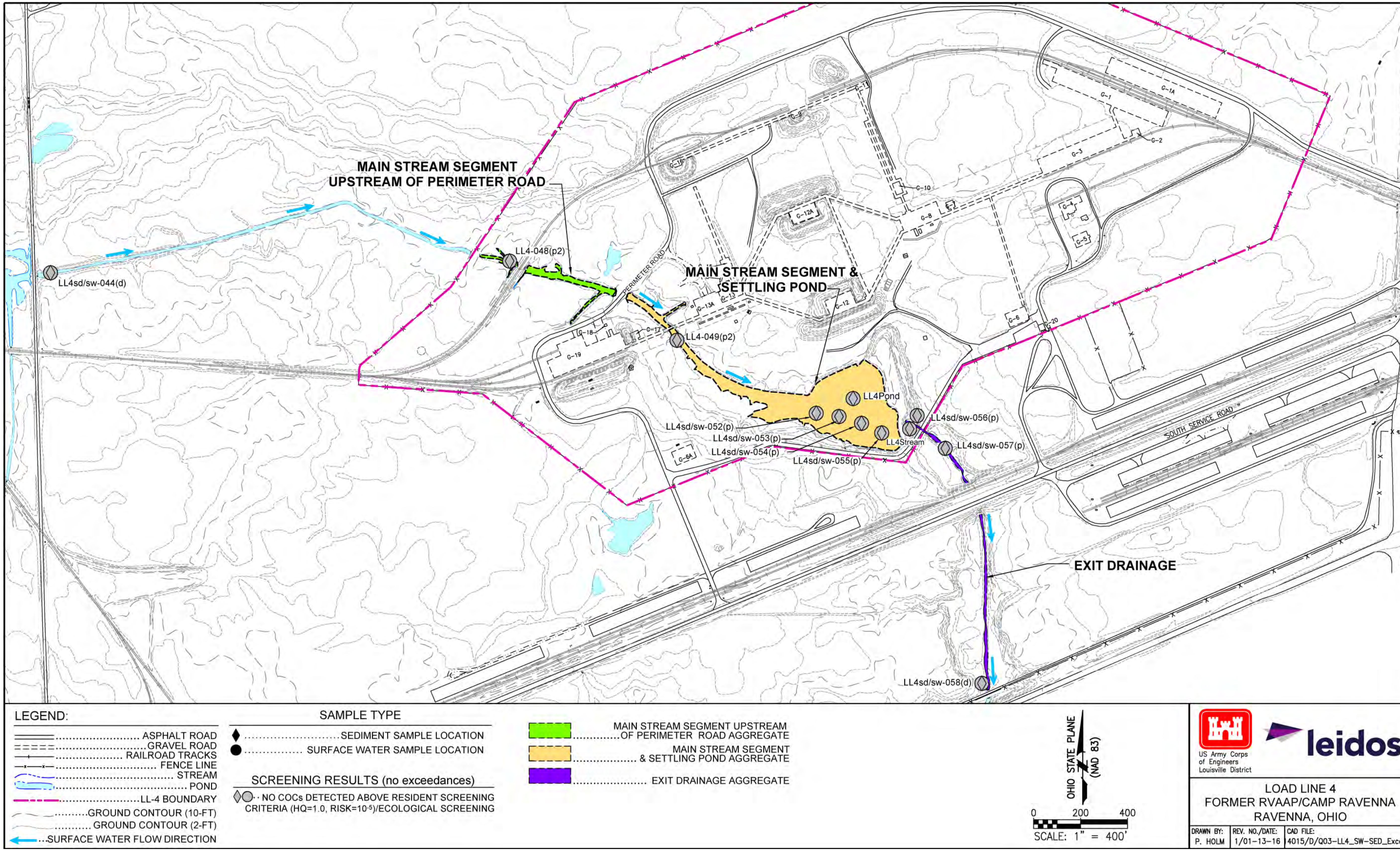


Figure D-2. Screening Results for Sediment and Surface Water at Load Line 4

THIS PAGE INTENTIONALLY LEFT BLANK.

***Main Stream Segment and Settling Pond Aggregate* –** In surface water, manganese and dichlorodiphenyltrichloroethane (DDT) were detected above the ESV (Table D-6). However, the average manganese concentration was below background (0.26 versus 0.391 mg/L). DDT was detected in one of two pond samples but was not detected in the following samples throughout Load Line 4: most upstream sample (in the Main Stream Segment Upstream of Perimeter Road Aggregate), closest downstream sample below the pond (in the Exit Drainage Aggregate), and the most downstream sample near the Load Line 4 boundary (in the Exit Drainage Aggregate). DDT was not a COI in any of the three sediment aggregates. Of the two PBT chemicals, mercury was detected but at levels below its ESV. While DDT, the other PBT chemical, was detected above the ESV, it was only detected in one sample throughout the entire Load Line 4. In sediment, there were no exceedances in the ISM sample. Only two metals, cadmium and nickel, had any discrete exceedances. However, the ISM sample concentration of cadmium (0.78 mg/kg) was below the Ohio sediment reference value (SRV) (0.79 mg/kg) and the ESV (0.99 mg/kg). The ISM sample concentration of nickel (26.4 mg/kg) was below the Ohio SRV (33 mg/kg) but just above the ESV (22.7 mg/kg).

***Exit Drainage Aggregate* –** In surface water, only manganese was detected above the ESV (Table D-6). However, the average manganese concentration was below background (0.33 versus 0.391 mg/L). In sediment, there were no ISM or discrete sample exceedances. The PBT chemical PCB-1248 was detected in one of three samples but below the ESV.

Based on the surface water and sediment screening results above, collecting additional surface water and sediment samples is not warranted. In surface water, only two metals had any exceedances, and average concentrations were usually below or just above background. All PBT chemical detections except for DDT were below their ESVs. DDT was only detected in one surface water sample throughout the entire Load Line and was not a COI in sediment. For sediment, there were no ISM sample exceedances, and there were limited discrete exceedances. Those metals with discrete exceedances had average concentrations near or below the Ohio SRV and ESV.

D.4.3 Proposed Surface Water and Sediment Sample Locations for Load Line 4

Surface water and sediment data were evaluated at all three aggregates for human health and ecological screening criteria. No additional sampling is recommended as surface water and sediment have been adequately characterized.

THIS PAGE INTENTIONALLY LEFT BLANK.

D.5 REFERENCES

Army National Guard-ILE Cleanup, U.S. Army (ARNG) 2014. *Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program, Portage/Trumbull Counties, Ohio*. Memorandum between ARNG-ILE Cleanup and the Ohio Environmental Protection Agency. Dated February 2014.

EQM (Environmental Quality Management) 2014. *Final Facility-Wide Groundwater Monitoring Program - RVAAP-66 Facility-Wide Groundwater Report on the January 2014 Sampling Event*. August 2014.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger 2000. "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems." *Arch. Environ. Contam. Toxicol*. 39, 20-31. 2000.

Ohio EPA (Ohio Environmental Protection Agency) 2008. Email correspondence from Ms. Eileen T. Mohr, Ohio EPA Facility Coordinator, to Mr. Dave Cobb, Shaw Project Manager, dated April 14, 2008, regarding acceptance of LL1ss-29 excavation for PCBs. April 2008.

Ohio EPA 2014. Division of Surface Water. Ohio Administrative Code, Chapters 3745-1, 3745-2, (Ohio River Basin). Accessed November 2014.

U.S. Army Corps of Engineers (USACE) 1996. *Preliminary Assessment for the Characterization of Areas of Contamination Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 1996.

USACE 1998. *Phase I Remedial Investigation Report for the Phase I Remedial Investigation of High Priority Areas of Concern at the Ravenna Army Ammunition Plant*. February 1998.

USACE 2004a. *Phase II Remedial Investigation Report for the Load Line 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. July 2004.

USACE 2004b. *Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4*. September 2004.

USACE 2005a. *Final November 2004 Sampling Completion Report*. February 2005.

USACE 2005b. *Final Focused Feasibility Study for the Remediation of Soils at Load Lines 1 through 4*. May 2005.

USACE 2005c. *Facility-Wide Biological and Water Quality Study*. November 2005.

USACE 2007. *Interim Record of Decision for the Remediation of Soils at Load Lines 1 Through 4*. January 2007.

USACE 2008. *Remedial Action Completion Report for the Remediation of Soils and Dry Sediments at RVAAP 08-11 (Load Lines 1-4) Ravenna Army Ammunition Plant Ravenna, Ohio*. June 2008.

USACE 2009a. *Sampling and Screening Analysis of Soils Below Floor Slabs at RVAAP-09, 10, and 11*. July 2009.

USACE 2009b. *Multi-Increment Sampling and Analysis of Soils Below Floor Sabs at RVAAP-09, 10, and 11*. December 2009.

USACE 2010a. *Sampling and Analysis of Soils Below Floor Slabs at RVAAP-08 Load Line 1 and Other Building Locations*. September 2010.

USACE 2010b. *Remediation Completion Report for Sub-Slab Soils at Load Lines 2, 3, and 4*. December 2010.

USACE 2010c. *Draft Guidance Document of the Evaluation of Land Use Controls at Ravenna Army Ammunition Plant, Ravenna, Ohio.* October 2010.

USACE 2011. *Sampling Report of Surface and Subsurface Incremental Sampling Methodology at Load Lines 1, 2, 3, and 4*. Volumes 1 and 2. March 2011.

USACE 2012. *Draft Remedial Investigation/Feasibility Study Report for RVAAP-67 Facility-Wide Sewers*. September 2012.

USACE 2013. *Characterization Sampling Report of Surface and Subsurface Incremental Sampling Methodology Load Lines 1, 2, 3, 4, and 12*. March 2013.

US Army Toxic and Hazardous Materials Agency (USATHAMA) 1978. *Installation Assessment of Ravenna Army Ammunition Plant*. Report No. 132. November 1978.

ATTACHMENT I
LOAD LINE 4 SCREENING RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK.

ATTACHMENT I: LOAD LINE 4 SCREENING RESULTS

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 4

Attachment Table 2. Ecological Screening Results for ISM Sediment at Load Line 4

Attachment Table 3. Human Health Screening Results for Discrete Sediment at Load Line 4

Attachment Table 4. Human Health Screening Results for ISM Sediment at Load Line 4

Attachment Table 5. Ecological Screening Results for Surface Water at Load Line 4

Attachment Table 6. Human Health Screening Results for Surface Water at Load Line 4

THIS PAGE INTENTIONALLY LEFT BLANK.

Attachment Table 1. Ecological Screening Results for Discrete Sediment at Load Line 4

		Chemical	Aluminum	Barium	Beryllium	Cadmium	Calcium	Iron	Lead	Magnesium
		Screening Criteria	**29000**	**190**	**0.8**	**0.99**	**21000**	**41000**	**47**	**7100**
		Criteria Source	**SRV**	**SRV**	**SRV**	**MacDonald et al.**	**SRV**	**SRV**	**SRV**	**SRV**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL4sd-056-0971-SD	08/13/2001	0 - 0.5	7130	39	0.45	0.26	2770	16700	18.3	2540
LL4sd-057-0973-SD			4580	30.2	0.3	0.36	2850	11900	12.6	1850
LL4sd-058-0975-SD	08/20/2001	0 - 0.5	3390	12.3	<0.23 U	<0.65 U	1500	11600	6.4 J	1640
LL4sd-048-0957-SD			5980	56.8	<0.48 U	<0.17 U	8330	12100	11.4 J	1500
LL4sd-044-0955-SD	08/13/2001	0 - 0.5	7890	54.2	0.56	0.25	13900	18600	13.7	4150
LL4sd-049-0959-SD	08/20/2001	0 - 0.5	7810	44.6	<0.44 U	<0.67 U	975	9420	12.3 J	1460
LL4sd-052-0963-SD	08/14/2001	0 - 0.5	14600	118 J	<0.76 U	0.88 J	3330 J	34100 J	23.3 J	3550 J
LL4sd-053-0965-SD			15000	140 J	<0.85 U	0.83 J	3910 J	34500 J	25.6 J	3700 J
LL4sd-054-0967-SD			15500	162 J	<0.98 U	0.84 J	4300 J	39400 J	26.9 J	3790 J
LL4sd-055-0969-SD			16500	163 J	<0.98 U	**1 J***	6710 J	38000 J	27.7 J	4220 J

		Chemical	Nickel	Thallium	Vanadium	2,4,6-Trinitrotoluene	PCB-1248
		Screening Criteria	**33**	**4.7**	**40**		**0.0598**
		Criteria Source	**SRV**	**SRV**	**SRV**	**None**	**Total PCB-MacDonald et al.**
Sample ID	**Date**	**Depth (ft)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**	**Conc. (mg/kg)**
LL4sd-056-0971-SD	08/13/2001	0 - 0.5	15	0.31	13.1	NA	<0.048 U
LL4sd-057-0973-SD			11.1	0.18 J	8.1	NA	<0.047 U
LL4sd-058-0975-SD	08/20/2001	0 - 0.5	9.8 J	0.47	5.9	NA	**0.09 ***
LL4sd-048-0957-SD			13 J	<0.74 U	10.4	<0.25 U	<0.058 U
LL4sd-044-0955-SD	08/13/2001	0 - 0.5	15.7	0.4	12.1	NA	<0.051 U
LL4sd-049-0959-SD	08/20/2001	0 - 0.5	11 J	0.71	10.5	NA	<0.044 U
LL4sd-052-0963-SD	08/14/2001	0 - 0.5	25 J	1.5	22.3 J	<0.25 U	<0.14 U
LL4sd-053-0965-SD			30.5 J	0.99	25.4 J	<0.25 U	<0.15 U
LL4sd-054-0967-SD			32.2 J	2.1	26 J	<0.25 U	<0.18 U
LL4sd-055-0969-SD			**33.4 J***	2.7	27 J	<0.25 U	<0.17 U

***Bold indicates sample exceeds screening criteria.**
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
SRV = Sediment Reference Value.
U = Not detected.

Attachment Table 2. Ecological Screening Results for ISM Sediment at Load Line 4

		Chemical	Aluminum	Barium	Beryllium	Cadmium	Calcium	Iron	Lead	Magnesium
		Screening Criteria	29000	190	0.8	0.99	21000	41000	47	7100
		Criteria Source	SRV	SRV	SRV	MacDonald et al.	SRV	SRV	SRV	SRV
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-025-0000	06/26/2003	0 - 0.5	4200 J	25.4	0.24	0.15 J	2260 J	10500	9.6 J	1790 J
FSW-SD-032-0000	06/23/2003	0 - 0.3	11400 J	96.9	0.62	0.62	4040	23700 J	18	2810

		Chemical	Nickel	Thallium	Vanadium	2,4,6-Trinitrotoluene	PCB-1248
		Screening Criteria	33	4.7	40		0.0598
		Criteria Source	SRV	SRV	SRV	None	Total PCB-MacDonald et al.
Sample ID	Date	Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-025-0000	06/26/2003	0 - 0.5	9.4	<1.3 UJ	7.7	<0.1 U	<0.051 U
FSW-SD-032-0000	06/23/2003	0 - 0.3	20.5 J	<2.6 U	19.1	<0.1 U	<0.097 U

ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
SRV = Sediment Reference Value.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 3. Human Health Screening Results for Discrete Sediment at Load Line 4

Sample ID	Date	Chemical	Aluminum	Arsenic	Lead	Manganese	Thallium	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene
		Screening Criteria	73798	19.5	400	2927	6.12	2.21	0.221	2.21	0.221
		Criteria Source	RC	BKG	RSL	RC	RC	RA	RA	RA	RA
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL4sd-056-0971-SD	08/13/2001	0 - 0.5	7130	6.3	18.3	201	0.31	NA	NA	NA	NA
LL4sd-057-0973-SD			4580	5.9	12.6	210	0.18 J	NA	NA	NA	NA
LL4sd-058-0975-SD	08/20/2001	0 - 0.5	3390	5.8	6.4 J	315	0.47	<0.43 UJ	<0.43 UJ	<0.43 UJ	<0.43 UJ
LL4sd-048-0957-SD			5980	4.8	11.4 J	519	<0.74 U	<0.58 UJ	<0.58 UJ	<0.58 UJ	<0.58 UJ
LL4sd-044-0955-SD	08/13/2001	0 - 0.5	7890	10.2	13.7	469	0.4	NA	NA	NA	NA
LL4sd-049-0959-SD	08/20/2001	0 - 0.5	7810	2	12.3 J	78.2	0.71	NA	NA	NA	NA
LL4sd-052-0963-SD	08/14/2001	0 - 0.5	14600	10.7 J	23.3 J	749 J	1.5	NA	NA	NA	NA
LL4sd-053-0965-SD			15000	13.2 J	25.6 J	669 J	0.99	NA	NA	NA	NA
LL4sd-054-0967-SD			15500	16 J	26.9 J	786 J	2.1	<1.8 UJ	<1.8 UJ	<1.8 UJ	<1.8 UJ
LL4sd-055-0969-SD			16500	15.9 J	27.7 J	731 J	2.7	NA	NA	NA	NA

Sample ID	Date	Chemical	Indeno(1,2,3-cd)pyren	PCB-1254	PCB-1260
		Screening Criteria	2.21	1.2	2.03
		Criteria Source	RA	RC	RA
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
LL4sd-056-0971-SD	08/13/2001	0 - 0.5	NA	<0.048 U	<0.048 U
LL4sd-057-0973-SD			NA	<0.047 U	<0.047 U
LL4sd-058-0975-SD	08/20/2001	0 - 0.5	<0.43 UJ	<0.043 U	<0.043 R
LL4sd-048-0957-SD			<0.58 UJ	<0.058 U	<0.058 R
LL4sd-044-0955-SD	08/13/2001	0 - 0.5	NA	<0.051 U	<0.051 U
LL4sd-049-0959-SD	08/20/2001	0 - 0.5	NA	<0.044 U	<0.044 R
LL4sd-052-0963-SD	08/14/2001	0 - 0.5	NA	<0.14 U	<0.14 U
LL4sd-053-0965-SD			NA	<0.15 U	<0.15 U
LL4sd-054-0967-SD			<1.8 UJ	<0.18 U	<0.18 U
LL4sd-055-0969-SD			NA	<0.17 U	<0.17 U

BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
R = Rejected.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 4. Human Health Screening Results for ISM Sediment at Load Line 4

Sample ID	Date	Chemical	Aluminum	Arsenic	Lead	Manganese	Thallium	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene
		Screening Criteria	73798	19.5	400	2927	6.12	2.21	0.221	2.21	0.221
		Criteria Source	RC	BKG	RSL	RC	RC	RA	RA	RA	RA
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-025-0000	06/26/2003	0 - 0.5	4200 J	4	9.6 J	164	<1.3 UJ	<0.51 U	<0.51 U	<0.51 U	<0.51 U
FSW-SD-032-0000	06/23/2003	0 - 0.3	11400 J	9.5 J	18	409	<2.6 U	<0.97 U	<0.97 U	<0.97 U	<0.97 U

Sample ID	Date	Chemical	Indeno(1,2,3-cd)pyren	PCB-1254	PCB-1260
		Screening Criteria	2.21	1.2	2.03
		Criteria Source	RA	RC	RA
		Depth (ft)	Conc. (mg/kg)	Conc. (mg/kg)	Conc. (mg/kg)
FSW-SD-025-0000	06/26/2003	0 - 0.5	<0.51 U	<0.051 U	<0.051 U
FSW-SD-032-0000	06/23/2003	0 - 0.3	<0.97 U	<0.097 U	<0.097 U

BKG = Background.
ft = feet.
J = Estimated.
ID = Identification.
mg/kg = Milligrams per kilogram.
PCB = Polychlorinated biphenyl.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

Attachment Table 5. Ecological Screening Results for Surface Water at Load Line 4

	Chemical	Calcium	Iron	Magnesium	Manganese	Mercury	Potassium	4,4'-DDT
	Screening Criteria	**41.4**	**2.56**	**10.8**	**0.391**	**0.00091**	**3.17**	**1.1 X 10-8**
	Criteria Source	**BKG**	**BKG**	**BKG**	**BKG**	**OMZA**	**BKG**	**OMZA**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-025-0000	06/26/2003	36.4	1.42	8.21	**0.479 ***	<0.00035 U	1.72	<0.00005 U
FSW-SW-065-0000	09/17/2003	58.5	1.57	12.6	0.308	<0.00035 U	5.53	NA
LL4sw-056-0972-SW	08/13/2001	49.5	1.7	8.2	**0.43 ***	<0.0002 U	2.3 J	NA
LL4sw-057-0974-SW		49.2	1.5	7.3	0.34	<0.0002 U	2.8 J	NA
LL4sw-058-0976-SW	08/14/2001	53	0.22 J	12.3	0.095	<0.0002 U	1.9 J	<0.00005 U
LL4sw-048-0958-SW	08/20/2001	34.6	**4.6 ***	9	**3.2 ***	0.00008 J	3.1 J	<0.00005 U
LL4sw-044-0956-SW	08/13/2001	61.6	1.2	16.6	**3.6 ***	<0.0002 U	3.3 J	NA
LL4sw-049-0960-SW	08/20/2001	19.8	1.7	6.9	0.081	0.00009 J	<0.49 U	NA
FSW-SW-032-0000	06/23/2003	21.3	1.41	4.9	0.153	<0.00035 U	1.42	<0.00005 U
FSW-SW-072-0000	08/06/2003	15.2	2.1	3.11	0.0649	<0.00035 U	1.55	NA
LL4sw-052-0964-SW	08/14/2001	22.5	0.72	8.2	0.2	<0.0002 U	0.87 J	NA
LL4sw-053-0966-SW		22.5	1.1	8.2	0.35	<0.0002 U	0.91 J	NA
LL4sw-054-0968-SW		22.6	1	8.2	**0.46 ***	<0.0002 U	0.92 J	**0.00031**
LL4sw-055-0970-SW	08/12/2001	22.9	1.1	8.2	**0.51 ***	<0.0002 U	0.91 J	NA

***Bold indicates sample exceeds screening criteria.**
BKG = Background.
DDT = dichlorodiphenyltrichloroethane.
J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
OMZA = Outside Mixing Zone Average.
U = Not detected.

Attachment Table 6. Human Health Screening Results for Surface Water at Load Line 4

Sample ID	Chemical	Aluminum	Arsenic	Lead	Manganese	Thallium	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene
	Screening Criteria	**148.27**	**0.011**	**0.015**	**6.326**	**0.0124**	**0.0001**	**8E-6**	**0.0001**	**5E-6**	**0.0001**
	Criteria Source	**RC**	**RA**	**RSL**	**RC**	**RC**	**RA**	**RA**	**RA**	**RA**	**RA**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-025-0000	06/26/2003	0.202	<0.019 UJ	0.0026 J	0.479	<0.02 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U
FSW-SW-065-0000	09/17/2003	0.486	<0.019 U	<0.008 U	0.308	<0.02 UJ	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U
LL4sw-056-0972-SW	08/13/2001	0.51	<0.015 U	<0.01 U	0.43	<0.002 UJ	NA	NA	NA	NA	NA
LL4sw-057-0974-SW		<0.65 U	<0.015 U	<0.01 U	0.34	<0.002 UJ	NA	NA	NA	NA	NA
LL4sw-058-0976-SW	08/14/2001	<0.2 U	<0.015 U	<0.01 U	0.095	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
LL4sw-048-0958-SW	08/20/2001	0.45	0.007 J	<0.01 U	3.2	<0.002 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
LL4sw-044-0956-SW	08/13/2001	<0.28 U	0.0071 J	<0.01 U	3.6	<0.002 UJ	NA	NA	NA	NA	NA
LL4sw-049-0960-SW	08/20/2001	1.1	<0.015 U	<0.01 U	0.081	<0.002 U	NA	NA	NA	NA	NA
FSW-SW-032-0000	06/23/2003	0.17	<0.019 UJ	<0.008 UJ	0.153	<0.02 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U	<0.011 U
FSW-SW-072-0000	08/06/2003	0.999	<0.019 U	0.0029 J	0.0649	<0.02 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
LL4sw-052-0964-SW	08/14/2001	<0.15 U	<0.015 U	<0.01 U	0.2	<0.002 UJ	NA	NA	NA	NA	NA
LL4sw-053-0966-SW		<0.22 U	<0.015 U	<0.01 U	0.35	<0.002 UJ	NA	NA	NA	NA	NA
LL4sw-054-0968-SW		<0.17 U	<0.015 U	<0.01 U	0.46	<0.002 UJ	<0.01 U	<0.01 U	<0.01 U	<0.01 U	<0.01 U
LL4sw-055-0970-SW	08/12/2001	<0.16 U	<0.015 U	<0.01 U	0.51	<0.002 UJ	NA	NA	NA	NA	NA

Sample ID	Chemical	PCB-1254	PCB-1260
	Screening Criteria	**0.0031**	**0.0004**
	Criteria Source	**RC**	**RSL**
Sample ID	**Date**	**Conc. (mg/L)**	**Conc. (mg/L)**
FSW-SW-025-0000	06/26/2003	<0.001 U	<0.001 U
FSW-SW-065-0000	09/17/2003	NA	NA
LL4sw-056-0972-SW	08/13/2001	<0.0005 U	<0.0005 U
LL4sw-057-0974-SW		<0.0005 U	<0.0005 U
LL4sw-058-0976-SW	08/14/2001	<0.0005 U	<0.0005 U
LL4sw-048-0958-SW	08/20/2001	<0.0005 U	<0.0005 U
LL4sw-044-0956-SW	08/13/2001	<0.0005 U	<0.0005 U
LL4sw-049-0960-SW	08/20/2001	<0.0005 U	<0.0005 U
FSW-SW-032-0000	06/23/2003	<0.0011 U	<0.0011 U
FSW-SW-072-0000	08/06/2003	NA	NA
LL4sw-052-0964-SW	08/14/2001	<0.0005 U	<0.0005 U
LL4sw-053-0966-SW		<0.0005 U	<0.0005 U
LL4sw-054-0968-SW		<0.0005 U	<0.0005 U
LL4sw-055-0970-SW	08/12/2001	<0.0005 U	<0.0005 U

J = Estimated.
ID = Identification.
mg/L = Milligrams per liter.
NA = Chemical not analyzed for in that sample.
PCB = Polychlorinated biphenyl.
RA = Resident Adult.
RC = Resident Child.
RSL = Risk Screening Level.
U = Not detected.
UJ = Not detected and reporting limit estimated.

APPENDIX E
CAMP RAVENNA JOINT MILITARY TRAINING CENTER (CRJMTC) RESTORATION CONTRACTOR INFORMATION

THIS PAGE INTENTIONALLY LEFT BLANK.

THE ADJUTANT GENERAL'S DEPARTMENT
CAMP RAVENNA JOINT MILITARY TRAINING CENTER
1438 State Route 534 SW
Newton Falls, OH 44444

2 April 2014

RE: Camp Ravenna/Former Ravenna Army Ammunition Plant (RVAAP)
Portage and Trumbull Counties, Ohio
Update to Procedures to Follow as Related to the RVAAP Restoration Program due to the Accountability Transfer of the Remaining Property from BRACD to the ARNG/OHARNG

To: RVAAP Restoration Program Stakeholders and Contractors

Accountability for the remaining acreage of the former RVAAP has been transferred from the Base Realignment and Closure Division (BRACD) to the United States Property and Fiscal Office (USP&FO) for Ohio. The entire facility (all acreage) is now part of Camp Ravenna and licensed to the Ohio Army National Guard (OHARNG) for use as a military training site. With this transition, the OHARNG/Army National Guard (ARNG) has assumed responsibility for management of the RVAAP restoration program. The RVAAP restoration program is now part of the larger OHARNG environmental program, and as such, needs to be synchronized with the OHARNG environmental program requirements and Camp Ravenna operational policies and procedures. This letter is to advise you of the environmental program and operational policies and procedures applicable to you as an Army stakeholder and/or contractor involved in the RVAAP restoration program. Our hope is to facilitate a smooth transition. Items addressed in this letter include the following:

- Access procedures to Camp Ravenna/former RVAAP;
- Emergency/Spill procedure for Camp Ravenna/former RVAAP;
- Waste management procedures at Camp Ravenna/former RVAAP;
- Hazardous materials management procedures at Camp Ravenna/former RVAAP;
- Use of Building 1036 and job trailers at Camp Ravenna/former RVAAP;
- Revision to the general facility description in restoration documents; and
- Revisions to shipping address and document distribution.

1. Access Procedures for Camp Ravenna/Former RVAAP

The protocol for access is developed and implemented by the Camp Ravenna headquarters staff and may change depending upon the security level. The current procedure for restoration Army stakeholders, contractors, the Ohio Environmental Protection Agency (Ohio EPA), and any other restoration related visitors to Camp Ravenna is provided in Attachment A and summarized below.

- Request access to Camp Ravenna through Vista Sciences (Rebecca Haney, cc Gail Harris, Al Brillinger) at least 48 hours in advance on the access request form.
- Vista Sciences will confer with the Camp Ravenna Environmental Office (CR-ENV) to confirm the access request is valid.
- Vista Sciences will forward the access request form to the appropriate Camp Ravenna military security staff for approval.

- Camp Ravenna military security staff will approve or deny the request and forward it back to Vista Sciences. If approved, the Camp Ravenna military security staff will send the access form to the applicable gate at Camp Ravenna.
- Vista Sciences will inform access request submitter that the request has been approved.

At no time will contractors be granted access without prior approval by the Camp Ravenna Operations Office. Contractor work schedules must coincide with Camp Ravenna duty days and hours (Monday through Friday, 7:30AM-4:30PM). Extended work schedules must be approved by the Camp Ravenna Environmental Office (Restoration Program and/or Environmental Supervisor) and coordinated and approved by Operations, at least 48 hours prior to the intended start date. Federal holidays will not be approved as a normal work days. Please note: Any work outside of normal duty hours, weekends or holidays must be preapproved by Camp Ravenna.

2. Emergency/Spill Procedure for Camp Ravenna/Former RVAAP

The protocol for emergency procedures is developed and implemented by the Camp Ravenna headquarters staff. The procedure for spills at Camp Ravenna is developed and implemented by the Camp Ravenna Environmental Office in coordination with the Camp Ravenna headquarters staff and in accordance with latest version of the Camp Ravenna Integrated Contingency Plan (ICP or Spill Plan). Please note that the Camp Ravenna ICP/Spill Plan was updated and finalized in January 2014. The current procedure for Army stakeholders, contractors, the Ohio EPA, and any other restoration related visitors to Camp Ravenna is summarized below.

- In the event of an emergency or spill, contact Camp Ravenna Range Control at (614)336-6041.
- Range Control will contact the applicable emergency services which will be dispatched from Trumbull or Portage County depending on the location of the emergency.
- For spills (any time), follow the procedure and telephone notification on the Camp Ravenna First Responder form provided in Attachment B.
- For non-spill emergencies outside Camp Ravenna regular duty hours, dial 911 and ask for the Ravenna, Ohio emergency dispatch.

3. Waste Management Procedures for Camp Ravenna/Former RVAAP

All waste generated by the restoration program will now be managed by the OHARNG (Camp Ravenna Environmental Office). Katie Tait, with support from Vista Sciences (Brad Kline), will be the main contacts for the waste program at Camp Ravenna. Due to the transition from BRACD to OHARNG, procedures for waste management at the facility have changed. Changes are summarized below.

- All waste must be managed in accordance with the Camp Ravenna Waste Management Guidelines- Restoration Waste (see Attachment C)
- All waste must be inspected by the contractor who generated the waste on a weekly basis using the Camp Ravenna Waste Inspection form. Inspection forms must be submitted to Brad Kline (with cc to Katie Tait) on a weekly basis. If the contractor chooses to use Vista for weekly waste inspections, the contractor must work out the logistics and details with Vista including payment for services. Weekly waste inspections for contractor waste is not a government funded task under the Vista support contract.
- All waste profiles must be reviewed and signed by Katie Tait. The alternate for signature (in Katie Tait's absence) is Tim Morgan.
- All manifests must be reviewed and signed by Katie Tait prior to any waste leaving the facility. The alternate for signature is Tim Morgan or Kevin Sedlak (nonhazardous waste only).

- A waste sample must be collected within 10 days of generation of any waste. Analytical results for all waste must be submitted to the OHARNG/ARNG (Katie Tait, Kevin Sedlak) and Vista Sciences (Brad Kline) as soon as received by the contractor. Waiting to submit the analytical results with the IDW report is not acceptable (too much time elapses between sampling and IDW report generation and we must be expedient if the waste is determined to be hazardous).
- All hazardous waste must be removed from the facility within 90 days of generation and all nonhazardous waste must be removed from the facility within 120 days of generation. Any other disposal timeframes must be discussed and approved by the Camp Ravenna Environmental Office.
- A drum label in accordance with the Facility-wide Sampling and Analysis Plan (FWSAP) must be used to label the drum/container prior to sampling and as soon as waste is added to the drum/container. A Pending Analysis label may be used after a waste sample is collected. Use of a Pending Analysis label shall not exceed 20 days. An applicable waste label must be placed on waste containers within 7 days (1 week) of receiving the analytical results determining the waste type.
- All contractor waste must be staged at Building 1036 (nonhazardous) or Building 1047 (hazardous). All other waste storage locations must be approved by the Camp Ravenna Environmental Office prior to use.
- All empty drums that are not in use must be properly labeled as 'Empty'.
- Contractor waste stored onsite is to be tracked and logged in the Waste Binder on the appropriate Container Log within Building 1036 and 1047. When restoration waste is added to the storage area, Vista Sciences (Brad Kline) must be contacted and made aware of the newly added waste.
- The contractor is responsible for ensuring that all waste is ready for transport (proper containerization, labeling, paperwork, etc.) offsite prior to waste transport.

4. Hazardous Materials Management Procedures for Camp Ravenna/Former RVAAP

Hazardous materials may be brought onsite for applicable restoration purposes during the duration of the field work. Any hazardous materials brought onsite must be identified in the contractor's project work plan and on an inventory prior to work. The contractor is required to properly manage all hazardous materials while onsite, including but not limited to, having an inventory and Safety Data Sheets (SDSs) of materials, properly inspecting materials, properly storing on secondary containment, having spill supplies and the first responder form on hand, and having properly labeled materials. Hazardous materials must be removed and taken offsite by the contractor at the end of each field work episode. The OHARNG/ARNG is not responsible for disposing of or managing contractor hazardous materials. The Camp Ravenna Environmental Office must approve any long term storage of hazardous materials. All hazardous materials utilized during field work in Building 1036 are to be stored in the hazardous material lockers offered by OHARNG in Building 1036. All hazardous materials approved by Camp Ravenna Environmental Office for long term storage and the hazardous materials lockers are strictly managed (compatibility, SDS, containers labeled, shelves numbered, inventoried, inspected, etc.) in accordance with the OHARNG requirements. The contractor is required to comply with these requirements.

5. Use of Building 1036 and Work Trailers at Camp Ravenna/Former RVAAP

- If a contractor would like to use Building 1036, the contractor must contact Vista Sciences in the Camp Ravenna Environmental Office for building keys and access.
- All work trailer locations must be approved by Camp Ravenna prior to staging onsite.

6. Revision to General Facility Description in Restoration Documents

The following is a revision to the general facility description as it pertains to the restoration program Please use this description as applicable in all restoration documents.

The former Ravenna Army Ammunition Plant (RVAAP), now known as the Camp Ravenna Joint Military Training Center (Camp Ravenna), located in northeastern Ohio within Portage and Trumbull counties, is approximately three (3) miles east/northeast of the City of Ravenna and one (1) mile north/northwest of the City of Newton Falls. The facility is approximately 11 miles long and 3.5 miles wide. The facility is bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad to the south; Garret, McCormick, and Berry Roads to the west; the Norfolk Southern Railroad to the north; and State Route 534 to the east. In addition, the facility is surrounded by the communities of Windham, Garrettsville, Charlestown, and Wayland.

Administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Office (USP&FO) for Ohio and the property subsequently licensed to the OHARNG for use as a military training site, Camp Ravenna. The RVAAP restoration program involves cleanup of former production/operational areas throughout the facility related to former activities conducted under the RVAAP.

7. Revisions to Document Shipping Addresses and Document Distribution

For Preliminary Draft, Draft and Final Documents – OHARNG/ARNG
Send one (1) electronic copy of report to:
Army National Guard
Attn: Brett Merkel
ARNG-ILE Cleanup
111 South George Mason Drive
Arlington VA 22203

Send one (1) hardcopy and one (1) electronic copy of report to:
Camp Ravenna Environmental Office
Attn: Katie Tait/Kevin Sedlak
1438 State Route 534 SW
Newton Falls OH 44444

Send two (2) electronic copies and two (2) hardcopies of report to:
Camp Ravenna Environmental Office
Attn: RVAAP Administrative Records Manager (Gail Harris)
1438 State Route 534 SW
Newton Falls OH 44444

For Draft and Final Documents – Ohio EPA
Vista Sciences will send an email to the Ohio EPA Project Manger with the cover letter and attached document (not to include appendices for size purposes) with a cc to Nancy Zikmanis, Justin Burke, and Rod Beals.

One (1) hardcopy and three (3) electronic copies of the report (with all appendices included) will be sent to the Ohio EPA Project Manager at the Ohio EPA NEDO office along with the cover letter. If the document is too large for email submittal, then one (1) additional electronic copy will be sent to Justin Burke at the Ohio EPA Columbus office.

As we work through this transition, there are likely to be additional updates and changes to programs and policies that impact the RVAAP Restoration Program. We will do our best to keep all stakeholders informed and appreciate your patience during this process. If you have any questions or need additional information, please do not hesitate to contact Ms. Kathryn Tait, OHARNG Environmental Specialist 2, at kathryn.s.tait.nfg@mail.mil or (614)336-6136 or Mr. Kevin Sedlak, ARNG Restoration Project Manager, at kevin.m.sedlak.ctr@mail.mil or (614)336-6000 ext 2053.

Sincerely,

Timothy M. Morgan
Fort Ohio Environmental Supervisor

Cc: Kathryn Tait, OHARNG
Kevin Sedlak, ARNG
Brett Merkel, ARNG
Glen Beckham, USACE
Allan Brillinger, Vista Sciences
Nancy Zikmanis/Rod Beals, Ohio EPA

Attachments
Attachment A – Restoration Contractor Access Packet
Attachment B – Camp Ravenna First Responder Form
Attachment C – Camp Ravenna Waste Management Guidelines

Attachment A

CAMP RAVENNA JOINT MILITARY TRAINING CENTER (CRJMTC) RESTORATION CONTRACTOR INFORMATION

MARCH 2014

TABLE OF CONTENTS

INSTALLATION ACCESS

The Camp Ravenna Joint Military Training Center (CRJMTC) is a restricted access Ohio Army National Guard training installation. Due to the inherent risks involved with military training, access to the facility is controlled. All personnel enter and exit CRJMTC through either the Main or East entry gates (see attached map), and upon arrival, are required to present a valid, state-issued identification card to installation security officers.

Civilian personnel must be granted access, in writing, by the Camp Ravenna Operations office. For Restoration Contractors and non-OHARNG government personnel this approval will be coordinated by Vista Sciences Corporation (VSC) who will collect and submit access requests to Camp Ravenna Operations. VSC will confirm with the Camp Ravenna Environmental Office to ensure the access rosters are valid prior to submitting them to Operations for approval.

Requests for access must be submitted no later than 48 hours prior (two business days) to the desired arrival time. **At no time will contractors be granted access without prior approval by the Camp Ravenna Operations Office. Contractor work schedules must coincide with CRJMTC duty days and hours (Monday through Friday, 7:30AM-4:30PM).**

Extended work schedules must be approved by the Camp Ravenna Environmental Office (Restoration Program and/or Environmental Supervisor) and coordinated and approved by Operations, at least 48 hours prior to the intended start date. **Federal Holidays will not be approved as a normal work days.**

EMPLOYEE ROSTERS

Restoration contractors, subcontractors and non-OHARNG government personnel that require access to CRJMTC are required to submit employee rosters no later than one week prior to the scheduled project start date. Employee rosters, at a minimum, will include:

a. The first and last names of all employees requiring access
b. Site foreman's name and on-site phone number (for emergency notification)
c. Contractor's business office address, phone number, and email address
d. CRJMTC Project title, e.g. "WBG Remedial Investigation"
e. Anticipated dates access will be required, e.g. "08/12/2010 – 10/11/2010"

Employee rosters, once approved by Camp Ravenna Operations, will be forwarded to the guard post at the appropriate entry gate. Contractors must maintain accurate employee rosters and forward all updated rosters to VSC as necessary. Each updated and approved employee roster supersedes all previously submitted rosters.

DELIVERIES

All material deliveries (including FedEx/UPS packages) for contractors or subcontractors must be approved by Camp Ravenna Operations. Access requests for deliveries will be submitted via VSC no later than 24 hours prior (one business day) to the anticipated delivery date and must include:

a. The shipping company or supplier's name
b. Driver's name
c. CRJMTC Project title
d. Date or dates of delivery
e. Contractor or subcontractor on site point of contact, e.g. "XYZ Construction, Phil Hammer, (777) 888-9999

Depending on the location of the project site, contractors may be required to provide a vehicle escort to facilitate the movement of materials from the entry gate to the project site.

Contractors working on the **WEST** side (utilizing the State Route 5 **Main** entry gate) of the installation will provide delivery companies with the following address using the provided format:

Contractor/Subcontractor Name, Attn: Site Foreman's Name
CRJMTC Project Title
8451 State Route 5
Ravenna, Ohio 44266

Contractors working on the **EAST** side (utilizing the State Route 534 **East** entry gate) of the installation will provide delivery companies with the following address using the provided format:

Contractor/Subcontractor Name, Attn: Site Foreman's Name
CRJMTC Project Title
1438 State Route 534 Southwest
Newton Falls, Ohio 44444

CRJMTC employees and security personnel will at no time sign for or receive any packages addressed to contractors. Deliveries to CRJMTC during non-business hours or the weekend will not be granted access unless an extended work schedule has been approved and arrangement made for off-hour deliveries.

ACCESS CONTACT INFORMATION

All access related correspondence should be submitted on company letterhead or on the Camp Ravenna Contractor Access Form (see attached example). A confirmation email will be sent after the request has been processed.

Access Requests and Employee Rosters must be submitted by email to **each** the following VSC personnel:

NAME	EMAIL	OFFICE PHONE
Becky Haney	rebecca.haney@vistasciences.com	(330) 872-8010
Gail Harris	gail.harris3@us.army.mil	(330) 872-8003
Al Brillinger	allan.brillinger@vistasciences.com	(330) 872-8009

In the event you need to contact the Camp Ravenna Environmental Office directly, the contacts are below. Do not submit restoration project access rosters directly to the Camp Ravenna Environmental Office unless you are directed to do so.

NAME	EMAIL	OFFICE PHONE
Kevin Sedlak	kevin.m.sedlak.ctr@mail.mil	(614) 336-6000 ext 2053
Katie Tait	kathryn.s.tait.nfg@mail.mil	(614) 336-6136
Tim Morgan	timothy.m.morgan.nfg@mail.mil	(614) 336-6568

RESTRICTIONS

Contractors/non-OHARNG government personnel working on CRJMTC are responsible for ensuring all employees travel to and from the work site on the prescribed route (as briefed during the pre-construction meeting). Unlike some military installations, CRJMTC does not offer amenities such as fuel stations, convenience stores, public restrooms or restaurants. **Sightseeing, camping, hiking, fishing, trapping, hunting, ATV use and off-roading are strictly prohibited.**

Camp Ravenna is a "Forbidden Carry Zone" (as defined by Ohio's Concealed Carry Laws) and contractors are strictly prohibited from bringing weapons onto the installation. All vehicles entering and exiting the installation are subject to search.

Security guards are not authorized to grant access to any unannounced visitors, subcontractors, contractors or service personnel without permission from Camp Ravenna Operations.

The use or possession of alcohol or other illegal substances (in accordance with state and federal laws) is strictly prohibited on Camp Ravenna.

Ohio is a "Smoke-free Workplace" state. Smoking is prohibited inside all CRJMTC buildings.

VEHICLE SAFETY

The speed limit on CRJMTC is 35 MPH (during daylight hours) & 25 MPH (during hours of darkness) on all roads unless otherwise posted and 10 MPH when passing military personnel traveling on foot. Everyone is required to wear seatbelts at all times when the manufacturer (according to State law) provides such equipment. Drivers must have a valid state issued driver's license on their person while operating a vehicle on CRJMTC. The use of headphones or earphones, for the purpose of listening to music, is prohibited. This does not negate wearing hearing protection where conditions or vehicles require their use. Cell phone use, by the driver of a moving vehicle, is prohibited unless a "hands free" device is utilized. **Gross negligence with regard to vehicle safety will not be tolerated and may result in the loss of driving privileges on Camp Ravenna.**

UNEXPLODED ORDNANCE (UXO)

Camp Ravenna, formerly known as the Ravenna Army Ammunition Plant or "Ravenna Arsenal," produced ammunition for the US military during World War II, the Korean War and the Vietnam War. As a result, some UXO has been discovered by contracted service personnel. Any individual who finds any item resembling artillery projectiles, fuses, casings or other ordnance on post must immediately consider it as unexploded ordnance (UXO). **Do not touch or move the suspected UXO.** Report the incident immediately to the CRJMTC Range Control by telephone at (614) 336-6041 or contact the Main Gate at (330) 358-2017. CRJMTC personnel will take immediate action to secure the area and ensure proper disposal of the suspected UXO.

ACTIONS IF UXO IS FOUND

a. Seal off the area from other personnel
b. Initiate necessary protective and evacuation measures
c. Mark the entrance to the UXO area using easily identifiable markings (do not mark the ordnance).

d. Notify CRJMTC Range Control or Gate Guards immediately by telephone with the description of item. **DO NOT touch the suspected UXO**!
e. Show CRJMTC personnel the location of the item
f. Render such assistance as may be required in support of EOD operations

INADVERTENT DISCOVERY OF CULTURAL MATERIALS

- Report any observations or discoveries of artifacts or human remains immediately to CRJMTC Range Control (614) 336-6041. Range Control will immediately notify the CRJMTC Environmental Office & OHARNG Cultural Resources Manager (CRM).
- CRJMTC Range Control or the CRM will secure the artifacts or discovery site, as appropriate. If human remains are suspected, they are not to be disturbed and Range Control will promptly notify Ohio State Highway Patrol or Federal Bureau of Investigation, as appropriate.
- The CRM and Range Control will take measures to protect the location from further disturbance until appropriate parties are notified.
- If a concentration of artifacts or a burial site is identified as the source of materials discovered, the CRM will make arrangements for site recordation and stabilization, in consultation with the Ohio Historic Preservation Office and any interested Native American tribes.
- Once the site has been cleared by the CRM and CRJMTC Range Control, the activity may resume. Depending on the findings, activities may be cleared to resume in 48 hours or up to 6 months.

FOR EMERGENCY RESPONSE ON THE "WEST SIDE" (PORTAGE COUNTY):

- **For a spill emergency implement the Camp Ravenna Emergency Spill Notification IAW the Camp Ravenna First Responder Form.**
- **For non-spill emergencies from 0730-1630, Monday through Friday, contact CRJMTC Range Control by telephone at (614) 336-6041**
- **For non-spill emergencies outside CRJMTC duty hours, dial 911 and ask for the Ravenna, Ohio emergency dispatch.**
- State your emergency and location.
- Outside of CRJTMC duty hours, the Main Gate guard shack (330) 358-2017 should be notified so they can assist in the process (open the gate, direct vehicles).
- During CRJMTC duty hours, Range Control will contact the appropriate dispatch for emergency response and help guide units to your location.
- If the patient can be moved, transporting the patient to the nearest Medical Transfer Point, or EMS entrance gate (North Gate or Main Gate) will expedite the medical evacuation process.

- If the patient cannot be moved, post a signal person (time and resource permitting) at the nearest major intersection/road/medical transfer to help guide emergency vehicles.
- Medical Transfer Points are located throughout the installation. These predetermined points assist first responders in locating injured personnel.

DIRECTIONS TO ROBINSON MEMORIAL HOSPITAL:

- Exit the Main gate. Take State Route 5 west 7.2 miles to the junction of Routes 14 and 44 north. You will be at a stop light next to a McDonalds/BP.
- Turn right onto Routes 14/44 north.
- Go 2.4 miles to North Chestnut Street. You will pass a light at the intersection of Route 88 and will be at a second light at the intersection where Route 14 goes straight and Route 44 splits to the right and goes north, you need to be in the left lane at this intersection, to turn left (south) on North Chestnut Street.
- After turn, get into the right lane. The hospital entrance is 2/10ths of a mile on your right.
- Follow the signs to the Emergency Room.
- Robinson Memorial Patient Information (330) 297-2448

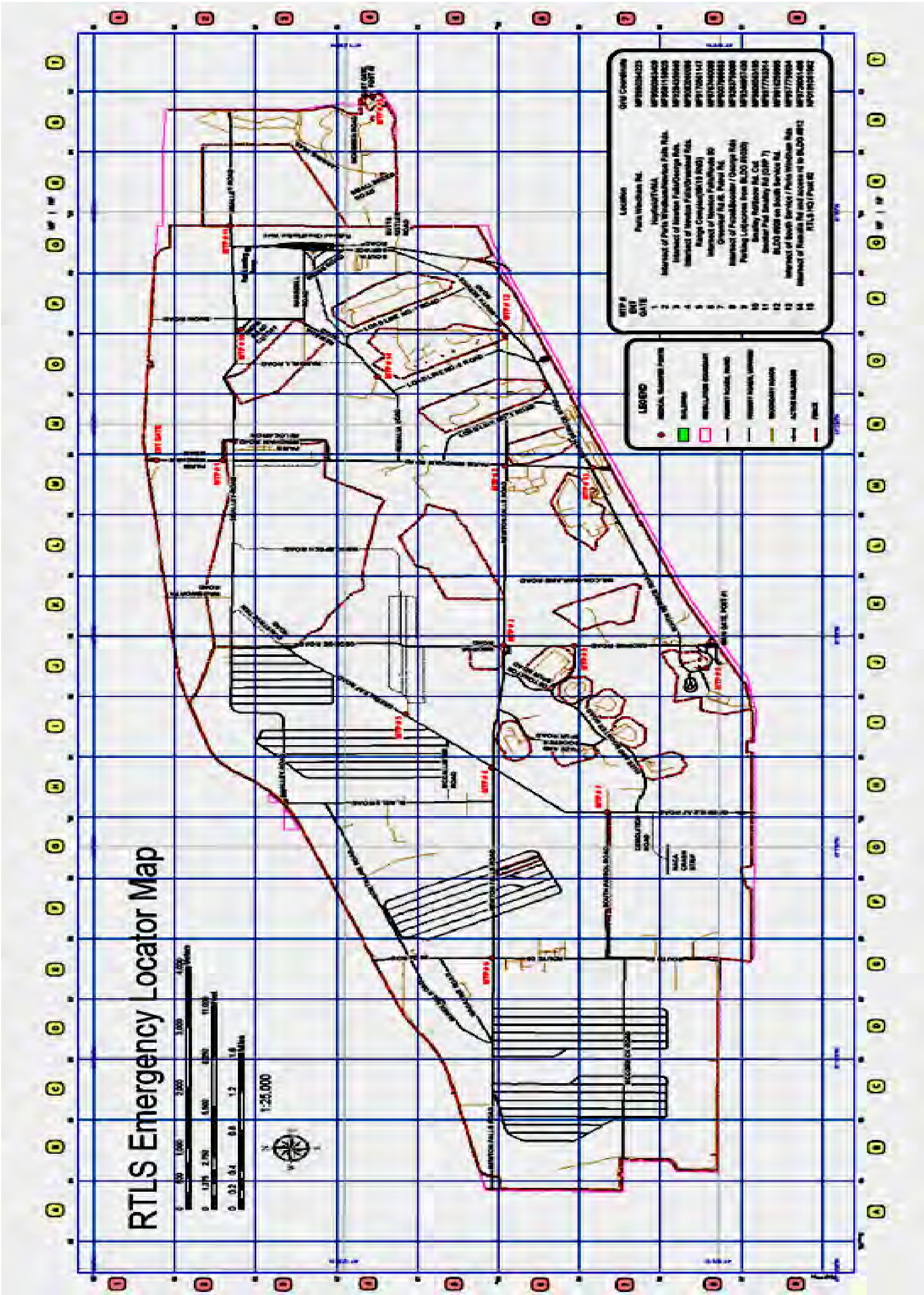
FOR EMERGENCY RESPONSE ON THE
EAST SIDE (TRUMBULL COUNTY):

- **For a spill emergency implement the Camp Ravenna Emergency Spill Notification IAW the Camp Ravenna First Responder Form.**
- **For non-spill emergencies from 0730-1630, Monday through Friday, contact CRJMTC Range Control by telephone at (614) 336-6041**
- **For non-spill emergencies outside CRJMTC duty hours, call 911 and ask for the Trumbull County (Ohio) dispatch.**
- State your emergency and location.
- Outside of CRJTMC duty hours, the East Gate guard shack (614) 336-6399 should be notified so they can assist in the process (open the gate, direct vehicles).
- During CRJMTC duty hours, Range Control will contact the appropriate dispatch for emergency response and help guide units to your location.
- If the patient can be moved, transporting the patient to the nearest Medical Transfer Point, or EMS entrance gate (East Gate) will expedite the medical evacuation process.

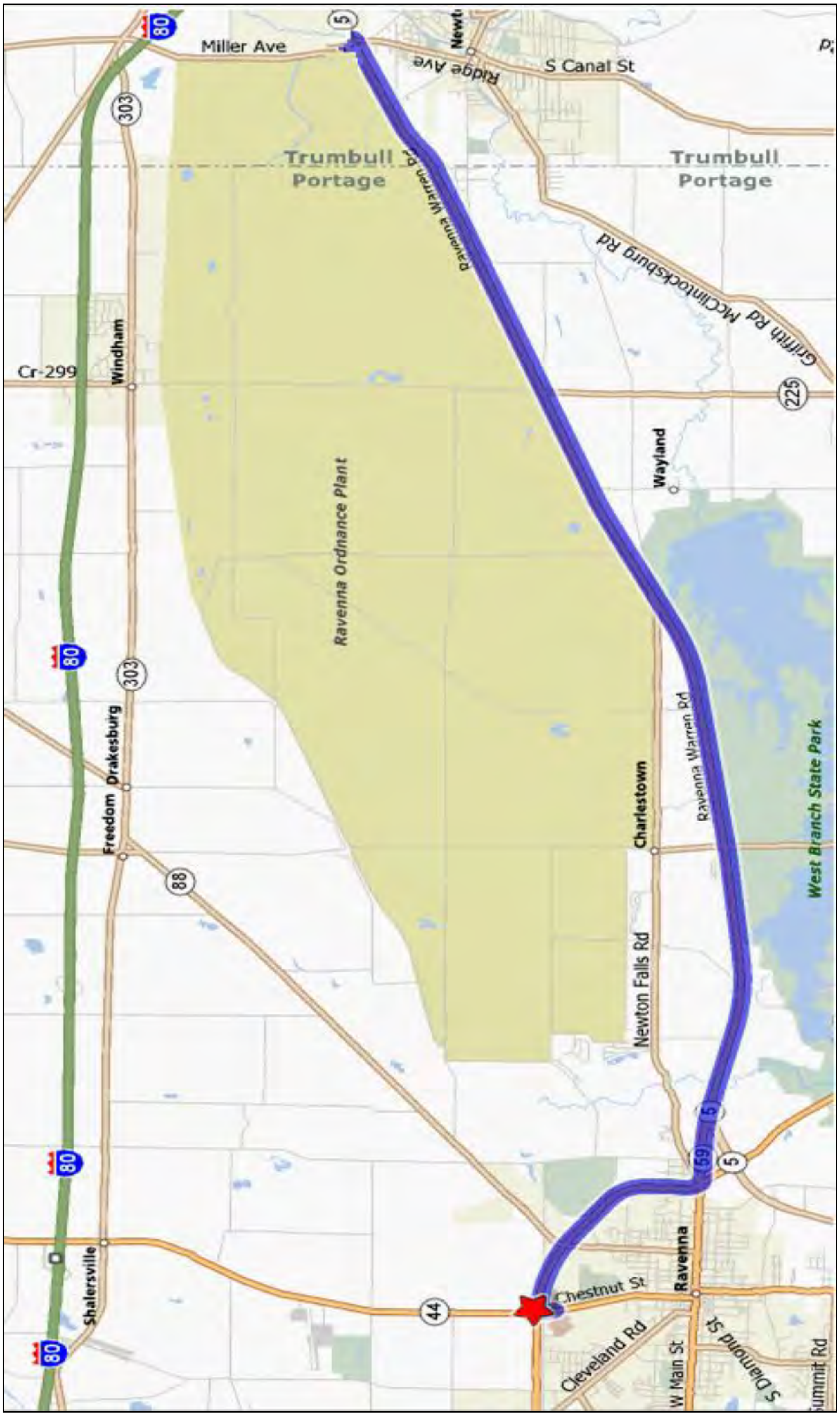
- If the patient cannot be moved, post a signal person (time and resource permitting) at the nearest major intersection/road/medical transfer to help guide emergency vehicles.
- Medical Transfer Points are located throughout the installation. These predetermined points assist first responders in locating injured personnel.

DIRECTIONS TO ROBINSON MEMORIAL HOSPITAL:

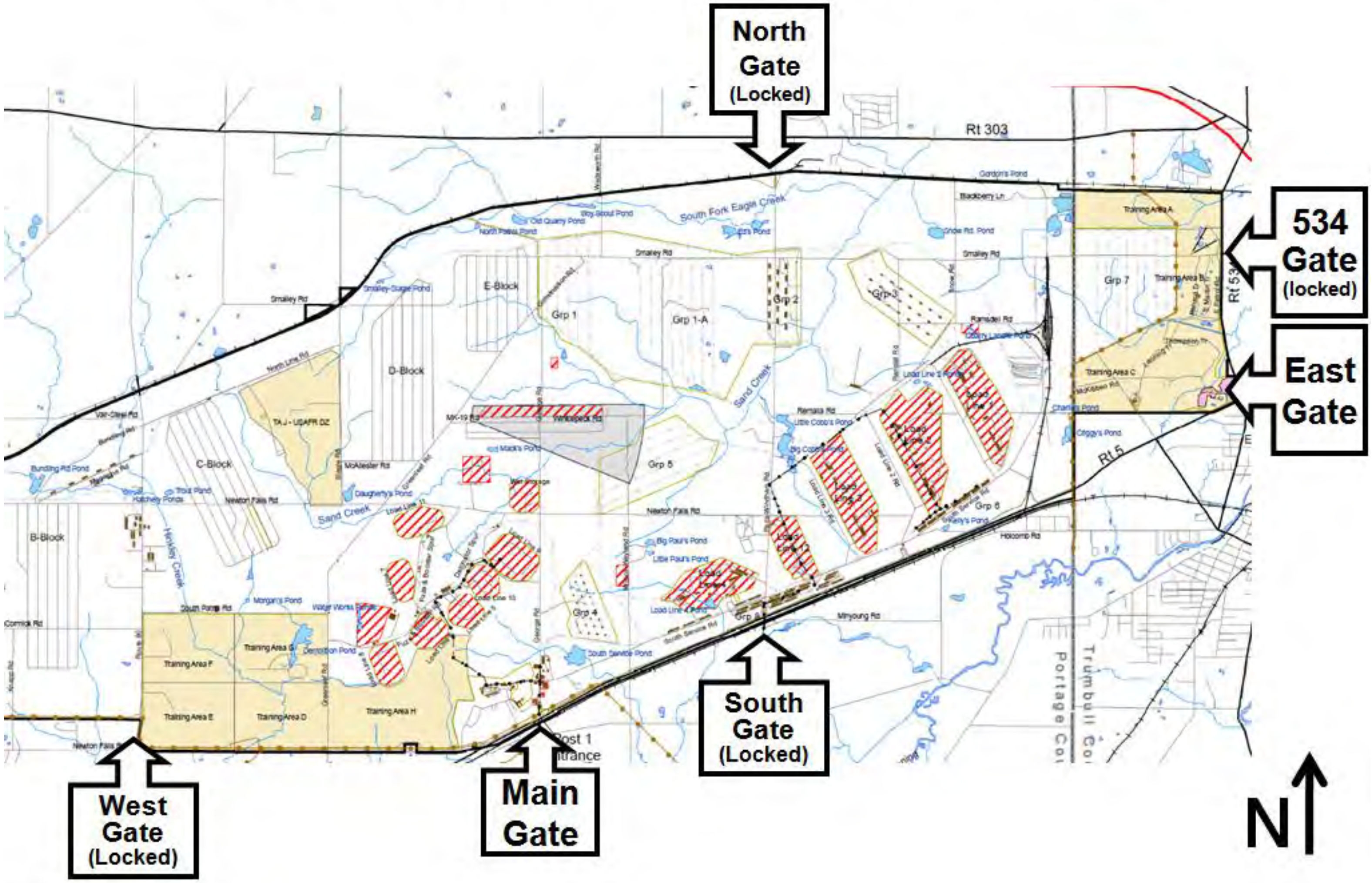
- Exit the East Gate. Turn right onto Route 534 and go 300 feet to the first stop light at the intersection of Route 534 and Route 5. Take State Route 5 west 12.4 miles to the junction of Routes 14 and 44 north. You will be at a stop light next to a McDonalds/BP.
- Turn right onto Routes 14/44 north.
- Go 2.4 miles to North Chestnut Street. You will pass a light at the intersection of Route 88 and will be at a second light at the intersection where Route 14 goes straight and Route 44 splits to the right and goes north, you need to be in the left lane at this intersection, to turn left or south on North Chestnut Street.
- After turning get into the right lane. The hospital entrance is 2/10ths of a mile on your right.
- Follow the signs to the Emergency Room.
- Robinson Memorial Patient Information (330) 297-2448


RTLS Emergency Locator Map
1:25,000

MAP TO ROBINSON MEMORIAL HOSPITAL



CRJMTC ACCESS GATES



CAMP RAVENNA

Joint Military Training Center

1438 State Route 534 Southwest
Newton Falls, Ohio 44444
(614) 336-6041

RESTORATION CONTRACTOR ACCESS REQUEST FORM

COMPANY NAME:	
STREET ADDRESS:	
CITY, STATE, ZIP:	
POC NAME:	
PHONE:	

PROJECT NAME/AREA OF WORK:	

PERSONNEL REQUIRING ACCESS TO FACILITY:

LAST NAME	FIRST NAME	CELL PHONE #	LIC. PLATE #

START DATE:		**END DATE:**	

CRJMTC APPROVAL:	

signature name rank date

CRJMTC ENV PROJECT POC/PHONE:	

ESCORT REQUIRED? ________ YES ________ NO

GATE #1______ GATE #2______ page___ of ____

PLEASE EMAIL COMPLETED FORM TO: VSC Points of Contact

IMPORTANT TELEPHONE NUMBERS	
Range Control Desk	**(614) 336-6041**
Range Control Cell	(614) 202-5783
CRJMTC HQ Fax	(614) 336-6796
Range and Operations	
CPT Yates	(614) 336-6193
SGM Finnegin	(614) 336-8934
SFC Fowler	(614) 336-6133
SFC Welker	(614) 336-6793
SFC Baucum	(614) 336-6562
Engineer Section	
CPT Dunlap	(614) 336-6567
SGM Garloch	(614) 336-6795
Logistics	
MAJ Saphore	(614) 336-6790
SFC Bosley	(614) 336-6791
Security	
Main Gate (West Side)	(330) 358-2017
East Gate	(614) 336-6399
Environmental Office	
Tim Morgan	(614) 336-6568
Katie Tait	(614) 336-6136
Kim Ludt	(614) 336-6569
Kevin Sedlak	(614) 336-6000 ext 2053

<u>DISCUSSION</u>

Most contractor-related access issues are due to a failure to provide CRJMTC with the proper access requests or a failure to provide delivery/service personnel with the correct information.

Due to poor road conditions on Camp Ravenna, “carpooling” is encouraged, in order to prevent unnecessary damage to privately owned vehicles (POVs). Employees working on the West side of CRJMTC may park their POVs in the parking lot located outside the Main Gate.

Employee rosters and access requests have expiration dates, and any warranty work that occurs after the project has been completed requires the submission of a separate access request.

Please keep in mind, at any given time the installation may have several construction projects underway. Taking the necessary steps to avoid confusion will help alleviate congestion around the access gates and prevent delays.

Know your worksite surroundings. **Take note of the nearest road intersection, Medical Transfer Point, firing range or training area and ensure all site employees know where they are and what actions to take in the event of an emergency.** If you don’t know, ask someone from Environmental or Range Control for help.

Some CRJMTC worksites are co-located or near training areas/firing ranges and therefore require (daily) Range Control authorizations (via phone) prior to entry/occupation. Your CRJMTC point of contact will advise when these requirements exist.

Attachment B

FIRST RESPONDER REPORTING FORM
(Print all information)

Collect as much of the information on the top half of this form as possible before making initial notification. Complete the top and bottom of the form before turning in to Camp Ravenna.

Name of individual reporting spill: ____

When did the spill occur (Date and Time)? ____

Spill Location (Building or area name / number, indoors or out; if vehicle involved, type and bumper number):
____

What was spilled? ______________________ **How much was spilled?** ______________________

Rate at which material is currently spilling. ____

Extent of spill travel? ____

Did the spill reach water (ditch, creek, stream, pond, well head)? ______________________________

Number of injured personnel and type injuries, if applicable. ______________________________

Do you need the Fire Department to respond to protect life, property, and environment? ____________________

Unit: ______________________ **State:** __________ **Report Date & Time:** ______________________

On Scene Coordinator Name and Grade: ______________________ **Phone:** ______________________

How did the spill occur (be specific). ____

____

What remedial action was taken? ____

____

Was soil and absorbent material generated? __________ **How much?** ______________________

What is the location of the soil and absorbents? ____

Was the Environmental Office contacted (yes or No, date and time)? ______________________________

Who did you talk to in the Environmental Office? ____

Was the site cleared by the Env. Office (Yes or No, date and time)? ______________________________

Who cleared the site (name and grade, date and time)? ____

Initial information is critical. Get as much information as you can, but don't hesitate to make the initial notification if a spill is moving or worsening rapidly!

This form must be completed for all releases and turned-in to Camp Ravenna Range Control within 24 hours.

FIRST RESPONDER SPILL/RELEASE RESPONSE ACTIONS

Units or contractors performing training or other operations at Camp Ravenna shall be responsible for adhering to the provisions identified in the Camp Ravenna Integrated Contingency Plans (ICP). A copy of the ICP may be obtained from the Camp Ravenna Environmental Supervisor. Following discovery of a spill (any size), the procedures outlined below shall be executed where applicable:

1. **If necessary, initiate evacuation of the immediate area.**

2. **Notify Camp Ravenna Range Control via two-way radio or by calling <u>(614) 336-6041</u>, and report information contained on the "First Responder Reporting Form" if it is known or can reasonably be determined. This form has been copied on the opposite side of this page. If Range Control cannot be reached, contact a Camp Ravenna OSC (listed below).**

3. **Stop spill flow when possible without undue risk of personal injury.**

4. **If trained, contain the spill using available spill response equipment or techniques.**

5. **Make spill scene OFF LIMITS to unauthorized personnel.**

6. **Restrict all sources of ignition when flammable substances are involved.**

7. **Report to the OSC upon his/her arrival to the scene.**

8. **Turn in a completed copy of the Camp Ravenna First Responder Form to Camp Ravenna Range Control for ALL releases, even ones cleaned up by the reporter.**

TELEPHONE NUMBER

When **Camp Ravenna Range Control** is ***<u>not available</u>*****, the Camp Ravenna OSC** ***<u>must be contacted</u>*** **by the discoverer/first responder following a release if it is in water, at or above a reportable quantity (25 gallons or more of POL), a hazardous or extremely hazardous substance, a hazardous waste, or involves fire, explosion, or is otherwise a major incident.**

NAME	JOB TITLE	OFFICE	24 HOUR
Camp Ravenna Range Control	**Operations and Training**	**(614)336-6041**	**(614) 202-5783**
Tim Morgan (Primary OSC)	**Environmental Supervisor**	**(614)336-6568**	**(330)322-7098**
Brad Kline (Alternate OSC)	**Environmental Specialist**	**(614)336-4918**	**Contact Alternate**
Katie Tait (Alternate OSC)	**Environmental Specialist**	**(614)336-6136**	**Contact Alternate**
Joint Forces Command (Alternate POC)	**OHARNG Emergency Center**	**(888)637-9053**	**(888)637-9053**

Off-site (from Camp Ravenna area code 614 phones)

Ravenna Dispatch ...……………………………………..…. 9-1-330 296-6486

SEE REVERSE FOR FIRST RESPONDER REPORTING FORM

Attachment C

CAMP RAVENNA WASTE MANAGEMENT GUIDELINES

PURPOSE: Guidelines to be followed by contractors working at Camp Ravenna Joint Military Training Center who are generating/shipping Hazardous, Non-Hazardous, Special or Universal Waste.

POLICY: The policy at Camp Ravenna is to comply with all local, state, federal and installation requirements. Contractor is responsible for waste minimization and is required to recycle materials if possible.

Restoration Program POC: Katie Tait (614) 336-6136 **Military & Non-Restoration POC: Brad Kline (614) 336-4918**

Coordination:

- Coordinate all waste generation and shipments with the appropriate Camp Ravenna POC listed above or the Environmental Supervisor in their absence at (614) 336-6568.
- Notify Camp Ravenna POC prior to waste sampling for characterization. Details about sampling activities must be included (i.e., number of sample, analyticals, etc.).
- All Hazardous and Non-Hazardous waste management storage locations must be pre-approved prior to generation.
- Ensure all labels include: Date, Contractor, and Waste Type.
- When contractors have waste onsite, a weekly Inspection inventory must be completed and submitted to the appropriate POC in the Camp Ravenna environmental office.
- All wastes shall be tracked and logged throughout the duration of the project. Contractor will provide Camp Ravenna POC with a monthly rollup report of all waste and recycled streams generated by no later than the 10th day of the following month.

Hazardous Waste Treatment, Storage and Disposal Facilities and Waste Haulers: Contractors are required to utilize hazardous waste haulers and Treatment, Storage, and Disposal Facilities on the latest Defense Reutilization Marketing Office (DRMO) approved list. The current qualified waste hauler and TSDF list can be viewed by following the “Qualified Facilities” and “Qualified Transporters” links found on the DLA Hazardous Waste Disposal Homepage, http://www.dispositionservices.dla.mil/newenv/hwdisposal.shtml.

Hazardous or Non-Hazardous manifest form, the following must be included:

- Military and non-restoration operations waste Site Name = Camp Ravenna Joint Military Training Center. Mailing and Site address: Camp Ravenna ENV, 1438 State Route 534 SW, Newton Falls, Ohio 44444, (614) 336-4918. Ohio EPA ID # – OHD981192925.
- Restoration Program waste Site Name = Former Ravenna Army Ammunition Plant. Mailing address is same as address above. Site address: 8451 State Route 5, Ravenna, Ohio 44266, (614) 336-6136. Ohio EPA ID # – OH5210020736.
- Contractor’s shipping Hazardous Waste must provide a Land Disposal Restriction (LDR) in accordance with 40 CFR Part 268.
- Profiling:
  - The required shipping documentation (i.e. waste profile and executive summary of lab reports (if available)) need to be submitted to appropriate Camp Ravenna POC or designee(s) for approval and signature prior to shipping.
  - Results of characterization must be submitted to appropriate Camp Ravenna POC within 30 days after collecting sample.
- Manifests - Hazardous and Non-Hazardous:
  - The waste carrier/transporter provides appropriate manifest to the contractor.
  - The contractor is required to:
    - Ensure that Camp Ravenna POC or designee(s) is available to sign the manifest on the scheduled day of shipment;
    - Verify that each manifest is properly completed and signed by Camp Ravenna POC or designee(s);
    - Provide the Generator copy of the manifest to Camp Ravenna POC or designee(s); and
    - Ensure that the original Generator copy of the manifest signed by the treatment storage disposal facility is returned to Camp Ravenna within 30 days of the shipping date for Hazardous and Non-Hazardous Waste.
    - The use of a Bill of Lading, in lieu of a waste manifest, must be approved by the Camp Ravenna environmental office.

All satellite accumulation storage sites and containers will comply with 40CFR 262.34(c)(1):

- Any material that is subject to Hazardous Waste Manifest Requirements of the US Environmental Protection Agency must comply with 40 CFR Part 262.
- From the time any waste is placed in a satellite storage container, proper labeling must be on the container (proper labeling includes date, contractors name and product type).
- Pending analysis label is to be used from the time the sample is taken until the results are received.
- In no case will waste labeled pending analysis exceed 45 days.

All Camp Ravenna Hazardous and Non-Hazardous records are maintained at the Camp Ravenna environmental office, point of contacts are Katie Tait at (614) 336-6136 and Brad Kline at (614) 336-4918.

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: _____________ Month: __________________ Year: ____________ Waste Description: ____________

Container Nos. ____

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: **Time:**	**Date:** **Time:**	**Date:** **Time:**	**Date:** **Time:**
Point of Contact (Name / Number)				
Project Name:				
Contracting Agency and POC:				
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.				
*Location on installation:				
Date Generated:				
Projected date of disposal:				
Non-Haz, Satellite, 90 day storage area				
Waste generation site:				
Number of Containers (size / type):				
Condition of Container:				
Containers closed, no loose lids, no loose bungs?	yes / no	yes / no	yes / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	yes / no	yes / no	yes / no	yes / no
Secondary containment	yes / no	yes / no	yes / no	yes / no
Incompatibles stored together?	yes / no	yes / no	yes / no	yes / no
Any spills?	yes / no	yes / no	yes / no	yes / no
Spill kit available?	yes / no	yes / no	yes / no	yes / no
Fire extinguisher present and charged?	yes / no	yes / no	yes / no	yes / no
Containers grounded if ignitables?	yes / no / na	yes / no / na	yes / no / na	yes / no / na
Emergency notification form/info present?	yes / no	yes / no	yes / no	yes / no
Container log binder present?	yes / no	yes / no	yes / no	yes / no
Signs posted if required?	yes / no	yes / no	yes / no	yes / no
Photo’s submitted	yes / no	yes / no	yes / no	yes / no
Printed Name:				
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

CONTAINER LOG

Container No. [1] ___________________ **Page ___ of ___**

Satellite Accumulation Area ☐ **Generator Accumulation Area** ☐

Date [2]	Material Name [3]	Quantity Added [4]	Cumulative Quantity [5]	Person Adding Material [6]

(When 55 gals total reached, must move from SAA within 3 calendar days.)
Date Container Transferred to Generator Accumulation Area ______________________

Materials shipped offsite date: ________________________

(1) Container ID Number (e.g., FC-FMS#1-2)
(2) Date when waste was added to container
(3) Name of waste added (e.g., Diesel Fuel)
(4) For items such as filters, note the number of items. For liquids, note the number of gallons.
(5) The total quantity of items of number of gallons currently in the container.
(6) The name of the person adding the waste.

CAMP RAVENNA WASTE TRACKING SHEET - RECYCLE & HAZ/SOLID WASTE DISPOSAL

PROJECT TITLE:

LOCATION OR PROJECT SITE	PICKUP DATE	TYPE - HW/NONHAZ/ RECYCLE/ SCRAP/ UNIVERSAL WASTE ETC.	SPECIFIC WASTE TYPE (Concrete/ demo debris/ metal/ paint/ etc)	WASTE CHARACTERIZATION PERFORMED? Y/N/NA	WASTE PROFILE? Y/N/NA	MANIFEST/ SHIPPING DOCUMENT #	WASTE AMT/ TOTAL - LBS/ TONS/ GALLONS	TRANSPORTER	DISPOSAL/ RECYCLE FACILITY	MANIFEST/ SHIPPING DOCUMENT REVIEWED AND APPROVED BY OHARNG - Y/N	WASTE INSPECTIONS PERFORMED - Y/N/NA

APPENDIX F
COMMENT RESPONSES

THIS PAGE INTENTIONALLY LEFT BLANK.

Ohio EPA

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

July 2, 2015

Re: **US Army Ravenna Ammunition Plt RVAAP**
Remediation Response
Project records
Remedial Response
Portage County
267000859030

Mr. Mark Leeper, P.G., MBA
Restoration/Cleanup Program Manager
ARNG Directorate
111 S. George Mason Dr.
Arlington, VA 22204

Subject: Comment on the "Draft PBA 13 Remedial Investigation Sample and Analysis Plan Addendum for Load Lines 1, 2, 3, 4 and 12" for the Former Ravenna Army Ammunition Plant (RVAAP)" Document, Dated January 30, 2015 (Work Activity No. 267-000859-030)

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA) received the draft PBA 13 Remedial Investigation Sample and Analysis Plan (SAP) Addendum for Load Lines 1, 2, 3, 4, and 12. Each of the Load Line AOCs has undergone several investigations and remedial action decisions to characterize the nature and extent of contamination, as well as evaluate human and ecological health risks. Previous remediation activities focused only on the National Guard Trainee receptor. Additional evaluation of data gaps for the unrestricted land use and possible sampling is proposed by this SAP Addendum.

The Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the RVAAP Installation Restoration Program, or Technical Memorandum, states if an AOC fails to meet the Unrestricted Land Use, then a Feasibility Study (FS) will be completed to evaluate cleanup options for all three land uses noted in the Technical Memorandum.

Below are both general and specific comments regarding the SAP Addendum:

1) General Comment Regarding Determining Decision Units within AOCs

Please ensure that an iterative sampling approach is used to determine the extent of contamination. The boundaries of a decision unit may expand or contract depending upon sample results. We assume the decision units will be determined with Ohio EPA input.

2) General Comment Regarding Incremental Sampling Method (ISM) Sampling
The sampling plan indicates either ISM or discrete sampling may be conducted for determining the extent of contamination at these proposed sample locations. The work plan does not always clearly state when samples will be collected as an ISM or collected as a discrete sample. Please provide rational and clarification as to the sample collection method that will be used.

Perhaps it is time to revisit the Final Facility Wide Sampling and Analysis Plan for possible revisions. As noted in this 2015 SAP Addendum, the ISM sampling proposed in this work plan is not consistent with the ISM sampling protocol outlined in the 2011 Final Facility Wide Sampling and Analysis Plan for Environmental Investigations, but will follow the sampling protocol outlined in the prior consultant's, Prudent, Load Line 1-4 and 12 sampling plan. The 2011 Final Facility Wide Sampling and Analysis Plan for Environmental Investigations document notes that the plan will likely need to be amended in the future due to the evolving science on subsurface ISM sampling methods.

3) General Comment Regarding Chemicals of Interest and Chemicals of Concern
a). The report identifies that the list of chemicals of interest (COIs) is larger than the list of chemicals of concern (COCs) in the interim record of decision (ROD) since the interim ROD contains only COCs exceeding national guard trainee Clean Up Goals (CUGs), and that COIs were developed from chemicals identified as exceeding residential risk in the Phase II Remedial Investigation (RI) (2004). Based on these facts, screening of chemicals of potential concern has already occurred; therefore, when the residential FWCUGs are used in the report they should be referred to as remedial goal objectives (RGOs) or clean up goals (CUGs) rather than screening criteria. In addition, the term screening should only be used when CUGs of one order of magnitude below the risk and hazard goal (*i.e.*, ELCR 1E-6 and HQ -0.1), *i.e.*, screening values, are used in the process.

ACTION ITEM: Revise the text throughout the document to be consistent with the proper use of screening and CUGs.

b). The plates in the appendices (A-3, B-3, C-3, and E-3) and figure D-12 identify former remediation areas (green-hashed areas) that were addressed in an interim ROD under the National Guard trainee receptor. Since the interim ROD CUGs were for the National Guard trainee, the former remediation areas may not meet residential remediation goals. Many of the former remediation areas on the plates are not bounded by discrete or ISM samples, are not identified as either meeting (grey) or exceeding (red) residential CUGS, and are not indicated as being included in the data-gap sampling (yellow); therefore, it is unclear how these former National Guard trainee CUG remediation areas will be handled going forward.

ACTION ITEM: Please clarify how the former National Guard trainee CUG remediation areas that appear to be unbounded will be sampled to determine extent for meeting residential remediation goals.

c). Human health and ecological COI lists provided in the appendices do not match, and should contain the same COIs. For example, in table A-4 for Load Line 1: RDX, antimony, TNT, and dieldrin are identified as human health COIs for surface water and sediment, but are omitted as ecological COIs in Table A-5. For example, the human health sediment screening criteria for antimony is 28.2 mg/kg, and the ecological Ohio sediment reference value (SRV) is 1.8 mg/kg, but antimony is not included as an ecological COI.

ACTION ITEM: Revision is needed to include all appropriate ecological COIs, or provide justification as to why a particular COI is a human health COI, but not an ecological COI when the ecological screening criteria is more conservative than the human health screening criteria, as provided in the example above. Also, provide the appropriate sediment reference value(s).

Project Scope Section 3.1 indicates that surface water and sediments samples will be collected at Load Lines 1 through 4; however, the proposed sampling summary Section 3.3 shows surface water sampling will be only conducted at Load Line 3.

ACTION ITEM: Clarify why surface water samples will be collected only at Load Line 3 and not at Load Lines 1, 2, and 4. Section 3.2.4.3 noted that a weight of evidence (WOE) evaluation was used for screening COIs that exceed the ecological screening criteria, but the 2015 SAP Addendum is not clear what that WOE was.

4) <u>Surface Water and Sediment (3.2.4.3) - *first bullet item at top of page 3-10*</u>
The act of demolition or remediation can mobilize soils to allow impacted media to run off into water ways, if storm water controls are not implemented correctly. The act of demolition is not always synonymous with improving the environmental conditions to eliminate further assessment of the surface water or sediment pathway. Based on the data in the tables included in this sampling plan, surface water and sediment samples were last collected in 2000, 2001, and 2003. More recent data from surface water and sediments were not provided. It is not clear if the prior data were screened using the appropriate ecological screening values, so additional assessment of these media may be needed.

ACTION ITEM: Confirm the appropriate screening value was used when the COIs were screened initially.

5) Section 3.2.2.3 discusses potential soil leaching COIs, and section 4.9 states a RI/FS Addendum Report will include an updated SESOIL model for the soil leaching COIs identified for each AOC (LL 1, 2, 3, 4, and 12). However, the screening criteria used to identify each soil leaching COIs is not provided in the 'Human Health Screening Criteria' tables in the Appendices. The soil leaching to ground water pathway screening criteria or RGOs need to be included in the report. See previous comments for PBA08 projects that specify ground water as the primary receptor of concern for compounds leaching from soils.

ACTION ITEM: Model inputs and/or soil leaching screening criteria or RGOs should be provided.

6) Section 3.2.3.2 states those COIs with exceedances were reviewed using the following criteria to make data gap sampling decisions. One criterion is to "eliminate non-toxic chemicals (*e.g.*, nitrocellulose)." Section B.5.2.3 further clarifies this criteria by stating, "North Ponds Aggregate – There were no discrete exceedances in sediment. Nitrocellulose was detected, but this explosive is essentially non-toxic."

ACTION ITEM: The term "non-toxic" should be justified or documented. In addition, for ecological assessment, non-toxic stressors, examples of which include nitrates, pH, and salinity, are still evaluated, if appropriate. Ensure that the ecological screening process discusses non-chemical stressors, if appropriate.

7) Surface Soil Sampling (4.1.1) Incremental Sampling (4.1.1.1) How does a sampler know when to collect a discrete vs. ISM? The plan is not clear from the narrative in Section 4.0 when these sampling methods will be used. This is described in greater detail in the Appendices, but is not in concert with what is noted in Section 4. The sampling plan (Section 4) indicates that only discrete samples will be collected in LL 12, due to how sampling was conducted in previous sampling events, but the LL12 sampling appendix suggests only ISM samples will be collected.

ACTION ITEM: Provide clarity regarding the sampling method that should be used to obtain the media being sampled.

8) Section 4.2 states, "Ten sediment samples will be collected as discrete samples using ten aliquots per sample. Ten separate aliquots will be collected at random locations within an area with an approximate 5-ft radius to the same depth. These 10 aliquots will be composited"

ACTION ITEM: It is recommended that sediment samples be completed as ISM samples after defining the appropriate sediment decision units for lotic waterbodies or ditches being addressed as surface water. In similar sediment evaluations, 100 meter stream lengths have been used. Ponds and lakes would likely require discrete sampling to define the extent of contamination in sediment and representative contaminant concentrations. The 2011 Facility-Wide Sampling and Analysis Plan for Environmental Investigations describes methods to follow for collecting dry or wet sediments. It is not clear why other sampling methods are proposed in this plan. Revise the sampling plans as appropriate.

Please clarify where and how the sediment samples will be collected. The depth of these sediment samples needs clarification.

9) Section 4.10 states an updated HHRA will be submitted, and that the HHRA will be used to identify COCs and locations recommended for evaluation in an FS. Given that a remedy and interim ROD were previously completed for these five AOCs, the AOCs could go directly into Feasibility Studies, if the prior Phase II data are reliable, or after the data-gap analysis samples are collected. This would basically

consist of the values from the decision units (or applicable exposure point concentrations of appropriate areas) being compared to the appropriate CUGs (multiple chemical adjustments may be needed). Both residential and commercial CUGs should be used in the focused FS to evaluate differences (*e.g.,* costs, volumes of material to be treated) and recommend a preferred remedial option(s). This would also be a de-facto risk assessment, because, if concentrations of COCs are above CUGs, then there would be unacceptable risk.

ACTION ITEM: Evaluate the option to go directly into a Feasibility Study.

10) Section 4.10.1 states for ISM sampling an EU can consist of "a group of ISM samples". Reminder that, per Ohio EPA's June 2014 and November 2014 comments, while there may be some instances where adjacent and small ISM areas could be combined to make larger exposure areas or decision units, results from ISM samples should usually not be combined with either discrete or other ISM data to calculate EPCs and should be considered independent decision units. If small groups of ISM samples are combined, it should be based on site-specific information, such as the extent of contamination, the type or types of COCs, their concentrations, and spatial considerations.

    ACTION ITEM: The work plans should specify and explain the rationale behind the proposed decision units and EUs, and be approved prior to sampling.

11) Will the exposure point concentration (EPC) be a maximum detection or a 95% UCL? This is not identified in section 4.10.1 of the document. Per U.S. EPA, EPCs are to be the 95% UCL of the mean.

    ACTION ITEM: Please clarify.

12) The appendices contain a number of discrete and ISM samples that "don't warrant additional investigation" or "do not require additional delineation to determine extent" and are not bound by other discrete or ISM samples. For example, at LL 1, Plate A-3 inset CB-4 and CA-6, discrete sample LL1-024 and ISM LL1ss-609. The report does not identify what will be done with these samples. It is assumed this data will be carried forward in the process, but it is not clear how extent is resolved. Another example, LL 2 sample LL2ss-100-0778 contains the maximum concentration of lead for this AOC, but it is not clear if the data point has been fully bound by data that is below the resident screening criteria. Metals are not

included in the additional sampling proposed for this AOC. No additional samples are proposed in the area of this sample.

ACTION ITEM: Please clarify how these kinds of areas will be addressed.

13) Field Quality Control Sampling Procedures. Page 4-5, Lines 25-43 (FSP): Please note that per conference call on May 7, 2015, between the NGB and Ohio EPA, it was agreed upon that from this point forward that the primary sample results will be reported as long as the field duplicate data do not exceed the acceptance criteria of 30% relative percent difference. When the field duplicate result exceeds this criterion, the data shall be evaluated to determine the source of the difference. This usually would result in resampling that particular sampling location. In lieu of resampling, the conservative approach may be used, which would be to report the highest concentration of that particular analyte (from the field duplicate). In addition, all duplicate sample data should be included in tables and figures as part of typical summary reporting information.

ACTION ITEM: Include as warranted.

14) Section B.5.2.1 states one sample will be collected from the middle of Kelly's pond.

ACTION ITEM: Samples should also be collected at inlet from LL 2, to assess if run-off occurred since the remedial actions were completed.

15) Table B-16: 2,4-DNT should be marked as a 'Soil to Groundwater CMCOPC', based on the text in section B-6, line 19.

ACTION ITEM: Please change or provide clarification

16) Section D.5.2.2 states manganese was screened out from the upstream segment of the waterway, because the average concentrations in the downstream segments of the waterway were below background values. However, the source of the exceedances in the upstream segment has not been identified, and the upstream segment will not be evaluated in another AOC's report.

ACTION ITEM: Unless the detections of manganese in the upstream segment are below a background value or ESL, the upstream segment should not be eliminated from further discussions. In addition, maximum site concentrations are to be used in the background screening. For additional details, see:

- http://www.epa.state.oh.us/portals/30/rules/Use%20of%20Background%20for%20RR%20Sites.pdf.

17). The Ohio EPA ecological SRVs for iron (LL1 Table A-5) and manganese (LL1, Table A-5 and LL4, Table D-5), or site-specific background values, should be used instead of marking the sediment screening level as "NA".

ACTION ITEM: Please change or provide clarification.

18). In the data tables for surface water, a number of the ecological screening criteria for surface water is marked as "NA" when an Outside the Mixing Zone Average (OMZA) value exists; the OMZA should be used. The 2008 Ohio EPA Guidance for Conducting Ecological Risk Assessment (Page 3-6) states that the surface water chemical concentrations are to be compared to the chemical criteria pursuant to OAC 3745-1. The outside mixing zone average criteria for human health and aquatic life should be compared against ambient samples averaged over a 30-day period. It is not clear if the data used to calculate the average were collected within a window of 30 days. Single ambient samples are not to exceed the OMZM.

ACTION ITEM: If COIs were screened out from further evaluation, because it was compared to the OMZM or removed because there was no calculated OZMA value available on Ohio EPA, Division Of Surface Water's water quality standards table, further assessment of the COI may be warranted for ecological risk. Chemical concentrations are to be compared to the chemical criteria pursuant to OAC 3745-1.

19) Surface Water and sediment in load line 12 AOC are being assessed in the PBA08. It would seem that a complete Conceptual Site Model (CSM) of the dynamics of this AOC may not be available until the PBA08 study has been completed.

ACTION ITEM: Additional assessment of this area may be needed at a later date.

20) The "Proposed Sampling Locations" Tables in the appendices list the "Number of Proposed Subsurface ISM Sub-borings". It is unclear if these borings are the

number of samples to be collected to comprise the ISM sample, or the number of ISM samples. For a single ISM sample, generally about 30 sub-samples should be taken to comprise the ISM sample.

ACTION ITEM: Clarify the number of aliquots to be collected for each ISM sample.

If you have questions or need clarification regarding the comments, please feel free to contact me at (330) 963-1201 or e-mail at susan.netzly-watkins@epa.ohio.gov.

Sincerely,

Sue Netzly-Watkins

Sue Netzly-Watkins
Site Coordinator
Division of Environmental Response and Revitalization

SN-W/nvr

cc: Kevin Sedlak, ARNG-ILE, Camp Ravenna
Katie Tait, OHARNG, Camp Ravenna
Quyet La, USACE Louisville
Nat Peters, USACE Louisville
Gail Harris, Vista Sciences Corp
Gregory F. Moore, USACE, Louisville District
Vasudha Peterson, Leidos

ec: Rod Beals, Ohio EPA, NEDO, DERR
Justin Burke, Ohio EPA, CO-DERR
Brian Tucker, Ohio EPA, CO-DERR
Carrie Rasik, Ohio EPA, CO-DERR

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

August 14, 2015

Ohio Environmental Protection Agency
DERR-NEDO
Attn: Sue Netzly-Watkins, Environmental Specialist
2110 East Aurora Road
Twinsburg, OH 44087-1924

Subject: Responses to Comments on the Draft Remedial Investigation Sample and Analysis Plan Addendum for Load Lines 1-4 and 12 for the Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties (Work Activity No. 267-000859-030)

Dear Ms. Netzly-Watkins:

The Army appreciates your time and comments on the *Draft PBA 13 Remedial Investigation Sample and Analysis Plan Addendum for Load Lines 1,2,3,4 and 12* dated July 2, 2015. Enclosed for your approval are responses to your comments with text revisions which will be incorporated in the final document. We would be pleased to schedule a resolution meeting if you anticipate the need for additional comments or discussion. A hardcopy of this letter can be provided at your request.

Please contact the undersigned at (703) 607-7955 or Mark.S.Leeper.civ@mail.mil if there are issues or concerns with this submission.

Sincerely,

Mark Leeper
RVAAP Restoration Program Manager
Army National Guard Directorate

ec: Rod Beals, Ohio EPA, NEDO-DERR
Justin Burke, Ohio EPA, CO-DERR
Brian Tucker, Ohio EPA, CO-DERR
Carrie Rasik, Ohio EPA, CO-DERR
Kevin Sedlak, ARNG, Camp Ravenna
Katie Tait, OHARNG, Camp Ravenna
Quyet La, USACE Louisville
Gail Harris, Vista Sciences Corporation
Greg Moore, USACE Louisville
Vasu Peterson, Leidos

Responses to Ohio EPA Comments (dated July 7, 2015)
Draft PBA13 Remedial Investigation Sample and Analysis Plan Addendum for Load Lines 1, 2, 3, 4 and 12
Former Ravenna Army Ammunition Plant (RVAAP), January 30, 2015
(Work Activity No. 267-000859-030)

1) General Comment Regarding Determining Decision Units within AOCs
Please ensure that an iterative sampling approach is used to determine the extent of contamination. The boundaries of a decision unit may expand or contract depending upon sample results. We assume the decision units will be determined with Ohio EPA input.

Response: *Comment acknowledged. It is anticipated that this will be the last sampling event to address data gaps for the FS given the extent of data available at the Load Lines. The size and location of Incremental Sample Method (ISM) samples are clearly defined in the SAP as required to satisfy nature and extent. Decision units will be developed and evaluated in the RI/FS using existing and new data. A Technical Project Planning (TPP) meeting could be conducted prior to submittal of the RI/FS to streamline review and ensure team understanding.*

2) General Comment Regarding Incremental Sampling Method (ISM) Sampling
The sampling plan indicates either ISM or discrete sampling may be conducted for determining the extent of contamination at these proposed sample locations. The work plan does not always clearly state when samples will be collected as an ISM or collected as a discrete sample. Please provide rational and clarification as to the sample collection method that will be used.

Perhaps it is time to revisit the Final Facility Wide Sampling and Analysis Plan for possible revisions. As noted in this 2015 SAP Addendum, the ISM sampling proposed in this work plan is not consistent with the ISM sampling protocol outlined in the 2011 Final Facility Wide Sampling and Analysis Plan for Environmental Investigations, but will follow the sampling protocol outlined in the prior consultant's, Prudent, Load Line 1-4 and 12 sampling plan. The 2011 Final Facility Wide Sampling and Analysis Plan for Environmental Investigations document notes that the plan will likely need to be amended in the future due to the evolving science on subsurface ISM sampling methods.

Response: *Each AOC appendix includes tables with proposed sample locations and provides sample details (i.e., Table A-10). The third column indicates the sample type (discrete or ISM sample).*

Comment acknowledged. Although the FWSAP does not include procedures for collecting subsurface ISM samples, the program precedent for the subsurface ISM *sample procedures was established with the approval (from all stakeholders) of the Final Work Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern prepared by Prudent in 2010. This report provided sufficient rationale and justification for collecting a reduced number of aliquots (i.e., sub-samples) for subsurface ISM samples.*

3) General Comment Regarding Chemicals of Interest and Chemicals of Concern

a). The report identifies that the list of chemicals of interest (COIs) is larger than the list of chemicals of concern (COCs) in the interim record of decision (ROD) since the interim ROD contains only COCs exceeding national guard trainee Clean Up Goals (CUGs), and that COIs were developed from chemicals identified as exceeding residential risk in the Phase II Remedial Investigation (RI) (2004). Based on these facts, screening of chemicals of potential concern has already occurred; therefore, when the residential FWCUGs are used in the report they should be referred to as remedial goal objectives (RGOs) or clean up goals (CUGs) rather than screening criteria. In addition, the term screening should only be used when CUGs of one order of magnitude below the risk and hazard goal *(i.e.,* ELCR 1E-6 and HQ -0.1), *i.e.,* screening values, are used in the process.

ACTION ITEM: Revise the text throughout the document to be consistent with the proper use of screening and CUGs.

Response: *Agree. Terminology will be changed as requested. A few examples are below.*

1) *The second and fourth bullets in Section 3.2 Data Gap Analysis will be revised as follows–*
    - *Perform the data screen on a sample-by-sample basis using the current residential ~~screening criteria~~ Remedial Goal Objectives (RGOs) (all media). The residential RGOs are the residential FWCUGs at a target risk level of 1E-05 and a target hazard quotient of 1;*
    - *Perform a detailed evaluation of each sample location that exceeds residential RGOs and/or ecological screening criteria to determine if nature and extent is defined to complete evaluation of land uses*
2) *The second paragraph on Section 3.2.2.1 Human Health COIs will be revised as follows – "Upon completion of data collection activities conducted as part of this SAP Addendum, all available chemical data, including newly acquired data, will be evaluated ~~to determine chemicals of potential concern (COPCs)~~ in the RI/FS Addendum for each AOC."*
3) *The last sentence in Section 4.10.2 Use of FWCUGs in the HHRA will be added as follows: "When residential FWCUGs at a target risk level of 1E-05 and target hazard index of 1 are used in the report they will be referred to as RGOs."*

b). The plates in the appendices (A-3, B-3, C-3, and E-3) and figure D-12 identify former remediation areas (green-hashed areas) that were addressed in an interim ROD under the National Guard trainee receptor. Since the interim ROD CUGs were for the National Guard trainee, the former remediation areas may not meet residential remediation goals. Many of the former remediation areas on the plates are not bounded by discrete or ISM samples, are not identified as either meeting (grey) or exceeding (red) residential CUGS, and are not indicated as being included in the data-gap sampling (yellow); therefore, it is unclear how these former National Guard trainee CUG remediation areas will be handled going forward.

ACTION ITEM: Please clarify how the former National Guard trainee CUG remediation areas that appear to be unbounded will be sampled to determine extent for meeting residential remediation goals.

Response: *Areas where remediation has already occurred are not likely to be source areas and likely only exceed residential remediation goals. As noted in Section 3.2.4 "Concentrations only exceeding residential criteria (below NGT and Industrial/Commercial criteria) are typically not indicative of source areas and are likely attributable to residual contamination; these areas will generally be further addressed in the FS and no additional sampling will be recommended for the RI. Professional judgment will be applied to some areas only exceeding residential criteria that may be indicative of an undelineated source and additional sampling will be recommended at these locations"*

For areas where exceedances of residential remediation goals remain unbounded, development of the remedial alternative in the FS will include final confirmation samples collected to verify the extent of contamination has been addressed.

c). Human health and ecological COI lists provided in the appendices do not match, and should contain the same COIs. For example, in table A-4 for Load Line 1: RDX, antimony, TNT, and dieldrin are identified as human health COIs for surface water and sediment, but are omitted as ecological COIs in Table A-
5. For example, the human health sediment screening criteria for antimony is 28.2 mg/kg, and the ecological Ohio sediment reference value (SRV) is 1.8 mg/kg, but antimony is not included as an ecological COI.

ACTION ITEM: Revision is needed to include all appropriate ecological COIs, or provide justification as to why a particular COI is a human health COI, but not an ecological COI when the ecological screening criteria is more conservative than the human health screening criteria, as provided in the example above. Also, provide the appropriate sediment reference value(s).

Response: *It is possible but unlikely that the human health and ecological COIs would ever be the same because of how they were derived. The Phase II RIs completed for each of the five AOCs presented the results of human health screening evaluations that* *identified COCs exceeding residential screening criteria. These COCs were compiled for each medium under investigation in this RI/FS Addendum and identified as COIs (Section 3.2.2.1). The Phase II RIs completed for Load Lines 1 through 4 presented the results of ecological risk evaluations that identified chemical of ecological concern (COECs) or chemicals of potential ecological concern (COPECs). These COECs and COPECs were compiled for surface water and sediment and identified as COIs (Section 3.2.2.2). As a result, there never was an expectation that the lists would be the same nor was any checking deemed necessary to explain inconsistencies between the lists. For Load Line 1, RDX, antimony, TNT, and dieldrin were not identified as COPECs in the SERA. The SRVs in Table A-5 are consistent with those used in the PBA08 RIs and are from the EOLP column of Attachment H in the Ohio EPA Ecorisk Guidance.*

Project Scope Section 3.1 indicates that surface water and sediments samples will be collected at Load Lines 1 through 4; however, the proposed sampling summary Section 3.3 shows surface water sampling will be only conducted at Load Line 3.

ACTION ITEM: Clarify why surface water samples will be collected only at Load Line 3 and not at Load Lines 1, 2, and 4. Section 3.2.4.3 noted that a weight of evidence (WOE) evaluation was used for screening COIs that exceed the ecological screening criteria, but the 2015 SAP Addendum is not clear what that WOE was.

<u>Response:</u>

Text in Section 3.1 will be amended to read: "Conduct surface and subsurface soil, surface water, and sediment sampling <u>as needed</u> at Load Lines 1 through 4 to finalize the RI/FS Addendum for each AOC". The WOE evaluation conducted at each AOC is identified below.

Load Line 1- Sections A.5.2.1 and A.5.2.2 present both the human health and ecological surface water evaluations and WOE. Chemicals that exceed the screening criteria in surface water at the four aggregates are limited; therefore, no additional samples are recommended. The existing surface water data will be used in the Addendum RI.

Load Line 2- Sections B.5.2.1 and B.5.2.2 present the surface water evaluations. Chemicals did not exceed the screening criteria in surface water at the two aggregates; therefore, no additional samples are recommended.

Load Line 4- Sections D.5.2.1 and D.5.2.2 present the surface water evaluations. D.5.2.2 provides WOE for chemicals in each aggregate exceeding ecological screening criteria. Chemicals that exceed the screening criteria in surface water at the three aggregates are limited; therefore, no additional samples are recommended (this is summarized for surface water on page D-51; lines 38-41). The existing surface water data will be used in the Addendum RI.

Load Line 12- Surface water and sediment are not included in this investigation. These media were evaluated independently of soil during the PBA08 contract and are addressed in the *Phase III RI Report for Wet Sediment and Surface Water at RVAAP-12 Load Line 12*

(USACE 2012).

Additionally, the ecological WOE is discussed in Section 3.2.3.2. To clarify, the fourth bullet in Section 3.2.4.2 will be modified as follows: "All COI concentrations that exceed the ecological screening criteria were assessed using a WOE evaluation **(discussed in Section 3.2.3.2)**. If WOE results indicate that there is not enough evidence to interpret the occurrence of the exceedance, a new sample was proposed for only those COIs that exceeded the screening criteria"

4) Surface Water and Sediment (3.2.4.3)- *first bullet item at top of page 3-10*
The act of demolition or remediation can mobilize soils to allow impacted media to run off into water ways, if storm water controls are not implemented correctly. The act of demolition is not always synonymous with improving the environmental conditions to eliminate further assessment of the surface water or sediment pathway. Based on the data in the tables included in this sampling plan, surface water and sediment samples were last collected in 2000, 2001, and 2003. More recent data from surface water and sediments were not provided. It is not clear if the prior data were screened using the appropriate ecological screening values, so additional assessment of these media may be needed.

ACTION ITEM: Confirm the appropriate screening value was used when the COIs were screened initially.

Response: *All applicable historical data were screened against updated and appropriate screening values. Historical screening values were not used unless they were part of the updated screening hierarchy.*

5) Section 3.2.2.3 discusses potential soil leaching COIs, and section 4.9 states a RI/FS Addendum Report will include an updated SESOIL model for the soil leaching COIs identified for each AOC (LL 1, 2, 3, 4, and 12). However, the screening criteria used to identify each soil leaching COIs is not provided in the 'Human Health Screening Criteria' tables in the Appendices. The soil leaching to ground water pathway screening criteria or RGOs need to be included in the report. See previous comments for PBA08 projects that specify ground water as the primary receptor of concern for compounds leaching from soils.

ACTION ITEM: Model inputs and/or soil leaching screening criteria or RGOs should be provided.

Response: *At the end of each Soil Leaching Evaluation Section, a table will be added that provides the soil leaching screening criteria (SSLs, Site-specific SSLs, groundwater screening criteria MCLs and/or RSLs) for the soil leaching COIs to be evaluated in the RI.*

6) Section 3.2.3.2 states those COIs with exceedances were reviewed using the following

criteria to make data gap sampling decisions. One criterion is to "eliminate non-toxic chemicals (e.g., nitrocellulose)." Section 8.5.2.3 further clarifies this criteria by stating, "North Ponds Aggregate- There were no discrete exceedances in sediment. Nitrocellulose was detected, but this explosive is essentially non-toxic."

ACTION ITEM: The term "non-toxic" should be justified or documented. In addition, for ecological assessment, non-toxic stressors, examples of which include nitrates, pH, and salinity, are still evaluated, if appropriate. Ensure that the ecological screening process discusses non-chemical stressors, if appropriate.

Response: *The following reference will be added to Section B.5.2.1: **"**Nitrocellulose was detected, but this explosive is essentially non-toxic because stomach impaction would occur before toxicity (USEPA 1987)." Non-toxic stressors such as nitrates are evaluated if there is historical information suggesting there could have been a non-toxic stressor release (for instance, Load Line 12 had previously been leased by a fertilizer company to make ammonium nitrate fertilizers).*

USEPA. 1987. Health Advisory for Nitrocellulose. Office of Drinking Water. September 1987.

7) Surface Soil Sampling (4.1.1) Incremental Sampling (4.1.1.1) How does a sampler know when to collect a discrete vs. ISM? The plan is not clear from the narrative in Section 4.0 when these sampling methods will be used. This is described in greater detail in the Appendices, but is not in concert with what is noted in Section 4. The sampling plan (Section 4) indicates that only discrete samples will be collected in LL 12, due to how sampling was conducted in previous sampling events, but the LL12 sampling appendix suggests only ISM samples will be collected.

ACTION ITEM: Provide clarity regarding the sampling method that should be used to obtain the media being sampled.

Response: *Clarification provided. Each AOC appendix includes tables with proposed sample locations and provides sample details (i.e., Table A-10). The third column indicates the sample type (discrete or ISM sample). Section 4.0 will updated as follows to reflect that ISM and discrete samples will be collected at Load Line 12, Page 4-4, Lines 10-11.*

"~~To maintain consistency with historical sampling procedures, discrete subsurface samples will be collected at Load Line 12.~~ Direct-push sample collection…"

8) Section 4.2 states, "Ten sediment samples will be collected as discrete samples using ten aliquots per sample. Ten separate aliquots will be collected at random locations within an area with an approximate 5-ft radius to the same depth. These 10 aliquots will be composited"

ACTION ITEM: It is recommended that sediment samples be completed as ISM samples after defining the appropriate sediment decision units for lotic waterbodies or ditches being addressed as surface water. In similar sediment evaluations, 100 meter stream lengths have been used. Ponds and lakes would likely require discrete sampling to define the extent of contamination in sediment and representative contaminant concentrations. The 2011 Facility-Wide Sampling and Analysis Plan for Environmental Investigations describes methods to follow for collecting dry or wet sediments. It is not clear why other sampling methods are proposed in this plan. Revise the sampling plans as appropriate.

Please clarify where and how the sediment samples will be collected. The depth of these sediment samples needs clarification.

Response: *Clarification. The method provided in the Draft Work Plan to collect sediment samples was previously specified by Ohio EPA during the development of the PBA08 Work Plan.*

As requested in this comment, the Work Plan will be revised so that 1) stream samples will be collected as ISM samples at roughly 100 meters in length per sample (contingent upon overall length of decision unit); and 2) sediment in ponds and lakes will be collected as discrete samples. The sediment samples will be collected from 0-1 ft bgs and analyzed for the specific analytes presented in each site's "Proposed Sediment Sampling Locations" table (e.g., Table A-15 for Load Line 1). The results of the sample analyses will be evaluated individually against the screening criteria for the specified analytes.

The text and figures will be revised accordingly.

9) Section 4.10 states an updated HHRA will be submitted, and that the HHRA will be used to identify COCs and locations recommended for evaluation in an FS. Given that a remedy and interim ROD were previously completed for these five AOCs, the AOCs could go directly into Feasibility Studies, if the prior Phase II data are reliable, or after the data-gap analysis samples are collected. This would basically consist of the values from the decision units (or applicable exposure point concentrations of appropriate areas) being compared to the appropriate CUGs (multiple chemical adjustments may be needed). Both residential and commercial CUGs should be used in the focused FS to evaluate differences (e.g., costs, volumes of material to be treated) and recommend a preferred remedial option(s). This would also be a de-facto risk assessment, because, if concentrations of COCs are above CUGs, then there would be unacceptable risk.

ACTION ITEM: Evaluate the option to go directly into a Feasibility Study.

Response: *The Army deems it necessary to complete an RI. Since new samples are proposed to determine nature and extent, the additional data should be evaluated in an RI. The RI will include a re-analysis of the data for different receptors than done previously. In* *addition, the Revised Risk Assessment/Land Use Tech Memo has requirements for the evaluation of three Land Uses in the RI/FS. Following the Tech Memo and the fact we are determining N&E for various Land Uses precludes the ability to skip the RI phase. The document to be prepared following field investigation is an Addendum RI/FS which will combine (into a single report) the summary of existing and new data with evaluation and comparison of remedial alternatives specific to land use options. The RI component of this report will be streamlined and the FS components will feature prominently.*

10) Section 4.10.1 states for ISM sampling an EU can consist of "a group of ISM samples". Reminder that, per Ohio EPA's June 2014 and November 2014 comments, while there may be some instances where adjacent and small ISM areas could be combined to make larger exposure areas or decision units, results from ISM samples should usually not be combined with either discrete or other ISM data to calculate EPCs and should be considered independent decision units. If small groups of ISM samples are combined, it should be based on site-specific information, such as the extent of contamination, the type or types of COCs, their concentrations, and spatial considerations.

ACTION ITEM: The work plans should specify and explain the rationale behind the proposed decision units and EUs, and be approved prior to sampling.

Response: *Agree. As noted by the commenter, if small groups of ISM samples are combined it should be based on site-specific information such as the extent of contamination. Therefore, the decision to combine ISM data cannot be made until after sample results are reviewed to determine extent of contamination in the Addendum RI/FS. In general, each ISM sample will be evaluated as a separate exposure unit. The following text will be added to Section 4.10.1: "In most cases, where ISM samples are available, each ISM sample will be evaluated as a separate EU".*

11) Will the exposure point concentration (EPC) be a maximum detection or a 95% UCL? This is not identified in section 4.10.1 of the document. Per U.S. EPA, EPCs are to be the 95% UCL of the mean.
ACTION ITEM: Please clarify.

Response: *Agree. If enough discrete data are available for an EU, the EPC will be the 95% UCL of the mean. However, it is anticipated that most EUs will be defined by a single ISM sample. In all cases U.S. EPA guidance regarding use of minimum number of samples and calculation of 95% UCL using ProUCL will be followed.*

12) The appendices contain a number of discrete and ISM samples that "don't warrant additional investigation" or "do not require additional delineation to determine extent" and are not bound by other discrete or ISM samples. For example, at LL 1, Plate A-3 inset CB-4 and CA-6, discrete sample LL1-024 and ISM LL1ss-609. The report does not identify what will be done with these samples. It is assumed this data will be carried

forward in the process, but it is not clear how extent is resolved. Another example, LL 2 sample LL2ss-100-0778 contains the maximum concentration of lead for this AOC, but it is not clear if the data point has been fully bound by data that is below the resident screening criteria. Metals are not included in the additional sampling proposed for this AOC. No additional samples are proposed in the area of this sample.

ACTION ITEM: Please clarify how these kinds of areas will be addressed.

Response: *The examples noted were evaluated per the decision rules identified in Section 3.2.4. Section 3.2.4.1 and 3.2.4.2 will be amended to clarify how exceedances will be carried through the RI/FS process. This will include risk assessment and WOE evaluation. Samples that do not appear to be bound likely only occur for residential remediation goals and may be further evaluated in the FS as locations warranting removal under the residential land use alternative.*

- *LL1-024 – the arsenic concentration (18.6 mg/kg) is above the surface soil background screening value of 15.4 mg/kg but is considered to be naturally occurring because it is less than the subsurface background screening value of 19.8 mg/kg and less than other naturally occurring arsenic levels for this area. This will likely be addressed in the WOE section of the RI. Description of the exceedance at LL1-024 will be added to Section A.4.2.2.*
- *LL1ss-609 – the concentrations of these COIs, benzo(a)pyrene and PCB-1254 (0.24 mg/kg and 4.9 mg/kg), are very close to their Residential FWCUGs (0.221 mg/kg and 1.2 mg/kg) and below their Industrial RSLs (2.9 mg/kg and 10 mg/kg). If remediation is required in this area, development of the remedial alternative in the FS will include final confirmation samples collected to verify the extent of contamination has been addressed. LL1ss-609 is discussed in detail in Section A.4.2.1.*
- *LL2ss-100 – although lead at this discrete sample location exceeds the residential screening criteria, this sample has numerous ISM samples that overlap and replace the sample (including ISM sample LL2ss-300M); all with no exceedances. Discrete sample data that is replaced with an ISM will not be carried through to the RI/FS. LL2ss-100 is discussed in detail in Section B.4.2.9.*
- *As noted in Section 3.2.4 of the SAP Addendum, "Concentrations only exceeding residential criteria (below NGT and Industrial/Commercial screening criteria) are typically not indicative of source areas and are likely attributable to residual contamination; these areas will generally be further addressed in the FS and no additional sampling will be recommended for the RI." These areas under the residential land use scenarios will be evaluated in an FS where pre-delineation sampling may be required or confirmation samples will be a part of the alternative to verify attainment of remediation goals.*

13) Field Quality Control Sampling Procedures. Page 4-5, Lines 25-43 (FSP): Please note that per conference call on May 7, 2015, between the NGB and Ohio EPA, it was agreed upon that from this point forward that the primary sample results will be reported as long as the field duplicate data do not exceed the acceptance criteria of 30% relative percent difference. When the field duplicate result exceeds this criterion, the data shall be evaluated to determine the source of the difference. This usually would

result in resampling that particular sampling location. In lieu of resampling, the conservative approach may be used, which would be to report the highest concentration of that particular analyte (from the field duplicate). In addition, all duplicate sample data should be included in tables and figures as part of typical summary reporting information.

ACTION ITEM: Include as warranted.

Response: *This work plan was submitted January 30, 2015 before the May 7, 2015 decision was made to change the screening approach. The data screens in the work plan will remain unchanged with regards to the use of duplicate samples. However, new data collected will be evaluated under the May 7, 2015 decision.*

14) Section B.5.2.1 states one sample will be collected from the middle of Kelly's pond.

ACTION ITEM: Samples should also be collected at inlet from LL 2, to assess if run-off occurred since the remedial actions were completed.

Response: *Agree. A sediment sample at the inlet from LL2 will be added to the proposed sampling approach for Load Line 2 to determine if current concentrations present ongoing concern.*

15) Table B-16: 2,4-DNT should be marked as a 'Soil to Groundwater CMCOPC', based on the text in section B-6, line 19.

ACTION ITEM: Please change or provide clarification

Response: *Agree. 2,4-DNT will be revised to be marked as a 'Soil to Groundwater CMCOPC'.*

16) Section D.5.2.2 states manganese was screened out from the upstream segment of the waterway, because the average concentrations in the downstream segments of the waterway were below background values. However, the source of the exceedances in the upstream segment has not been identified, and the upstream segment will not be evaluated in another AOC's report.

ACTION ITEM: Unless the detections of manganese in the upstream segment are below a background value or ESL, the upstream segment should not be eliminated from further discussions. In addition, maximum site concentrations are to be used in the background screening. For additional details, see:

- httpJ/wNw.epa. .ate.oh.us/portals/30/ru!es/Use%20ofo/c20Background%20for%20RR%20Sites.pdf.

Response: *Maximum site concentrations were used in the background screening. In the Weight-of-Evidence evaluation to determine if additional sampling was required, average concentration also were used. While further sampling is not proposed for manganese, a Level I Scoping ERA will be conducted for Load Line 4. A Level I Scoping ERA will evaluate whether the AOC had past releases, the potential for current contamination, and if there are important ecological resources in or near the AOC. If an AOC has* *contaminants but lacks important ecological resources, the ERA process will stop at Level I. Contamination and important ecological resources must both be present to proceed to a Level II Screening ERA.*

17) The Ohio EPA ecological SRVs for iron (LL1 Tabie A-5) and manganese (LL1, Table A-5 and LL4, Table D-5), or site-specific background values, should be used instead of marking the sediment screening level as "NA".
ACTION ITEM: Please change or provide clarification.

Response: *As defined in the footnotes, "NA = Not applicable because the analyte was not a chemical of interest for that medium." As a result, SRVs or site-specific background values are not required for iron and manganese in Tables A-5 and D-5.*

18) In the data tables for surface water, a number of the ecological screening criteria for surface water is marked as "NA" when an Outside the Mixing Zone Average (OMZA) value exists; the OMZA should be used. The 2008 Ohio EPA Guidance for Conducting Ecological Risk Assessment (Page 3-6) states that the surface water chemical concentrations are to be compared to the chemical criteria pursuant to OAC 3745-1. The outside mixing zone average criteria for human health and aquatic life should be compared against ambient samples averaged over a 30-day period. It is not clear if the data used to calculate the average were collected within a window of 30 days. Single ambient samples are not to exceed the OMZM.

ACTION ITEM: If COIs were screened out from further evaluation, because it was compared to the OMZM or removed because there was no calculated OZMA value available on Ohio EPA, Division Of Surface Water's water quality standards table, further assessment of the COl may be warranted for ecological risk. Chemical concentrations are to be compared to the chemical criteria pursuant to OAC 3745-1.

Response: *Average surface water concentrations were based on multiple samples from different locations. Multiple surface water samples collected within a window of 30 days from the same location are not available. Thus, all detected COI concentrations from individual sample locations were screened against the OMZM unless only an OMZA was available.*

19) Surface Water and sediment in load line 12 AOC are being assessed in the PBA08. It would seem that a complete Conceptual Site Model (CSM) of the dynamics of this AOC may not be available until the PBA08 study has been completed.

ACTION ITEM: Additional assessment of this area may be needed at a later date.

Response: *Comment acknowledged.*

20) The "Proposed Sampling Locations" Tables in the appendices list the "Number of

Proposed Subsurface ISM Sub-borings". It is unclear if these borings are the number of samples to be collected to comprise the ISM sample, or the number of ISM samples. For a single ISM sample, generally about 30 sub-samples should be taken to comprise the ISM sample.

ACTION ITEM: Clarify the number of aliquots to be collected for each ISM sample

Response: *Sub-borings are the number of samples to be collected to comprise the ISM sample (i.e., aliquots). As noted in response to Comment 2, subsurface ISM sample procedures were established with the approval (from all stakeholders) of the Final Work Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern prepared by Prudent in 2010. The number of Proposed Subsurface ISM Sub-borings (or aliquots) is based on the total square footage of the subsurface ISM and is consistent with the approach developed in Prudent's report as detailed in Section 4.1.2.1 of this SAP Addendum.*

Additional Comments:

The Army received verbal comments from Ohio EPA during a teleconference on April 9, 2015 associated with the LL1-4 and 12 SAP Addendum DQOs . Based on the discussion, there were two action items. The Army and Leidos provided responses and additional information as requested and transmitted to Ohio EPA on April 14, 2015 via e-mail.

1. Provide DQOs from previous investigations that demonstrate the initial sampling approach and rationale for reducing the analytical list.
   - During the *Preliminary Assessment for the Characterization of Areas of Contamination (SAIC 1996),* contaminants of concern were identified as those associated with the explosive melt-pour process for large caliber shells that was conducted at the Load Lines. Subsequently, in the *Phase I RI of High Priority Areas of Concern (SAIC 1998*), the primary constituents remained the same (explosives and metals) but investigation also included an expanded analyte list including (VOCs, SVOCs, TAL metals, PCBs, and pesticides) on 20 percent of discrete samples. In the *Phase II RI Report for Load Line 1 (SAIC 2003)*, investigation was planned to define extent in the areas where soil contamination was identified in Phase I. In accordance with the *Facility-Wide SAP for Environmental Investigations and Facility-Wide QAPP (SAIC 2011)*, 10% of discrete samples collected were full suite. Subsequent ISM investigations focused on building specific DQOs to further define nature and extent after soil removal actions and slab removals for area specific undelineated constituents. The appendices of the SAP Addendum provide detailed summaries of historical site activities and previous investigations for additional information.

     - From the PA: *Potential chemicals of concern at RVAAP sites are predominantly explosives (TNT, RDX, HMX, RDXX, Composition B, and lead azide) and heavy metals Lead and mercury). Primary contaminant release mechanisms from load lines were process effluent discharges to surface water (drainage ditches, settling ponds, and streams) and process building wastewater wash-out onto surface soils. Media of concern are soil , sediment, groundwater, and surface water.*

     - From the Phase I RI DQOs: *Process knowledge (munitions assembly and demilitarization), historical information, and the results of previous investigations were used to determine the Phase I RI Data Quality Objectives (DQOs) and to develop the Phase I RI investigative strategy for each AOC. The DQO process followed the Data Quality Objectives Process for Superfund, Interim Final Guidance Document (EPA 1993), and is explained in detail in the RVAAP Phase I SAP Addendum for High Priority AOCs (USACE 1996).* From Section 2.0 Study Area Investigations: *The expanded analyses were performed on 20% of the samples collected to evaluate the potential for unknown process-related chemicals. Samples analyzed for full suite of chemicals were selected at potential source areas based on process knowledge, or on a random statistical basis where no process knowledge existed to guide biased sampling.*

     - From the Phase II RI DQOs*: Potential source areas and accumulation points were the specific focus of the sampling effort. Biased sampling of surface and subsurface soils in the production area (Buildings CB-4, CB-4A, CA-6, and CA-6A) and in Buildings CB-2, CB-3, CB-10, CB-13, CB-14, and CB-17 was planned to define extent in the areas where soil contamination had been identified in Phase I*. From Facility-Wide QAPP Section 2.5: *Samples requiring the "full suite" of parameters will be analyzed for Target Analyte List (TAL) metals, explosives (including nitroglycerin), propellants (nitroguanidine and nitrocellulose), semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), pesticides, and polychlorinated biphenyls (PCBs). Typically, 10% of the samples are* *submitted for full suite analysis while the remaining 90% will have targeted analyses based on the investigation-specific goals. Other analyses, including but not limited to herbicides, perchlorate, cyanide, hexavalent chromium, or polycyclic aromatic hydrocarbons (PAHs), will be performed as needed based on historical information or data quality objectives (DQOs).*

2. Provide an explanation of the use of field duplicate samples and how they are used in the RI.
   - Programmatic use of duplicate samples at RVAAP is demonstrated in the *Facility-Wide SAP for Environmental Investigations and Facility-Wide QAPP (SAIC 2011)* as noted below. The Phase II RIs for all the Load Lines also cite how the samples were collected and how data was excluded from analysis. Load Line 1 Is provided as an example. Duplicate samples are used as part of the Data Quality Assessment and not incorporated in the data screens for use in the risk assessment.

     - From Facility-Wide SAP Section 5.4.7 Field Quality Control Sampling Procedures: *A duplicate sample is collected along with a field sample at the same sampling location and is placed into a separate container labeled with a unique sample number. The duplicate is submitted as "blind" to the laboratory and is used to determine whether the field sampling technique is reproducible and to check the accuracy of reported laboratory results.* From Facility-Wide QAPP Section 4.2: *Field blanks, source blanks, equipment rinsate blanks, trip blanks, and field duplicate (co-located) samples will be submitted for analysis as required by investigation-specific addenda. These samples will provide a means to assess the quality of the data resulting from the field sampling program. Field duplicate samples are analyzed to determine sample heterogeneity and sampling methodology reproducibility.* From Facility-Wide QAPP Section 9.3.3.2.1: *Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. This duplicate sample should not be a method blank, source blank, equipment rinsate, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be re-examined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number.*

From Phase II Load Line 1 RI Section 3.6.4 Laboratory Analyses: *Field duplicate samples were analyzed to determine sample heterogeneity and sampling methodology reproducibility. Laboratory method blanks and laboratory control samples were employed to determine the accuracy and precision of the analytical method as implemented by the laboratory. Matrix spikes provided information about the effect of the sample matrix on the measurement methodology.* ***Laboratory sample duplicates and MSDs assisted in determining the analytical reproducibility and precision of the analysis for the samples of interest.*** *Evaluation of these QC measures and of their contribution to documenting the project data quality is provided in Appendix G as the project Quality Control Summary Report (QCSR).* From Phase II RI Section 4.1.3 Data Reduction and Screening: *The data screening process employed to identify SRCs involved first calculating data summary statistics. Site data were extracted from the database such that QC splits and field duplicates were excluded from the screening data sets.*

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

November 27, 2015

Re: US Army Ravenna Ammunition Plt RVAAP
Remediation Response
Project records
Remedial Response
Portage County
267000859030

Mr. Mark Leeper
Army Nation Guard Directorate
ARNGD-ILE Clean Up
111 South George Mason
Arlington, VA 22203

Subject: Comments on the August 14, 2015 Response to Comments on the "Draft PBA 13 Remedial Investigation Sample and Analysis Plan Addendum for Load Lines 1, 2, 3, 4 and 12" for the Former Ravenna Army Ammunition Plant (RVAAP)" Document, Dated January 30, 2015 (Work Activity No. 267-000859-030)

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA) received the draft PBA 13 Remedial Investigation Sample and Analysis Plan (SAP) Addendum for Load Lines 1, 2, 3, 4, and 12. Each of these Load Line areas of concern (AOCs) has undergone several investigations and remedial action decisions to characterize the nature and extent of contamination, as well as evaluate human and ecological health risks. Previous remediation activities focused only on the National Guard Trainee receptor. Additional evaluation of data gaps for the unrestricted land use and possible sampling is proposed by this SAP Addendum.

The Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the RVAAP Installation Restoration Program, or Technical Memorandum, states if an AOC fails to meet the Unrestricted Land Use, then a Feasibility Study (FS) will be completed to evaluate cleanup options for all three land uses noted in the Technical Memorandum.

The responses you provided in the August 14, 2015 letter adequately addressed our comments except for two of our comments. We still need clarification and concurrence from you on Comment #2 regarding ISM methodology and Comment #18 regarding the appropriate surface water standards.

Comment # 2: Due to the difference between the ISM methodology proposed for these Load Lines with current ISM sampling guidance, Ohio EPA suggests discrete samples be collected at these Load Lines to expedite the application of the work plans. Discrete samples may also be more efficient at these AOCs considering the investigations have been proposed to evaluate remedy modifications and an extensive amount of historical data related to prior investigations and remedial efforts at these Load Lines is available. Areas with historical exceedances should be bound horizontally by collecting one discrete sample on each side of the area, and bound vertically by collecting one sample from the middle of the area; the sampling can be repeated as needed. The proposed sample depth intervals (0-1, 1-3, 3-5, 5-7, 7-13 feet) remain appropriate, and samples can be collected and held, as desired. The Winklepeck Burning Grounds Work Plan is a good resource to utilize. Ohio EPA can help with determining sample locations and depths prior to submittal of a revised work plan. For a specific example, regarding the proposed ISM sample LL2sb-628M at Load Line 2 (inset DA-6 on Plate B-3), discrete samples can be placed on each side of the prior remediation area (green hashed area) to determine horizontal extent, and one discrete sample collected from the middle of this area to determine vertical extent, perhaps starting at a depth of 4 feet since prior sampling reported an exceedance of residential facility wide clean up goals in the 2-3 foot sampling interval.

While discrete sampling is suggested for these Load Lines, Ohio EPA understands the usefulness of ISM sampling, when conducted appropriately. Therefore, Ohio EPA may consider ISM sampling, if it was designed and conducted in accordance with current ISM sampling guidance protocols, including a minimum of 30 aliquots, replicates, and clearly defined decision units.

Comment # 18: Regardless of whether surface water concentrations were determined from a single-sample event at one location, are averages calculated from samples taken at multiple locations, or are averages calculated from multiple samples collected over a period of time from a single location, the data must also be compared to the Outside the Mixing Zone Average (OMZA) value, in addition to the other criteria cited in the report (OMZM, Human Health, etc.). For ecological receptors, the OMZA is the surface water criteria used to determine if chemical concentrations are protective of aquatic life short term exposure. While the OMZA criteria for human health and aquatic life should be compared against ambient samples averaged over a 30-day period, if only one sample is collected, that data is considered the 'average'. Include the OMZAs in the ecological screening criteria tables (A-5, B-5, C-5, and D-5), and in the future in Load Line 12's (RVAAP-44) to-be-submitted-under-separate-cover report.

If you have questions or need clarification regarding the comments, please feel free to contact me at (330) 963-1201 or e-mail at susan.netzly-watkins@epa.ohio.gov.

Sincerely,

Sue Netzly-Watkins

Sue Netzly-Watkins
Site Coordinator
Division of Environmental Response and Revitalization

SN-W/nvr

cc: Kevin Sedlak, ARNG-ILE, Camp Ravenna
Katie Tait, OHARNG, Camp Ravenna
Quyet La, USACE Louisville
Nat Peters, USACE Louisville
Gail Harris, Vista Sciences Corp
Gregory F. Moore, USACE, Louisville District
Vasudha Peterson, Leidos

ec: Rod Beals, Ohio EPA, NEDO, DERR
Bob Princic, Ohio EPA, NEDO, DERR
Justin Burke, Ohio EPA, CO-DERR
Brian Tucker, Ohio EPA, CO-DERR
Carrie Rasik, Ohio EPA, CO-DERR

Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part II: Site Safety and Health Plan

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Leidos
11951 Freedom Drive
Reston, Virginia 20190

January 27, 2016

APPROVALS

Site Safety and Health Plan
PBA13 Sample and Analysis Plan Addendum
for Surface Water and Sediment at Load Lines 1, 2, 3, and 4
Ravenna Army Ammunition Plant, Ravenna, Ohio

Vasu Peterson, P.E. Leidos Project Manager (571) 526-7744	January 27, 2016 Date
Stephen H. Lowery, CIH (6620 CP) Leidos ESG Health and Safety Manager (405) 701-3158	January 27, 2016 Date
J.M. Crenshaw Leidos ECI Operation Health and Safety Manager (865) 481-4767	January 27, 2016 Date

Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part II: Site Safety and Health Plan

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:
Leidos
11951 Freedom Drive
Reston, Virginia 20190

January 27, 2016

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

A2	Suspected Human Carcinogen
A3	Not Classifiable as Human Carcinogen
ACM	Asbestos-containing Material
AHA	Activity Hazard Analysis
AOC	Area of Concern
ARNG	Army National Guard
Ca	Potential Occupational Carcinogen
Camp Ravenna	Camp Ravenna Joint Military Training Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COR	Commanding Officer's Representative
CPR	Cardiopulmonary Resuscitation
CRJMTC	Camp Ravenna Joint Military Training Center
dB	Decibel
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DEHP	Di(2-ethylhexyl)phthalate
DOT	U.S. Department of Transportation
EH&S	Environmental Health and Safety
EM	Engineer Manual
EMS	Emergency Medical Services
ER	Engineer Regulation
eV	Electron Volt
FS	Feasibility Study
FM	Field Manager
FP	Flash Point
FWFSP	Facility-Wide Field Sampling Plan
FWSHP	Facility-Wide Safety and Health Plan
GFCI	Ground Fault Circuit Interrupter
HAZWOPER	Hazardous Waste Operations
IATA	International Air Transport Association
IDLH	Immediately Dangerous to Life and Health
IDW	Investigation-Derived Waste
IP	Ionization Potential
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams per Kilogram
mm	Millimeters
MRS	Munitions Response Site

ACRONYMS AND ABBREVIATIONS (CONTINUED)

MSDS	Material Safety Data Sheet
NA	Not Applicable
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
P.E.	Professional Engineer
P.G.	Professional Geologist
PAH	Polycyclic Aromatic Hydrocarbon
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
PEL	Permissible Exposure Limit
PFD	Personal Flotation Device
PID	Photoionization Detector
POC	Point of Contact
PPE	Personal Protective Equipment
ppm	Parts per Million
RAC	Risk Assessment Code
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
REL	Recommended Exposure Limit
RVAAP	Ravenna Army Ammunition Plant
SOP	Standard Operating Procedure
SRC	Site-Related Contaminant
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STEL	Short-Term Exposure Limit
SVOC	Semivolatile Organic Compound
TBD	To Be Determined
TLV	Threshold Limit Value
TWA	Time-Weighted Average
USACE	U. S. Army Corps of Engineers
USCG	U.S. Coast Guard
USP&FO	United States Property and Fiscal Officer
UXO	Unexploded Ordnance
VP	Vapor Pressure

THIS PAGE INTENTIONALLY LEFT BLANK

1.0 INTRODUCTION

Leidos has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District to conduct a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Feasibility Study (FS) for surface water and sediment at areas of concern (AOCs) within the former Ravenna Army Ammunition Plant (RVAAP). This work is being performed under a firm fixed price basis in accordance with USACE, Louisville District Contract No. W912QR-12-D-0020, Delivery Order No. 0008, under a Performance-Based Acquisition (PBA). The AOCs covered under this investigation include:

- Load Line 1;
- Load Line 2;
- Load Line 3; and
- Load Line 4.

1.1 PURPOSE

The purpose of this Site Safety and Health Plan (SSHP) is to describe potential hazards that may be encountered during the implementation of the *PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4 (*herein referred to as the SAP Addendum) and provide a hazard risk analysis (USACE 2015). This SSHP is an addendum to the Facility-Wide Safety and Health Plan for Environmental Investigations (USACE 2011a) (herein referred to as the FWSHP) and will also outline staff organization, qualifications, responsibilities, and training requirements; identify required personal protective equipment (PPE); and present monitoring and standard operating procedures (SOPs) needed to implement the field component of this investigation.

1.2 SCOPE

The SSHP scope covers all health and safety components of the SAP Addendum sampling activities. The following elements are covered under this SSHP:

- Pre-mobilization activities for environmental media sampling (e.g., land survey, utility clearance);
- Mobilization and site setup (e.g., clearing and grubbing);
- Sediment and surface water sampling;
- Investigation-derived waste (IDW) handling;
- Equipment decontamination; and
- Demobilization.

Sampling activities will be overseen by USACE and implemented by Leidos. Leidos (under contract with USACE) is responsible for investigating and characterizing sediment and surface water at the AOCs listed earlier. Implementation of these activities will meet the requirements of the

Facility-Wide Field Sampling Plan for Environmental Investigations (USACE 2011b) (herein referred to as the FWFSP), the FWSHP (USACE 2011a), and the SAP Addendum.

1.3 POTENTIAL HAZARDS AND EXPOSURE

Potential hazards posed by the planned tasks include injury from lifting, noise, chemical exposure, temperature extremes, stinging/biting insects, poisonous plants, drowning, and snakes.

The potential for chemical overexposure appears to be very low, based on the nature of planned tasks and review of available data. The Leidos Site Safety and Health Officer (SSHO) will observe all site tasks during daily safety inspections and will use professional judgment and appropriate monitoring results to determine if upgrading PPE is required. A detailed analysis of these hazards and specific appropriate controls is presented in Table 3-3.

Activities performed during the sampling will be performed in Level D PPE, and personnel will use chemical-resistant gloves when handling potentially contaminated materials. If one of several action levels is exceeded or the potential for increased risk becomes apparent during field activities, protective procedures and protective clothing will be upgraded as necessary by the SSHO.

1.4 HEALTH AND SAFETY PROGRAM

Leidos formal policy, stated on the Leidos Intranet page, takes every reasonable precaution to protect the health and safety of our employees, the public, and the environment. To this end, the FWSHP (USACE 2011a) and this SSHP collectively set forth the specific procedures required to protect Leidos personnel involved in field activities. These plans are driven by requirements contained in the most current revisions of the USACE *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste, Engineer Regulation (ER)-385-1-92* (USACE 2007a), *Safety and Health Requirements for Munitions and Explosives of Concern (MEC) Operations, ER-385-1-95* (USACE 2007b), and the USACE *Safety and Health Manual, Engineer Manual (EM)-385-1-1* (USACE 2008), which are available online via the USACE web site. Leidos activities are also subject to the requirements of the Leidos Corporate Environmental Health and Safety (EH&S) Program and associated procedures. All field personnel are required to comply with the requirements of these programs and plans.

Leidos project personnel and Subcontractors are required to review this plan prior to on-site project participation. In addition, Subcontractors are responsible for providing their employees with a safe work place, and these plans do not relieve Subcontractors of this responsibility. Subcontractors must have and use their own safety programs and plans in compliance with applicable regulations. This SSHP was developed in accordance with Ohio Administrative Code 3745-20-01 and 3745-20-05, 40 Code of Federal Regulations (CFR) Part 763, and USACE Safety and Health Requirements Manual EM-385-1-1. In addition, Subcontractor personnel are required to submit to Leidos certifications relating to their training and medical monitoring to ensure compliance with these requirements, as detailed in the SSHP. Standard procedures will be used to minimize the potential for personnel injury or illness. These procedures include site-specific training, routine inspections, visual and instrument surveillance for hazards, and enforcement of health and safety requirements by project management. Leidos policy takes every reasonable precaution to protect the health and safety of project personnel, the public, and the environment. Any person found to have intentionally or negligently violated this policy will be subject to disciplinary action, which may include dismissal. The goal is zero accidents.

The FWSHP addresses program issues and hazards and hazard controls common to the entire facility for environmental investigations. This SSHP addresses the hazards and controls specific to implementation of the SAP Addendum. Copies of the FWSHP and this SSHP will be present at the work site during all fieldwork.

THIS PAGE INTENTIONALLY LEFT BLANK.

2.0 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

2.1 FACILITY DESCRIPTION

The facility, consisting of 21,683 acres, is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 kilometers (3 miles) east/northeast of the City of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the City of Newton Falls. The facility, previously known as RVAAP, was formerly used as a load, assemble, and pack facility for munitions production. As of September 2013, administrative accountability for the entire acreage of the facility has been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site (Camp Ravenna Joint Military Training Center [Camp Ravenna]). References in this document to RVAAP relate to previous activities at the facility as related to former munitions production activities or to activities being conducted under the restoration/cleanup program.

2.2 AOC DESCRIPTIONS

Descriptions, histories, previous investigation activities, and recommended characterization activities for each AOC are presented in the SAP Addendum.

2.3 CONTAMINANTS

Tables 2-1 through 2-4 present the contaminants known to occur in surface water and wet sediment. A contaminant's inclusion in these tables indicates the potential to encounter a contaminant during sampling activities, but it does not necessarily indicate that the contaminant is present in sufficient quantity to pose a health risk to workers.

Table 2-1. Maximum Concentrations of Chemicals of Concern at Load Line 1

Analyte	Maximum Detected Concentration	
	Sediment (mg/kg)	Surface Water (mg/L)
Antimony	1.2	ND
Arsenic	37.9	0.031
Lead	73.3	0.0031
Manganese	1300	1.4
2,4,6-Trinitrotoluene	ND	0.000068
2,4-Dinitrotoluene	ND	0.00027
2,6-Dinitrotoluene	ND	0.00011
Benz(a)anthracene	0.056	ND
Benzo(a)pyrene	0.056	ND
Benzo(b)fluoranthene	0.071	ND

ND = Not Detected

Table 2-2. Maximum Concentrations of Chemicals of Concern at Load Line 2

Analyte	Maximum Detected Concentration	
	Sediment (mg/kg)	Surface Water (mg/L)
Aluminum	16400	1.3
Antimony	9.5	0.015
Arsenic	18.7	ND
Cadmium	0.79	0.00028
Copper	28.8	0.007
Lead	80.5	0.0044
Manganese	1150	0.151
Thallium	0.43	ND
2,4,6-Trinitrotoluene	0.27	0.0011
2,4-Dinitrotoluene	0.19	ND
RDX	ND	0.012
Benz(a)anthracene	1.25	ND
Benzo(a)pyrene	1.4	ND
Benzo(b)fluoranthene	2.3	ND
Dibenz(a,h)anthracene	0.135	ND
Indeno(1,2,3-cd)pyrene	1.045	ND

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
ND = Not Detected

Table 2-3. Maximum Concentrations of Chemicals of Concern at Load Line 3

Analyte	Maximum Detected Concentration	
	Sediment (mg/kg)	Surface Water (mg/L)
Aluminum	11000	0.68
Antimony	18.2	0.0025
Arsenic	19	0.0047
Barium	87.2	0.08
Cadmium	3.5	ND
Lead	91.6	ND
Manganese	692	7.8
Thallium	0.32	ND
2,4,6-Trinitrotoluene	0.65	ND
PCB-1254	0.18	ND

PCB = Polychlorinated Biphenyl
ND = Not Detected

Table 2-4. Maximum Concentrations of Chemicals of Concern at Load Line 4

Analyte	Maximum Detected Concentration	
	Sediment (mg/kg)	Surface Water (mg/L)
Aluminum	16500	1.1
Arsenic	16	0.0071
Lead	27.7	0.0029
Manganese	786	3.6
Thallium	2.7	ND

ND = Not Detected

THIS PAGE INTENTIONALLY LEFT BLANK.

3.0 HAZARD/RISK ANALYSIS

The purpose of the task hazard/risk analysis is to identify and assess potential hazards that may be encountered by personnel and prescribe required controls. Table 3-1 presents a general checklist of hazards that may be posed by this project and indicates whether a particular major type of hazard is present. If additional tasks or significant hazards are identified during the fieldwork, this document will be modified by addendum or field change order to include the additional information.

Table 3-1. Hazards Inventory

Yes	No	Hazard
	X	Confined space entry
	X	Excavation entry
	X	Heavy equipment (drill rig, Geoprobe, skidsteer)
	X	Fire and explosion (fuels)
	X	Electrical shock (utilities and tools)
X		Exposure to chemicals (contaminants and chemical tools)
X		Temperature extremes
X		Biological hazards (poison ivy, Lyme disease, West Nile disease)
	X	Radiation or radioactive contamination
	X	Noise (drill rig, chain saw, pressure washer)
X		Drowning (Kelly's Pond at Load Line 2 only)
	X	ACM
X		MEC (potential to encounter UXO) (Load Line 1 MRS only)

ACM = Asbestos Containing Material
MEC = Munitions and Explosives of Concern
MRS = Munitions Response Site
UXO = Unexploded Ordnance

Specific tasks are as follows:

- Site mobilization and demobilization;
- Site walk and/or civil survey;
- Sediment or surface water sampling using hand augers, scoops, or sediment sampler on foot and from a boat;
-
- Vegetation clearing with machetes and loppers, as required;
- IDW handling and disposition; and
- Equipment decontamination.

3.1 POTENTIAL EXPOSURES

Prior sampling results indicate that the chemicals of potential concern (COPCs) at the AOCs are as follows:

- Metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, and thallium);
- Polychlorinated biphenyls (PCBs);
- Polycyclic aromatic hydrocarbons (PAHs) [such as benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene]; and
- Explosives (RDX, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene).

Table 3-2 contains information on the potential contaminants, as well as chemicals that will be used for the project. It is important to note that the contaminants listed in Table 3-2 have been detected in a number of locations at the former RVAAP and might be expected to occur at any former operations area. Exposure to chemical tools, such as corrosive sample preservatives, is a possibility and will be controlled through standard safe handling practices.

3.2 TASK-SPECIFIC HAZARD ANALYSIS

Table 3-3 presents task-specific hazards, relevant hazard controls, and required monitoring, if appropriate, for all of the planned tasks.

Table 3-2. Potential Exposures

Chemical	TLV[a]/PEL/REL/STEL/IDLH	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)[b]
Hydrochloric acid (potentially used to preserve water samples or for equipment decontamination)	TLV: 2 ppm ceiling NIOSH REL: 5 ppm (7 mg/m^3) ceiling OSHA PEL: 5 ppm (7 mg/m^3) ceiling IDLH: 50 ppm	Irritation of eyes, skin, respiratory system	Liquid; VP: fuming; IP: 12.74 eV; FP: none	Inhalation Ingestion Contact
Nitric acid (potentially used to preserve water samples)	TLV/TWA: 2 ppm OSHA PEL/TWA: 2 ppm NIOSH STEL/TWA: 4 ppm IDLH: 25 ppm	Irritation of eyes, skin, respiratory system; dental erosion	Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor; IP: 11.95 eV; VP: 48 mm	Inhalation Ingestion Contact
Sulfuric acid (potentially used to preserve water samples)	TLV/TWA: 0.2 mg/m^3 OSHA PEL/TWA: 1 mg/m^3 NIOSH REL/TWA: 1 mg/m^3 NIOSH STEL: 3 mg/m^3 IDLH: 15 mg/m^3	Irritation of eyes, skin, nose, throat, respiratory system; dental erosion; eye, skin burn; dermatitis	Colorless to dark brown, oily, odorless liquid; VP: 0.001 mm; FP: none; IP: none	Inhalation Ingestion Contact
Sodium hydroxide (potentially used to preserve water samples)	TLV: 2 mg/m^3 ceiling OSHA PEL/TWA: 2 mg/m^3 NIOSH REL/TWA: 2 mg/m^3 IDLH: 10 mg/m^3	Irritation of eyes, skin, respiratory system	Colorless to white, odorless solid. VP: 0 mm; VP: NA	Inhalation Ingestion Contact
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 200 ppm (491 mg/m^3) OSHA PEL/TWA: 400 ppm (980 mg/m^3) NIOSH REL/TWA: 400 ppm (980 mg/m^3) NIOSH STEL: 500 ppm (1,225 mg/m^3) IDLH: 2,000 ppm (10% LEL)	Irritation of eyes, skin, respiratory system; drowsiness; headache	Colorless liquid with alcohol odor; VP: 33 mm; IP: 10.10 eV; FP: 53°F	Inhalation Ingestion Contact

Table 3-2. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)[b]
Gasoline (used for fuel)	TLV/TWA: 300 ppm, A3 IDLH: Ca	Potential carcinogen per NIOSH, dizziness, eye irritation, dermatitis	Liquid with aromatic odor FP: -45°F; VP: 38-300 mm	Inhalation Ingestion Absorption Contact
Liquinox (used for decontamination)	TLV/TWA: None	Inhalation may cause local irritation to mucus membranes	Yellow odorless liquid (biodegradable cleaner); FP: NA	Inhalation Ingestion
Antimony (potential contaminant)	TLV/TWA: 0.5 mg/m³ OSHA PEL/TWA: 0.5 mg/m³) NIOSH REL/TWA: 0.5 mg/m³ IDLH: 50 mg/m³	Dust explosion possible if in powder or granular form, mixed with air	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder	Inhalation Ingestion Contact
Aluminum	TLV/TWA: 15 mg/m³ (1 mg/m³-resp.) OSHA PEL/TWA: 15 mg/m³ (5 mg/m³ – resp.) NIOSH REL: 10 mg/m³ (5 mg/m³ – resp.) IDLH: Not Determined	The substance is irritating to the eyes, skin, and respiratory tract	Silvery-white, malleable, ductile, odorless metal; combustible solid, finely divided dust easily ignited; may cause explosions FP: NA, IP: NA	Inhalation Contact
Arsenic	TLV/TWA: 0.01 mg/m³, A1 OSHA PEL/TWA: 0.010 mg/m³ NIOSH REL: 0.002 mg/m³ ceiling (15 minute) Ca IDLH: 5 mg/m³	Potential carcinogen per NIOSH, ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation	Silver-gray or tin-white, brittle, odorless solid FP: NA; IP: NA	Inhalation Absorption Ingestion Contact
Barium (potential contaminant)	TLV/TWA: 0.5 mg/m³ OSHA PEL/TWA: 0.5 mg/m³ NIOSH REL/TWA: 0.5 mg/m³ IDLH: 1,100 mg Ba/m³	The substance is irritating to the eyes, the skin, and the respiratory tract; exposure could cause hypokalaemia, resulting in cardiac disorders and muscular disorders. Exposure may result in death	White, odorless solid. Noncombustible solid, but will accelerate the burning of combustible materials	Inhalation Ingestion Contact

Table 3-2. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)[b]
Cadmium	TLV/TWA: 0.01 mg/m³, A2 NIOSH REL: Ca *[footnote: Potential occupational carcinogen]* OSHA PEL/TWA: 0.005 mg/m^3 IDLH: 9 mg/m^3 (as Cd) (Ca)	Potential occupational carcinogen per NIOSH (prostatic and lung cancer); may cause pulmonary edema, Breathing difficulty, cough, chest tightness, pain beneath the sternum, headache, chills, aches, vomiting, diarrhea; loss of the sense of smell, emphysema, proteinuria, mild anemia	Silver-white, blue-tinged lustrous, odorless solid; noncombustible solid in bulk form but will burn in powder form Solid; VP: 0 mmHg; FP: NA	Inhalation Ingestion
Chromium (potential contaminant)	TLV/TWA: 0.5 mg/m^3 OSHA PELTWA: 1 mg/m^3 NIOSH REL/TWA: 0.5 mg/m^3 IDLH: 250 mg Cr/m^3	Irritation eyes, skin; lung fibrosis (histologic)	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid	Inhalation Ingestion Contact
Copper	TLV/TWA: 1 mg/m^3 NIOSH REL/TWA: 1 mg/m^3 (as Cu) OSHA PEL/TWA: 1 mg/m^3 (as Cu) IDLH: 100 mg/m^3 (as Cu)	The substance is irritating to eyes, nose, pharynx; may cause nasal septum perforation; metallic taste; dermatitis; liver, kidneys (increased risk with Wilson's disease)	Reddish, lustrous, malleable, odorless solid; noncombustible solid in bulk form, but powdered form may ignite FP: NA, IP: NA	Inhalation Ingestion Contact
Dinitrotoluene (potential contaminant)	TLV/TWA: 0.2 mg/m^3, A3 OSHA PEL/TWA: 1.5 mg/m^3 NIOSH REL/TWA: Ca 1.5 mg/m^3 IDLH: Not listed	Suspected human carcinogen, anorexia, anemia, cyanosis, reproductive effects; liver damage	Orange-yellow solid; VP:1 mmHg; FP: 404°F	Inhalation Absorption Ingestion Contact

Table 3-2. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)[b]
Lead (potential contaminant)	TLV/TWA: 0.050 mg/m^3, A3 NIOSH REL/TWA (8-hour): 0.050 mg/m^3 OSHA PEL/TWA (1910.1025): 0.050 mg/m^3 IDLH: 100 mg/m^3 (as Pb)	Weakness, exhaustion; insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain; anemia; tremor; paralysis wrist, ankles; kidney disease; irritation eyes; main target is the nervous system	A heavy, ductile, soft, gray solid	Ingestion Inhalation Contact
Manganese (potential contaminant)	TLV/TWA (inhalable): 0.1 mg/m^3 TLV/TWA (resp): 0.02 mg/m^3 OSHA PEL/Ceiling: 5 mg/m^3 NIOSH REL/TWA: 1.0 mg/m^3 NIOSH STEL: 3.0 mg/m^3 IDLH: 500 mg/m^3	Hazardous in case of inhalation; slightly hazardous in case of skin contact (irritant), eye contact (irritant), or ingestion	Solid; properties vary depending upon specific compound	Inhalation Ingestion Contact
PCBs (potential contaminant)	TLV/TWA: 0.5 mg/m^3, A3 OSHA PEL/TWA 0.5 mg/m^3 NIOSH REL*/TWA: Ca 0.001 IDLH: Ca 5 mg/m^3	Repeated or prolonged contact with skin may cause dermatitis; chloracne is the most visible effect; may have effects on the liver; animal tests show that this substance possibly causes toxic effects upon human reproduction	Light yellow viscous liquid	Inhalation Ingestion Contact
PAHs (potential contaminant): Benzo(a)pyrene	TLV: Controlled as low as possible, A2 OSHA PEL: 0.2 mg/m^3 IDLH: Not determined	Suspected human carcinogen	PAHs are typically colorless, white, or pale yellow-green solid	Inhalation Ingestion Contact

Table 3-2. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)[b]
SVOCs: Bis(2-ethylhexyl)phthalate (potential contaminant)	TLV/TWA: 5 mg/m³, A3 OSHA PEL: 5 mg/m³ NIOSH REL/TWA: 5 mg/m³ NIOSH STEL: 10 mg/m³ IDLH: 5,000 mg/m³	It exhibits low toxicity from acute (short-term) and chronic (long-term) exposures; acute exposure to large oral doses of DEHP can cause gastrointestinal distress in humans; no information is available on the chronic, reproductive, developmental, or carcinogenic effects of DEHP in humans	Colorless liquid with almost no odor	Inhalation Ingestion Contact
Thallium (potential contaminant)	NIOSH REL/TWA: 0.1 mg/m³ OSHA PEL/TWA: 0.1 mg/m³ IDLH 15 mg/m³	Properties vary depending upon the specific soluble thallium compound	Appearance and odor vary depending upon the specific soluble thallium compound	Inhalation Ingestion Contact
Trinitrotoluene (potential contaminant)	TLV/TWA: 0.1 mg/m³ OSHA PEL: 1.5 mg/m³ NIOSH REL/TWA: 0.5 mg/m3 IDLH: Not listed	Irritation of skin and mucus membranes, liver damage, kidney damage; jaundice; cyanosis; sneezing, coughing, sore throat; peripheral neuritis, muscle pain; cardiac irregularities; cataracts; sensitization dermatitis; leukocytosis, anemia	Colorless to pale yellow, odorless solid; FP: explodes; VP: 0.05 mmHg	Inhalation Absorption Ingestion Contact

[a]From ACGIH 2015, *Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices*.
[b]From *NIOSH Guide to Chemical Hazards* web site.

A1 = Confirmed Human Carcinogen
A2 = Suspected Human Carcinogen
A3 = Not Classifiable as a Human Carcinogen
Ca = Potential Occupational Carcinogen
DEHP = Di(2-ethylhexyl)phthalate
eV = Electron Volt
FP = Flash Point
IDLH = Immediately Dangerous to Life and Health
IP = Ionization Potential
mm = Millimeters
mg/m³ = Milligrams per Cubic Meter
NA = Not Applicable
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
PEL = Permissible Exposure Limit
ppm = Parts per Million
REL = Recommended Exposure Limit
STEL = Short-Term Exposure Limit
TLV = Threshold Limit Value
TWA = Time-Weighted Average
VP = Vapor Pressure

Table 3-3. Activity Hazard Analysis

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Site Mobilization and Demobilization
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Risk Assessment Code (RAC): M

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, and long pants.

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	L
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks, if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L
	Contact with MEC	Any investigation work within a MRS will follow MEC avoidance protocol. MEC avoidance will be conducted in MRS by a UXO technician. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring – visual surveys for ordnance by UXO technician. Instrument surveys by UXO technician in MRS.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Site Mobilization and Demobilization

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 "Manual Lifting" to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L
	Slips, trips, and falls	Clean and organized work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L
	Struck by moving/mobile equipment or vehicle	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment and vehicles. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times.	M
Vehicle Operation	Vehicle accidents	Compliance with Engineering Solutions EH&S Procedure 110, Vehicle Operation. Vehicle operation (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). Visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, speedometer, fuel gage, horn, windshield, windshield wiper, defrosting/defogging system, rear view mirror, cab, non-slip surfaces on steps, and tires (approximately proper inflation). While driving on Camp Ravenna, facility personnel shall take necessary precautions to avoid hitting deer. Observe and maintain posted speed limits for both day and night driving conditions.	L

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles General hand tools, if necessary	Daily safety inspections of operations; initial and at least weekly inspections of equipment All tools must be inspected daily and taken out of service if damaged Daily vehicle inspection	Properly trained personnel to operate equipment Valid driver's licenses Site-specific training, including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-3. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): M

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Site Walk and/or Visual Survey
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, nitrile or similar gloves to handle potentially contaminated material, and long pants. Tyvek can be used in tall grassy or brush areas.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L
	Contact with MEC	Any investigation work within a MRS will follow MEC avoidance protocol. MEC avoidance will be conducted in MRS by a UXO technician and will accompany site walk participants. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring – visual surveys for ordnance by UXO technician. Instrument surveys by UXO technician in MRS.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Site Walk and/or Visual Survey

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Struck by moving/mobile equipment or vehicle	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment and vehicles. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times.	M
	Slips, trips, and falls	Clean and organized work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L
Vehicle Operation	Vehicle accidents	Compliance with Engineering Solutions EH&S Procedure 110, Vehicle Operation. Vehicle operation (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, speedometer, fuel gage, horn, windshield, windshield wiper, defrosting/defogging system, rear view mirror, cab, non-slip surfaces on steps, and tires (approximately proper inflation). While driving on Camp Ravenna, facility personnel shall take necessary precautions to avoid hitting wildlife. Observe and maintain posted speed limits for both day and night driving conditions.	L

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles	Daily safety inspections of operations; initial and at least weekly inspections of equipment Daily vehicle inspection	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate equipment Valid driver's licenses Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016

Project: RVAAP PBA 2013 SAP Addendum Activities

Job: Sediment or Surface Water Sampling Using Hand Augers, Scoops, or Sediment Sampler on Foot

Prepared By: Rich Sprinzl, P.E., Leidos

Reviewed By: Mike Crenshaw, Leidos

Risk Assessment Code (RAC): M

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, nitrile or similar gloves to handle potentially contaminated material, and long pants.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L
	Contact with MEC	Any investigation work within a MRS will follow MEC avoidance protocol. MEC avoidance will be conducted in MRS by a UXO technician and will accompany site walk participants. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring – visual surveys for ordnance by UXO technician. Instrument surveys by UXO technician in MRS.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Sediment or Surface Water Sampling Using Hand Augers, Scoops, or Sediment Sampler on Foot

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Struck by moving/mobile equipment or vehicle	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment and vehicles. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 “Manual Lifting” to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L
	Slips, trips, and falls	Clean and organize work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L
Sediment Sampling	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Staying upwind of any dust-generating activities. Minimal contact. Hazard communication training. MSDS for chemical tools on-site. Chemical containers labeled to indicate contents and hazard. HAZWOPER training and medical clearance for hazardous waste work. Decontamination of potentially contaminated equipment prior to servicing. Monitoring – PID or other sampling as appropriate.	L
Shipping and Packing Samples	Hazardous material shipping/transportation regulatory violation or spill (soil and water samples)	Ensure DOT/IATA compliance if shipping chemicals or other hazardous materials or samples. Hazardous materials shippers must be trained and certified.	L

Equipment to be Used	Inspection Requirements	Training Requirements
Sampling equipment if necessary	All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-3. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): M

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Surface Water and Sediment Collection from a Boat
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Recommended Protective Clothing & Equipment:
Level D PPE – Personal flotation devices, safety glasses, safety shoes, nitrile or similar gloves to handle potentially contaminated material, and long pants.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L
	Contact with MEC	Any investigation work within a MRS will follow MEC avoidance protocol. MEC avoidance will be conducted in MRS by a UXO technician and will accompany site walk participants. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring – visual surveys for ordnance by UXO technician. Instrument surveys by UXO technician in MRS.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Surface Water and Sediment Collection from a Boat

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 “Manual Lifting” to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L
	Slips, trips, and falls	Clean and organize work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L
Operating Boat	General safety hazards	Boat operator must be trained and experienced. Daylight operations only.	M
	Drowning	Operations between sunrise and sunset only. Check weather prior to each day of operations and stop work if a chance of small boat warning conditions or lightning. Trip plan and POC ashore familiar with plan and return time if out of site of POC. 100% communications capability with ashore POC and hourly safety checks (radio, cell, or satellite telephone) if out of site of POC. Throw ring or throw bag with line. USCG III PFD for each person. Throwable floatation shall be thrown to person in water and they shall be drawn alongside the boat and assisted into the boat. Caution must be taken to prevent tipping of the boat.	H
	Hypothermia	Each person aboard will have a change of clothes in waterproof container ashore. Rescue blanket ashore. Personnel will not wear cotton clothing aboard boat. Boats will not be used if there is a chance of rain and air temps are below 50°F. Boats will not be used if combined air and water temps equal to or above 100 unless waterproof suits are used.	M

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Surface Water and Sediment Collection from a Boat

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Slips, trips, and falls aboard	Footwear will have suitable soles for boat use (no lugged soles). All equipment and gear shall be stowed in an orderly manner and out of the way of foot traffic. Each person shall have a secure seat. No standing while boat is traveling.	M
	Capsize	No standing or walking upright until boat is secured.	H
Sediment and Water Sampling	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Staying upwind of any dust-generating activities. Minimal contact. Hazard communication training. MSDS for chemical tools on-site. Chemical containers labeled to indicate contents and hazard. Medical clearance for hazardous waste work. Decontamination of potentially contaminated equipment prior to servicing. Monitoring – PID or other monitoring as appropriate.	L
	Operating hand tools	Clean and organize work areas, keeping walkways and working areas clear.	L
	Drowning	Operations between sunrise and sunset only. Check weather prior to each day of operations and stop work if a chance of small boat warning conditions or lightning. Trip plan and POC ashore familiar with plan and return time if out of site of POC. 100% communications capability with ashore POC and hourly safety checks (radio, cell, or satellite telephone) if out of site of POC. Throw ring or throw bag with line. USCG III PFD for each person. Throwable floatation shall be thrown to person in water and they shall be drawn alongside the boat and assisted into the boat. Caution must be taken to prevent tipping of the boat.	H
	Hypothermia	Each person aboard will have a change of clothes in waterproof container ashore. Rescue blanket ashore. Personnel will not wear cotton clothing aboard boat. Boats will not be used if there is a chance of rain and air temps are below 50°F. Boats will not be used if combined air and water temps equal to or above 100 unless waterproof suits are used.	M

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Surface Water and Sediment Collection from a Boat

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
	Slips, trips, and falls aboard	Footwear will have suitable soles for boat use (no lugged soles). All equipment and gear shall be stowed in an orderly manner and out of the way of foot traffic. Each person shall have a secure seat. No standing while boat is traveling.	M
	Capsize	No standing to sample. Stay low at all times unless boat is stable enough to walk without rocking.	M

Equipment to be Used	Inspection Requirements	Training Requirements
Paddle boat Sampling equipment	Daily safety inspections of operations; initial and at least weekly inspections of boat All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate boat Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-3. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): M

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Vegetation Clearing with Machetes, and Loppers
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, nitrile or similar gloves to handle vegetation, and long pants.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L
	Contact with MEC	Any investigation work within a MRS will follow MEC avoidance protocol. MEC avoidance will be conducted in MRS by a UXO technician and will accompany site walk participants. Avoid areas or withdraw all personnel from area, as directed by UXO technician, if ordnance or suspected ordnance is discovered. Monitoring – visual surveys for ordnance by UXO technician. Instrument surveys by UXO technician in MRS.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Vegetation Clearing with Machetes, and Loppers

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 “Manual Lifting” to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L

Equipment to be Used	Inspection Requirements	Training Requirements
Machetes and loppers	Daily safety inspections of operations All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate tools Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

Table 3-3. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): M

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: IDW Handling
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, nitrile or similar gloves to handle potentially contaminated material, and long pants.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: IDW Handling

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Struck by moving/mobile equipment or vehicle	Workers will maintain a safe distance equivalent to the full, extended reach of all moving/mobile equipment and vehicles. Approach mobile/moving equipment only after getting permission of the operator. Maintain visual contact with equipment operators at all times.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 "Manual Lifting" to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L
	Slips, trips, and falls	Clean and organized work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles Fork trucks, bobcats, and trucks, if necessary Hand tools	Daily vehicle inspection Daily safety inspections of operation; initial and at least weekly inspections of equipment All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Properly trained personnel to operate equipment Valid driver's licenses Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel

Table 3-3. Activity Hazard Analysis (continued)

Risk Assessment Code (RAC): M

Date Prepared: January 12, 2016
Project: RVAAP PBA 2013 SAP Addendum Activities
Job: Equipment Decontamination (Soap and Water Washing, HCl, and Isopropanol Rinse)
Prepared By: Rich Sprinzl, P.E., Leidos
Reviewed By: Mike Crenshaw, Leidos

Recommended Protective Clothing & Equipment:
Level D PPE – Safety glasses, safety shoes, nitrile or similar gloves to handle potentially contaminated material, and long pants.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Biological hazards (bees, mosquitoes, ticks, Lyme disease, poisonous plants, wasps, and snakes)	Level D PPE. Use insect repellant and permethrin clothing treatment. Pant legs closed with tape to minimize tick entry or contact with harmful plants. Inspect for ticks during the day and at the end of each work day (see FWSHP Section 10.18). Protective ointments like Ivy Block and/or specialized cleaners like Technu if working in areas with poisonous plants. Site-specific instruction to recognize and avoid harmful plants and/or animals.	M
	Temperature extremes	Administrative controls (see FWSHP Section 9.0). Heat stress controls at 80°F. Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area and unscheduled breaks if needed (see FWSHP Section 9.0). Chilled water if temperature exceeds 70°F. Monitoring – ambient temperature measurements at least twice daily. Temperatures greater than 85°F, temperatures less than 30°F, and the use of impermeable clothing require additional controls (see FWSHP Section 9.0). Site- and season-specific instruction in weather hazards and hazard controls.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016

Project: RVAAP PBA 2013 SAP Addendum Activities

Job: Equipment Decontamination (Soap and Water Washing, HCl, and Isopropanol Rinse)

Job Steps	Hazards	Actions to Eliminate or Minimize Hazards	RAC
General	Exposure to chemicals	Wash face and hands and any other exposed areas prior to taking anything by mouth. HAZWOPER training and medical clearance.	L
	Electric shock	GFCIs for electrical equipment/tools used in decontamination. Inspect electrical equipment for damaged or missing insulation and remove unsafe equipment from use.	L
	Severe weather	Check weather prior to departure and reschedule if severe weather is forecasted. In case of severe weather, all personnel will move to a designated safe location if time permits. Suspend fieldwork if tornado warning issued. Suspend work from first evidence of lightning at least 30 minutes after the last sighting of lightning and/or last sound of thunder. Do not work in areas subject to flash flooding.	M
	Lifting injuries	Compliance with Engineering Solutions EH&S Procedure 150 “Manual Lifting” to limiting individual lifts by Leidos personnel to 50 pounds. Verification/observation of lifting by Leidos personnel by FM.	L
	Slips, trips, and falls	Clean and organized work areas, keeping walkways and working areas clear, including snow, ice, and standing water.	L
Equipment Decontamination	Hot water, slips, falls, and equipment handling	Level D PPE (see Section 6.0) plus nitrile gloves.	M
	Fire (decontamination solvents)	Flammable material stored in original containers or in safety containers labeled/listed by a nationally recognized testing laboratory. Fire extinguisher kept near decontamination area and inspected monthly. No ignition sources within 50 ft of areas where flammable materials are stored or used for decontamination.	M
	Exposure to chemicals	PPE (Level D) plus nitrile or equivalent gloves for contact with contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact. When using volatile chemicals, work should be performed under conditions of adequate ventilation. Hazard communication training for chemical tools. MSDS on-site. All chemical containers labeled to indicate contents and hazard. Suitable facilities/equipment for flushing eyes of harmful chemicals.	L

Table 3-3. Activity Hazard Analysis (continued)

Date Prepared: January 12, 2016

Project: RVAAP PBA 2013 SAP Addendum Activities

Job: Equipment Decontamination (Soap and Water Washing, HCl, and Isopropanol Rinse)

Equipment to be Used	Inspection Requirements	Training Requirements
Hand tools	Daily safety inspections of operations; initial and at least weekly inspections of equipment Daily test of GFCIs All tools must be inspected daily and taken out of service if damaged	HAZWOPER 40-hr training and current refresher training Medical clearance Site-specific training including site hazard communication training CPR and first aid training for at least two on-site personnel and at least one person per field team

CPR = Cardiopulmonary Resuscitation
dB = Decibel
DOT = U.S. Department of Transportation
EH&S = Environmental Health and Safety
FM = Field Manager
FWSHP = Facility-Wide Safety and Health Plan
GFCI = Ground Fault Circuit Interrupter
HAZWOPER = Hazardous Waste Operations
IATA = International Air Transport Association
MEC = Munitions and Explosives of Concern
MRS = Munitions Response Site
MSDS = Material Safety Data Sheet
PFD = Personal Flotation Device
PID = Photoionization Detector
POC = Point of Contact
PPE = Personal Protective Equipment
RAC = Risk Assessment Code
USCG = U.S. Coast Guard
UXO = Unexploded Ordnance

4.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This section presents the personnel (and their associated telephone numbers) responsible for site safety and health and emergency response. Table 4-1 identifies Leidos and Subcontractor staff who will fill key roles. See the FWSHP for information on the roles and responsibilities of key positions.

Table 4-1. Staff Organization

Position	Name	Phone
Leidos Health and Safety Manager	Stephen H. Lowery, CIH	(405) 701-3158 C: (405) 919-4176
Leidos Environmental & Civil Infrastructure Operation Health and Safety Manager	Michael Crenshaw	(865) 481-4767 C: (865) 406-2659
Leidos Project Manager	Vasu Peterson, P.E.	703-676-8736 C: 703-624-2936
Leidos FM[a]	Heather Adams, P.G.	(330) 405-5814 C: (330) 573-8571
Leidos SSHO	Heather Adams, P.G.	(330) 405-5814 C: (330) 573-8571
Subcontractor Waste Disposal	TBD	TBD

[a]FM is equivalent to the Field Operations Manager in the FWSHP (USACE 2011a).
The Leidos SSHO will be SSHO for all sampling activities.
CIH = Certified Industrial Hygienist
FM = Field Manager
P.E. = Professional Engineer
P.G. = Professional Geologist
SSHO = Site Safety and Health Officer
TBD = To Be Determined

THIS PAGE INTENTIONALLY LEFT BLANK.

5.0 TRAINING

Training requirements, from Section 5.0 of the FWSHP, are summarized in Tables 3-3 and 5-1.

Table 5-1. Training Requirements

Training	Worker	Leidos FM and SSHO	Site Visitor
HAZWOPER (40-hr, 3-day on-the-job training)	√	√	√
HAZWOPER Annual Refresher (8 hr)	√	√	√
HAZWOPER Supervisors Training (8 hr)	—	√	—
CPR and First Aid Training (required for two personnel and a minimum of one person per)	√	√	—
General Hazard Communication Training	√	√	√
Respiratory Protection Training (required only if respirators are worn)	—	—	—
Hearing Conservation Training (for workers in hearing conservation program)	√	√	—
Pre-entry Briefing	√	√	√
Site-specific Hazard Communication (contained in pre-entry briefing)	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	√
Equipment-specific Training (Equipment Operators)	—	—	—

— = Not required
√ = Required.
CPR = Cardiopulmonary Resuscitation
FM = Field Manager
HAZWOPER = Hazardous Waste Operations
SSHO = Site Safety and Health Officer

THIS PAGE INTENTIONALLY LEFT BLANK.

6.0 PERSONAL PROTECTIVE EQUIPMENT

General guidelines for selection and use of PPE are presented in Section 6.0 of the FWSHP. Specific PPE requirements for this work are presented in Table 3-3, Activity Hazard Analyses (AHAs).

THIS PAGE INTENTIONALLY LEFT BLANK.

7.0 MEDICAL SURVEILLANCE

Medical surveillance requirements, as presented in Section 7.0 of the FWSHP, are summarized in Table 7-1. The Leidos SSHO will verify that on-site Subcontractor employees have the required medical clearances for their respective medical surveillance programs.

Table 7-1. Medical Surveillance Requirements

Baseline	Routine	Overexposure	Termination
Prior to work assessment	Every 12 months, unless greater frequency is deemed appropriate by attending physician; not to exceed 2-year interval	Upon developing symptoms or where exposure limits have been exceeded or suspected to have been exceeded	Upon termination or re-assignment

THIS PAGE INTENTIONALLY LEFT BLANK.

8.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Most of the PBA 2013 field activities are not expected to pose airborne exposure hazards for the following reasons:

- Work will be performed in open areas with natural ventilation.
- Heavy equipment will not be used; therefore, no airborne dust or noise monitoring will be necessary.
- Sampling will be limited to wet sediment and surface water.
- Prior site sampling indicated that contaminant concentrations are unlikely to pose an airborne hazard. If a general evaluation of an AOC is being conducted, where the chemicals of concern (COCs) have not been previously identified, then monitoring based on previous AOC usage will be performed during the sampling activities.
- The most probable contaminants are metals, semivolatile organic compounds (SVOCs) (including PAHs) and explosives. Exposure to these chemicals can be controlled through dust suppression techniques.

Air monitoring of the breathing zone using a photoionization detector (PID) or equivalent is not anticipated. However, the SSHO will examine site conditions and contact the Leidos Field Manager and initiate monitoring if there is any indication of potential airborne exposure.

THIS PAGE INTENTIONALLY LEFT BLANK.

9.0 HEAT/COLD STRESS MONITORING

General requirements for heat/cold stress monitoring are contained in Section 9.0 of the FWSHP.

THIS PAGE INTENTIONALLY LEFT BLANK.

10.0 STANDARD OPERATING SAFETY PROCEDURES

Standard operating safety procedures are described in Section 10.7 of the FWSHP. All access roads and work areas within the project boundaries will be maintained free from soil that could cause a hazard or nuisance. Dust control will be maintained by keeping vehicles on improved roads, maintaining the posted speed limit, and applying water as required. Leidos will spray or mist water for dust control if airborne dust is observed. Water used for dust control will be clean (e.g., potable water obtained from an off-site source with approval of the Army National Guard [ARNG]/OHARNG Representative).

THIS PAGE INTENTIONALLY LEFT BLANK.

11.0 SITE CONTROL MEASURES

Site control measures are described in Section 11.0 of the FWSHP. No formal site control is expected to be necessary for this work, as the work areas are somewhat remote and bystanders are not anticipated. The facility has controlled access and only authorized personnel will be allowed to access the AOCs. If the SSHO determines that a potential exists for unauthorized personnel to approach within 25 ft of a work zone or otherwise be at risk due to proximity, then additional site controls will be established as described in Section 11.0 of the FWSHP.

THIS PAGE INTENTIONALLY LEFT BLANK.

12.0 PERSONNEL HYGIENE AND DECONTAMINATION

It is the SSHO's responsibility to verify that personnel hygiene and decontamination processes are adequate to protect personnel and meet the requirements of Sections 06.M and 28 of the *Safety and Health Requirements Manual* (USACE 2008). Personnel hygiene and decontamination requirements also are described in Section 11.0 of the FWSHP and in Section 3.0 of this Addendum.

All personnel will remove gloves and any other protective clothing once tasks are complete or when breaks are taken. Personnel also will wash hands and face prior to eating, drinking, or smoking. This step may be accomplished with soap and water or disposable disinfectant wipes. Specially formulated soap to cut oils from poisonous plants will be available for all site personnel to use as directed by the manufacturer.

THIS PAGE INTENTIONALLY LEFT BLANK.

13.0 EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility (Figures 16-3 and 16-4), and general procedures are provided in Section 13.0 of the FWSHP. Table 13-1 presents emergency telephone numbers used during normal working hours (Monday through Friday, 0800 to 1600). All on-site emergencies must be coordinated through **Camp Ravenna Range Control (614-336-6041)**, who will coordinate the response. If the injured worker can be moved, transporting the worker to the nearest Medical Transfer Point (Figure 16-2), or emergency medical services (EMS) entrance gate (Main Gate) will expedite the medical evacuation process. If the injured person cannot be moved, Leidos or the Subcontractor will post a signal person (time and resource permitting) at the nearest major intersection/road/medical transfer point to help guide emergency vehicles. The Leidos FM will remain in charge of all Leidos and Subcontractor personnel during emergency activities. Building 1036 will serve as the assembly point if it becomes necessary to evacuate the project sites (Figure 16-2). During mobilization, the Leidos FM will verify that the emergency information in this SSHP is correct.

Each field team will have a cellular telephone and/or a two-way radio capable of contacting Camp Ravenna Range Control and/or Main Gate for communications purposes.

During field operations, at least two on-site personnel will have cardiopulmonary resuscitation (CPR)/first aid training.

In the event of a spill, the procedures presented in the Update to Procedures to Follow as Related to the RVAAP Restoration Program due to the Accountability Transfer of the Remaining Property from the Base Realignment and Closure Division to the ARNG/OHARNG letter, dated 2 April 2014 and included as Appendix F of the FSP, will be followed and the Camp Ravenna First Responder form (included in Appendix A) will be completed.

Table 13-1. Emergency Telephone Numbers

Position	Telephone Number
Camp Ravenna Range Control (Police, Fire, Emergency Medical)	(614) 336-6041
Camp Ravenna Main Gate (outside CRJMTC duty hours)	(330) 358-2017
Hospital (Robinson Memorial, Ravenna)	(330) 297-0811/(330) 297-2850
WorkCare Clinic (Robinson Health Center, Streetsboro)	(330) 626-3455
WorkCare (for Leidos non-emergency care)	(888) 449-7787
Camp Ravenna Garrison Commander	(614) 336-6560
U.S. Army Representative Kevin Sedlak	Office: (614) 336-6000 x2053
Camp Ravenna Operation and Maintenance Contractor for site access requests Becky Haney, VISTA Sciences	Office: (330) 872-8010
USACE COR Quyet La	502-315-6892
Ohio EPA Rod Beals	Office: (330) 963-1218
Leidos Project Manager Vasu Peterson, P.E.	Office: (703) 676-8736 Cell: (703) 624-2936
Leidos Health and Safety Personnel Steve Lowery, CIH Mike Crenshaw Heather Adams, P.G.	 Office: (405) 242-6213 Cell: (405) 919-4176 Office: (865) 481-4767 Cell: (865) 406-2659 Office: (330) 405-5814 Cell: (330) 573-8571
Leidos FM and SSHO Heather Adams, P.G.	Office: (330) 405-5814 Cell: (330) 573-8571

CIH = Certified Industrial Hygienist
COR = Commanding Officer's Representative
CRJMTC = Camp Ravenna Joint Military Training Center
FM = Field Manager
Ohio EPA = Ohio Environmental Protection Agency
P.E. = Professional Engineer
P.G. Professional Geologist
SSHO = Site Safety and Health Officer
TBD = To Be Determined
USACE = U.S. Army Corps of Engineers

14.0 LOGS, REPORTS, AND RECORD KEEPING

Daily Safety Inspection, Daily Health and Safety Summary, Tailgate Safety Meeting Log, and USACE Accident Investigation Report forms are included in Appendix A of this SSHP. The Leidos FM (or SSHO) is responsible for completing these forms in accordance with the record keeping requirements listed in Section 14.0 of the FWSHP.

THIS PAGE INTENTIONALLY LEFT BLANK.

15.0 REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists) 2015. *Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices.* 2015.

USACE (U.S. Army Corps of Engineers) 2007a. *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste*, Engineer Regulation (ER)-385-1-92. May 2007.

USACE 2007b. *Safety and Health Requirements for Munitions and Explosives of Concern (MEC) Operations*, ER-385-1-95. March 2007.

USACE 2008. *Safety and Health Requirements Manual,* Engineer Manual (EM)-385-1-1. November 2008.

USACE 2011a. *Facility-Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* February 2011.

USACE 2011b. *Facility-Wide Field Sampling Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. February 2011.

THIS PAGE INTENTIONALLY LEFT BLANK.

16.0 FACILITY AND HOSPITAL MAPS

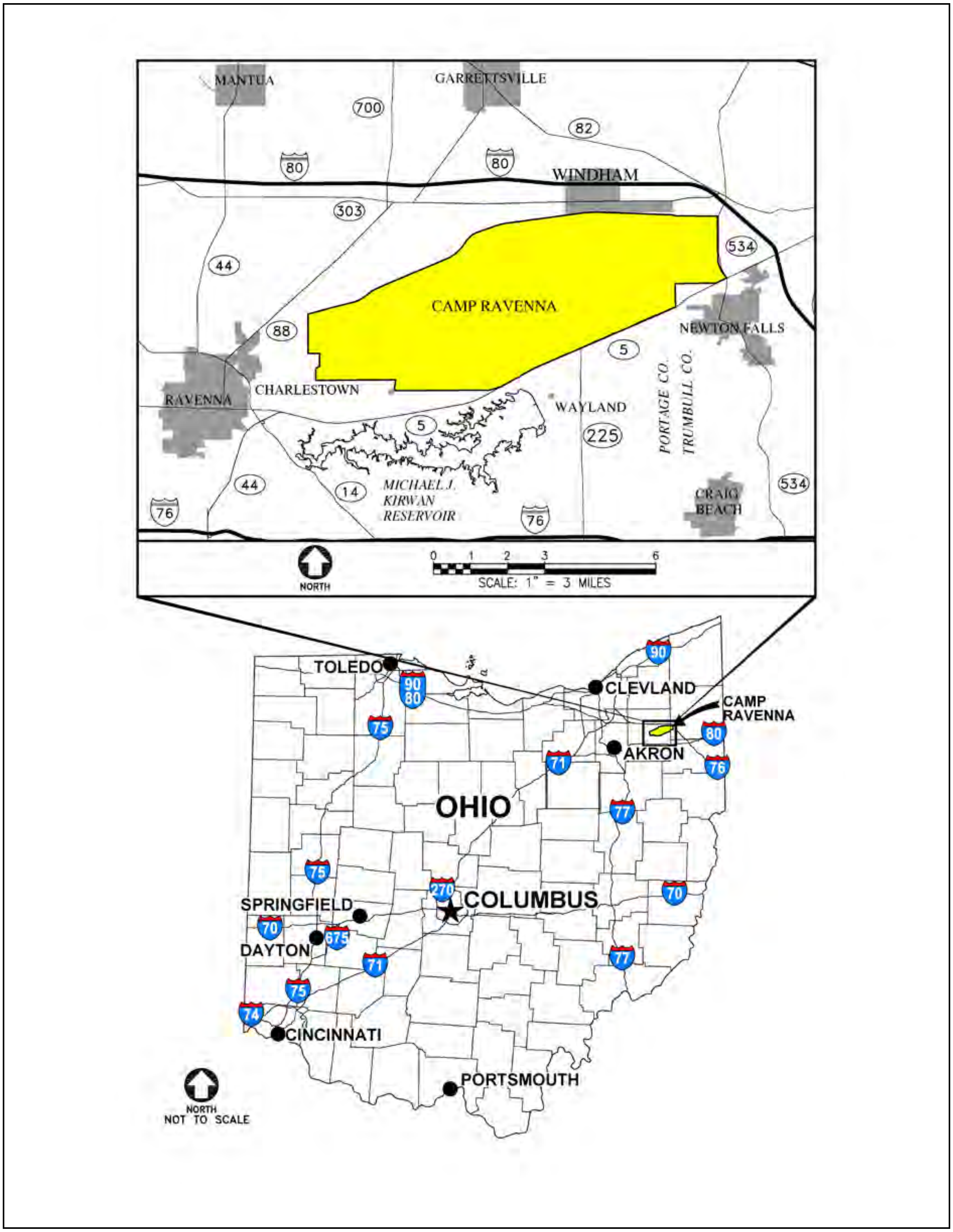


Figure 16-1. General Location and Orientation of Camp Ravenna

THIS PAGE INTENTIONALLY LEFT BLANK.

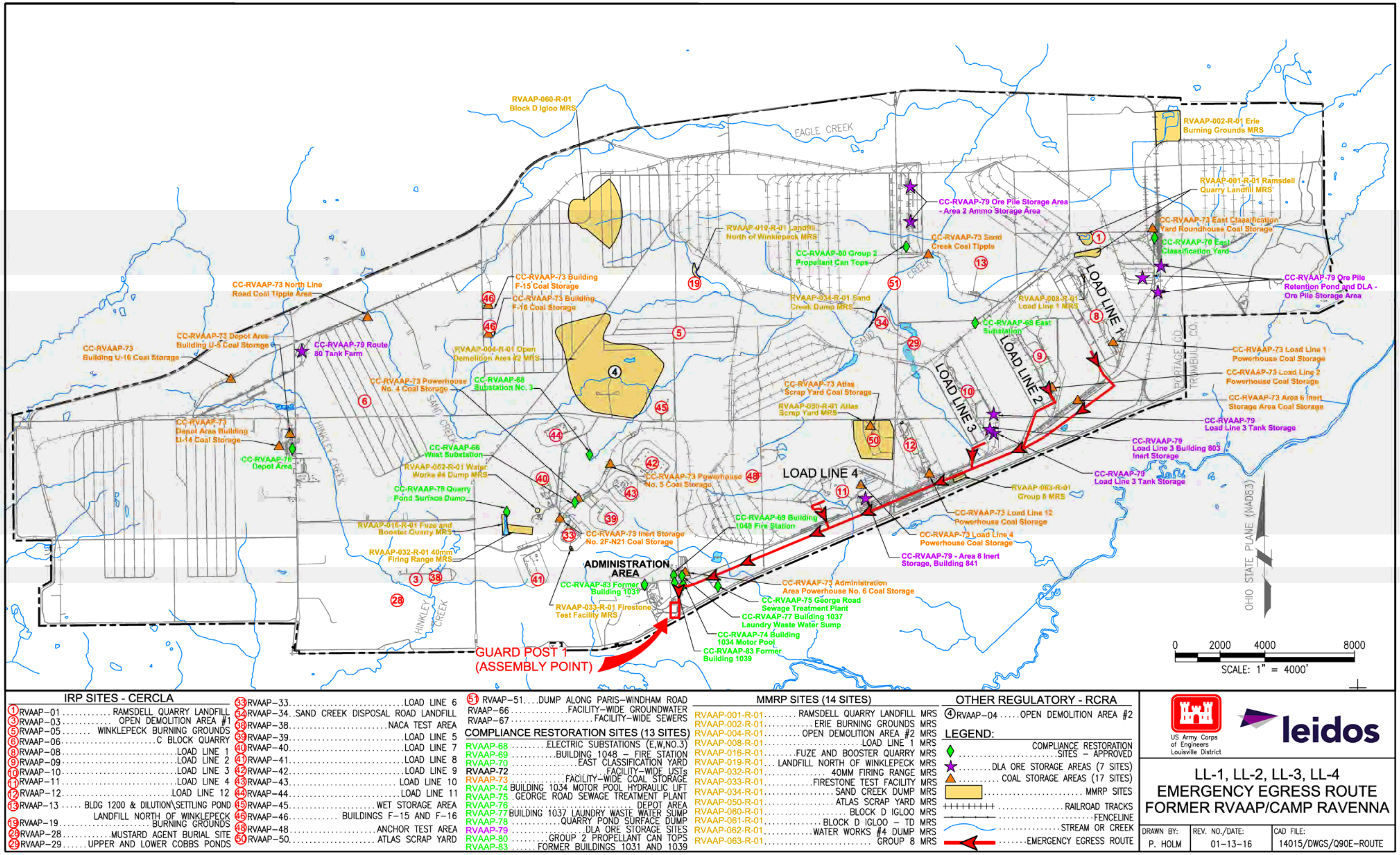


Figure 16-2. Camp Ravenna Site Map and Egress Route

THIS PAGE INTENTIONALLY LEFT BLANK.

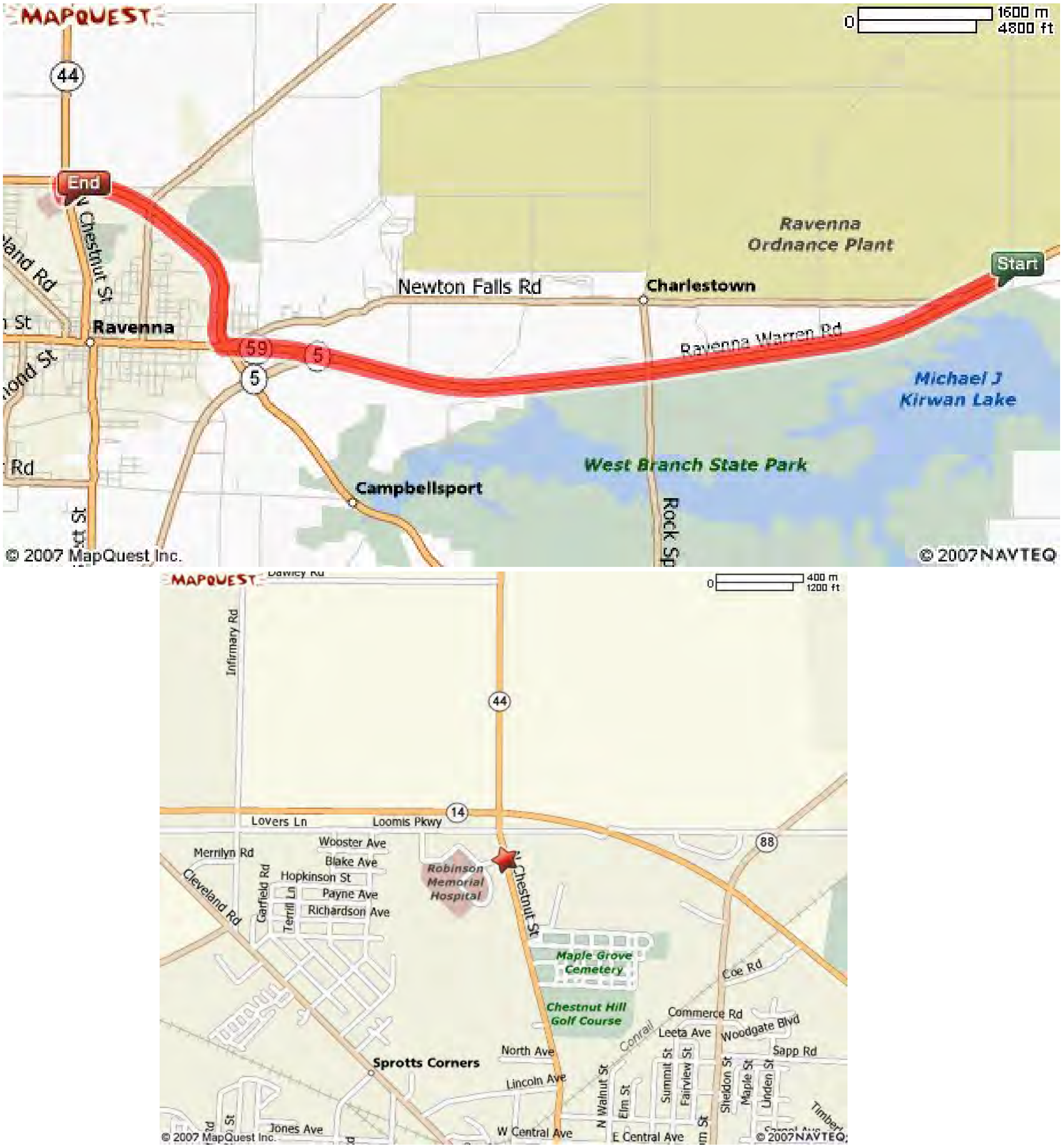


Figure 16-3. Route Map to Pre-Notified Medical Facility

Robinson Memorial Hospital
6847 N. Chestnut Street
Ravenna, Ohio
(330) 297-0811/ (330) 297-2850

Directions: West on State Route 5. Stay straight onto OH-59 West. Turn Right onto OH-14/OH-44. Turn Left onto North Chestnut St.

WorkCare Facility Information

This facility will be used for Leidos employee non-emergency care. Remember to contact WorkCare at (888) 449-7787 per Leidos policy.

Robinson Health Center (Urgent Care) at Streetsboro
9318 State Route 14
Streetsboro, Ohio 44241
(330) 626-3455

APPENDIX A

REPORTING FORMS

THIS PAGE INTENTIONALLY LEFT BLANK.

DAILY SAFETY INSPECTION PROJECT:____ Page 1 of 2			
N	Y	NA	Item
			Daily safety briefing conducted
			Emergency numbers and route to hospital posted
			FWSHP and project-specific Addenda on-site, available to employees, and complete
			Required exposure monitoring conducted and documented
			First aid kit available and inspected weekly
			Personnel wearing PPE required by SSHP for fieldwork (at least safety shoes or boots, safety glasses with side shields, and nitrile or similar gloves to handle potentially contaminated material)
			Personnel wearing personal flotation devices required by SSHP for fieldwork on a boat
			Personnel using buddy system (maintain visual or verbal contact and able to render aid)
			If temperature >70°F: heat stress training conducted, cool fluids available, pulse rates of personnel wearing Tyvek® are being monitored, work/rest cycle in SSHP being followed
			If temperature <40°F: cold stress training conducted, controls in SSHP implemented
			Personnel using appropriate biological hazard controls (See SSHP)
			Employees excluded from under lifted loads
			Unnecessary personnel excluded from hazardous areas, specifically near heavy equipment
			Personnel wearing hearing protection when within 25 ft of noisy equipment
			Containers of flammable liquids closed and labeled properly
			Fully charged fire extinguisher available 25 to 50 ft from flammables storage area and inspected monthly
			Personnel exiting potentially contaminated areas washing hands before eating
			Personnel using steam washer wearing faceshield, hearing protection, heavy duty waterproof gloves, Saranax or rainsuit

DAILY SAFETY INSPECTION

PROJECT:____ Page 2 of 2

N	Y	NA	Item
			Portable electrical equipment plugged to a GFCI
			Electrical wiring covered by insulation or enclosure
			Three wire, UL approved, extension cords used
			Housekeeping adequate (walkways clear of loose, sharp or dangerous objects and trip hazards, work areas clear of objects that might fall on employees)
			Walking/working surfaces safe (not slippery, no unguarded holes, no trip hazards)
			Moving (rotating) machinery guarded to prevent employee contact
			Fall protection provided for work at elevations greater than 4 ft
			All containers of hazardous material labeled to indicate contents and hazards
			MSDSs for hazardous materials on-site
			All vehicles equipped with two-way radios and cellular phones
			15-min eyewash (accessible and full) within 100 ft of areas where corrosive sample preservatives are poured or decontamination chemicals are used
			Portable eyewash available while filling pre-preserved water sample containers
			Potable and non-potable water labeled
			Chainsaws have anti kick-back protection, personnel wearing cut resistant gloves, protective chaps
			Visitor access controlled
			Site hazards and controls consistent with SSHP
			Site hazard controls appropriate and sufficient

Actions taken to correct or control any "N" responses

____

Name Signature Date

DAILY HEALTH AND SAFETY SUMMARY **PROJECT NAME: PROJECT NO:**
NAME: DATE: M Tu W Th F Sa Su TIME:
TASKS PERFORMED:
OFF-NORMAL EVENTS:

THIS PAGE INTENTIONALLY LEFT BLANK.

TAILGATE SAFETY MEETING LOG PROJECT NAME: PROJECT NO:		
DATE: M Tu W Th F Sa Su TIME:		
WEATHER:		
WORKING CONDITIONS:		
PPE:		
ITEMS DISCUSSED:		
THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)		

____

SITE SAFETY AND HEALTH OFFICER

THIS PAGE INTENTIONALLY LEFT BLANK.

(For Safety Staff only)	REPORT NO.	EROC CODE	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT (For Use of this Form See Help Menu and USACE Suppl to AR 385-40)	REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name (Last, First, MI)	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER (Specify)

3. GENERAL INFORMATION

a. DATE OF ACCIDENT (month/day/year)	b. TIME OF ACCIDENT (Military time) hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME:
e. CONTRACT NUMBER ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER (Specify)	f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER (Specify)	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER (Specify)	(2) SUBCONTRACTOR

4. CONSTRUCTION ACTIVITIES ONLY (Fill in line and corresponding code number in box from list - see help menu)

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION (Include name on line and corresponding code number in box for items e, f & g - see help menu)

a. SEVERITY OF ILLNESS/INJURY	(CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#		
SECONDARY	(CODE) #	TYPE	#
f. NATURE OF ILLNESS/INJURY	(CODE) #	SOURCE	(CODE) #

6. PUBLIC FATALITY (Fill in line and correspondence code number in box - see help menu)

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐ PICKUP/VAN ☐ AUTOMOBILE	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END	(1) FRONT SEAT			
☐ TRUCK ☐ OTHER (Specify)	☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER (Specify)	(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT (Fill in line and correspondence code number in box from list - see help menu)

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION (Use additional paper, if necessary)

ENG FORM 3394, MAR 99 Version 2 EDITION OF SEP 89 IS OBSOLETE. Page 1 of 4 pages (Proponent: CESO)

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*					
a. (Explain YES answers in item 13)	YES	NO	a. *(CONTINUED)*	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐	CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐	OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐	SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐	PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐	DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?		
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐	☐ YES *(If yes, attach a copy.)* ☐ NO		

12. TRAINING		
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. **FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES** *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. **ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).**

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.			
a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)		
c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT CORPS ____ CONTRACTOR ____	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL

16. **MANAGEMENT REVIEW** *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. **MANAGEMENT REVIEW** *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. **SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW**

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. **COMMAND APPROVAL**

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10. ACCIDENT DESCRIPTION *(Continuation)*

13a. DIRECT CAUSE *(Continuation)*

FIRST RESPONDER REPORTING FORM
(Print all information)

Collect as much of the information on the top half of this form as possible before making initial notification. Complete the top and bottom of the form before turning in to Camp Ravenna.

Name of individual reporting spill: ______________________________

When did the spill occur (Date and Time)? ______________________________

Spill Location (Building or area name / number, indoors or out; if vehicle involved, type and bumper number):
____

What was spilled? ______________ **How much was spilled?** ______________

Rate at which material is currently spilling. ______________________________

Extent of spill travel? ______________________________

Did the spill reach water (ditch, creek, stream, pond, well head)? ______________________________

Number of injured personnel and type injuries, if applicable. ______________________________

Do you need the Fire Department to respond to protect life, property, and environment? ______________

Unit: ______________ **State:** ________ **Report Date & Time:** ______________

On Scene Coordinator Name and Grade: ______________ **Phone:** ______________

How did the spill occur (be specific). ______________________________
____

What remedial action was taken? ______________________________
____

Was soil and absorbent material generated? ________ **How much?** ______________

What is the location of the soil and absorbents? ______________________________

Was the Environmental Office contacted (yes or No, date and time)? ______________________________

Who did you talk to in the Environmental Office? ______________________________

Was the site cleared by the Env. Office (Yes or No, date and time)? ______________________________

Who cleared the site (name and grade, date and time)? ______________________________

Initial information is critical. Get as much information as you can, but don't hesitate to make the initial notification if a spill is moving or worsening rapidly!

This form must be completed for all releases and turned-in to Camp Ravenna Range Control within 24 hours.

FIRST RESPONDER SPILL/RELEASE RESPONSE ACTIONS

Units or contractors performing training or other operations at Camp Ravenna shall be responsible for adhering to the provisions identified in the Camp Ravenna Integrated Contingency Plans (ICP). A copy of the ICP may be obtained from the Camp Ravenna Environmental Supervisor. Following discovery of a spill (any size), the procedures outlined below shall be executed where applicable:

1. **If necessary, initiate evacuation of the immediate area.**
2. **Notify Camp Ravenna Range Control via two-way radio or by calling <u>(614) 336-6041</u>, and report information contained on the "First Responder Reporting Form" if it is known or can reasonably be determined. This form has been copied on the opposite side of this page. If Range Control cannot be reached, contact a Camp Ravenna OSC (listed below).**
3. **Stop spill flow when possible without undue risk of personal injury.**
4. **If trained, contain the spill using available spill response equipment or techniques.**
5. **Make spill scene OFF LIMITS to unauthorized personnel.**
6. **Restrict all sources of ignition when flammable substances are involved.**
7. **Report to the OSC upon his/her arrival to the scene.**
8. **Turn in a completed copy of the Camp Ravenna First Responder Form to Camp Ravenna Range Control for ALL releases, even ones cleaned up by the reporter.**

TELEPHONE NUMBER

When **Camp Ravenna Range Control is *not available*, the Camp Ravenna OSC *must be contacted* by the discoverer/first responder following a release if it is in water, at or above a reportable quantity (25 gallons or more of POL), a hazardous or extremely hazardous substance, a hazardous waste, or involves fire, explosion, or is otherwise a major incident.**

NAME	JOB TITLE	OFFICE	24 HOUR
Camp Ravenna Range Control	Operations and Training	(614)336-6041	(614) 202-5783
Tim Morgan (Primary OSC)	Environmental Supervisor	(614)336-6568	(330)322-7098
Brad Kline (Alternate OSC)	Environmental Specialist	(614)336-4918	Contact Alternate
Katie Tait (Alternate OSC)	Environmental Specialist	(614)336-6136	Contact Alternate
Joint Forces Command (Alternate POC)	OHARNG Emergency Center	(888)637-9053	(888)637-9053

Off-site (from Camp Ravenna area code 614 phones)

Ravenna Dispatch 9-1-330 296-6486

SEE REVERSE FOR FIRST RESPONDER REPORTING FORM

THIS PAGE INTENTIONALLY LEFT BLANK

Final

PBA13 Sample and Analysis Plan Addendum for Surface Water and Sediment at Load Lines 1, 2, 3, and 4

Part III: Quality Assurance Project Plan

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract No. W912QR-12-D-0020
Delivery Order No. 0008

Prepared for:

U.S. Army Corps of Engineers
Louisville District
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Leidos
11951 Freedom Drive
Reston, Virginia 20190

January 27, 2016

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
A-E	Architect-Engineer
AOC	Area of Concern
COC	Chain of Custody
CUG	Cleanup Goal
BHC	Benzenehexachloride
DNT	Dinitrotoluene
DoD	U.S. Department of Defense
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management System
ELAP	Environmental Laboratory Accreditation Program
FS	Feasibility Study
FSP	Field Sampling Plan
GPS	Global Positioning System
HNO_3	Nitric Acid
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	Inductively Coupled Plasma
IDW	Investigation-Derived Waste
ISM	Incremental Sampling Methodology
LCQ	Louisville Chemistry Guideline
LCS	Laboratory Control Sample
LOQ	Limit of Quantitation
MRL	Method Reporting Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NaOH	Sodium Hydroxide
Ohio EPA	Ohio Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbon
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAAP	Quality Assurance Administrative Procedure
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) for the Performance-Based Acquisition (PBA) 2013 Sampling and Analysis Plan (SAP) Addendum (herein referred to as this SAP Addendum) addresses project-specific information not included in the Facility-Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP) (USACE 2011). The overall quality assurance (QA) objective for this data gap investigation is to develop and implement procedures for field sampling, chain of custody (COC), laboratory analysis, and reporting, which will provide results to be used in the Feasibility Study (FS) for surface water and sediment at Load Lines 1 through 4 and that are technically and legally defensible. Each QAPP section is presented documenting adherence to the Facility-Wide QAPP or stipulating project-specific addendum requirements.

Primary analytical direction for these projects will be obtained from the identified U.S. Environmental Protection Agency (USEPA) SW-846 Methods; the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories (DoD 2013); and the Louisville QSM Supplement.

THIS PAGE INTENTIONALLY LEFT BLANK.

2.0 PROJECT DESCRIPTION

This QAPP addresses project-specific information and tiers under the RVAAP Facility-Wide QAPP (USACE 2011). Each QAPP section documents adherence to the Facility-Wide QAPP or stipulates project-specific requirements.

Primary analytical direction for these projects will be obtained from the identified USEPA SW-846 Methods; the DoD QSM for Environmental Laboratories (DoD 2013); and the Louisville QSM Supplement.

2.1 SITE HISTORY/BACKGROUND INFORMATION

Facility-wide information is contained in Section 1.0 of the Field Sampling Plan (FSP) for this SAP Addendum. Area of concern (AOC)-specific background and history information is included in Appendices A through D of the SAP Addendum.

2.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is provided for each of the four AOCs in Appendices A through D of the SAP Addendum.

2.3 PROJECT OBJECTIVES AND SCOPE

This information is contained in Section 3.0 of the FSP of this SAP Addendum.

2.4 SAMPLE NETWORK DESIGN AND RATIONALE

General information regarding the sample network design and rationale is provided in Section 3.0 of the FSP of this SAP Addendum, with AOC-specific information contained in Appendices A through D.

2.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Appendices A through D of the SAP Addendum for each individual AOC. These sampling and analysis requirements are summarized in Table 2-1 of this QAPP, in conjunction with anticipated sample numbers, QA sample frequencies, and field quality control (QC) sample frequencies.

Table 2-1. Sampling and Analytical Requirements

Parameter	Methods[a]	Field Samples[b]			Field Duplicate Samples[c]	Site Source Water[d]	Sampler Rinsates[e]	Trip Blanks[f]	Total A-E Samples	USACE QA Split Samples[g]	USACE Trip Blanks[f]
		Discrete	ISM	Total							
Surface Water											
Load Line 3											
Metals (Only – Manganese)	SW-846, 6010B/6020	2	-	2	1	-	-	-	3	1	-
Sediment											
Load Line 1											
Metals (Only – Copper and Lead)	SW-846, 6010B/6020	5	-	5	-	1	1	-	7	-	-
Load Line 2											
Metals (Only – Lead and Silver)	SW-846, 6010B/6020	4	-	4	1	1	1	-	7	1	-
Explosives (Only – 2,4-DNT; 4-Amino-2,6-DNT; and 2,4,6-TNT)	SW-846, 8330B	4	-	4	1	1	1	-	7	1	-
Pesticides (Only – endrin ketone and beta-BHC)	SW-846, 8081A/3540C/3541	4	-	4	1	1	1	-	7	1	-
PAHs	SW-846, 8270C SIM[h] or 8270C low level	4	-	4	1	1	1	-	7	1	-
Load Line 3											
Metals (Only – Antimony, Copper, Iron, Silver, and Zinc)	SW-846, 6010B/6020	2	-	2	1	1	1	-	5	1	-
Explosives (Only – 4-Amino-2,6-DNT and 2,4,6-TNT)	SW-846, 8330B	2	-	2	1	1	1	-	5	1	-

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods[a]	Field Samples[b]			Field Duplicate Samples[c]	Site Source Water[d]	Sampler Rinsates[e]	Trip Blanks[f]	Total A-E Samples	USACE QA Split Samples[g]	USACE Trip Blanks[f]
		Discrete	ISM	Total							
Liquid IDW Samples											
TCLP VOC	SW-846, 1311, 8260	-	-	1	-	-	-	-	1	-	-
TCLP SVOCs	SW-846, 1311, 8270	-	-	1	-	-	-	-	1	-	-
TCLP Pesticides	SW-846, 1311, 8081	-	-	1	-	-	-	-	1	-	-
TCLP Herbicides	SW-846, 1311, 8151	-	-	1	-	-	-	-	1	-	-
TCLP Metals	SW-846, 1311, 6010, 7470	-	-	1	-	-	-	-	1	-	-
Total PCBs	SW 846 8082A	-	-	1	-	-	-	-	1	-	-
Explosive compounds	SW-846, 8330B	-	-	1	-	-	-	-	1	-	-
Total Sulfide	SM 4500 S2-E	-	-	1	-	-	-	-	1	-	-
Total Cyanide	SW-846, 9012A	-	-	1	-	-	-	-	1	-	-
pH	EPA 150.1 or SM 4500 H-B	-	-	1	-	-	-	-	1	-	-
Ignitability	SW-846 1010	-	-	1	-	-	-	-	1	-	-

[a]The analytical methods listed or more current versions may be used.
[b]MS/MSD samples will be collected at a frequency of 5% (1 per 20) of total samples per media.
[c]Duplicate samples are collected at a frequency of 10% for this investigation.
[d]Source water will be collected from a municipal water source for the project and will be analyzed for all applicable metals, explosives, pesticides, and PAHs.
[e]Rinsate samples will be collected at a frequency of one per field event for undedicated, decontaminated equipment used for sediment and surface water sample collection. One sediment rinsate will be associated with all AOCs and will be analyzed for all applicable metals, explosives, pesticides, and PAHs.
[f]One trip blank will be collected for each shipping container (e.g., cooler) that contains water samples for VOC analysis.
[g]USACE QA split samples will be collected at a frequency of 10% (1 per 10) of total samples per media.
[h]SW-846 8270C SIM is a previously accepted method for PAHs but is not listed in the Facility-Wide QAPP. The method meets the project quantitation levels in Table 4-7 of the Facility-Wide QAPP.

A-E = Architect-Engineer
AOC = Area of Concern
BHC = Benzenehexachloride
DNT = Dinitrotoluene
IDW = Investigation-Derived Waste
ISM = Incremental Sampling Methodology
MS = Matrix Spike
MSD = Matrix Spike Duplicate
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
QA = Quality Assurance
QAPP = Quality Assurance Project Plan
SIM = Selected Ion Monitoring
SVOC = Semivolatile Organic Compound
TCLP = Toxicity Characteristic Leaching Procedure
TNT = Trinitrotoluene
USACE = U.S. Army Corps of Engineers
USEPA = U.S. Environmental Protection Agency
VOC = Volatile Organic Compound

THIS PAGE INTENTIONALLY LEFT BLANK.

3.0 PROJECT ORGANIZATION

The project organization and responsibilities are presented in Section 2.0 of the FSP.

Analytical support for this work will be provided by Empirical Laboratories, a small business laboratory. The laboratory standard operating procedures (SOPs) are available upon request.

THIS PAGE INTENTIONALLY LEFT BLANK.

4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

4.1 DATA QUALITY OBJECTIVES

Data quality objective (DQO) summaries for this investigation will generally follow Tables 4-1 and 4-2 of the Facility-Wide QAPP. These tables reference the accuracy limits in Appendix G of the DoD QSM Version 4.2. The DoD QSM Version 5 has revised accuracy limits in Appendix C, which will be used for this project. All QC parameters stated in the specific USEPA SW-846 methods will be adhered to for each chemical listed. The SW-846 method references found in the Facility-Wide QAPP have been revised within this QAPP to reflect the Update III methods, as appropriate. For this data gap investigation, the laboratory will use these versions or later versions. Laboratories are required to comply with all methods as written; recommendations are considered requirements. Concurrence with the DoD QSM for Environmental Laboratories (DoD 2013) and the Louisville QSM Supplement is expected.

Empirical will deliver an electronic data deliverable (EDD) that is automated data review (ADR) compatible. Empirical must identify variances to the established library prior to any analysis being performed. No variances to the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement are anticipated.

4.2 LEVEL OF QUALITY CONTROL EFFORT

QC efforts will follow Section 4.2 of the Facility-Wide QAPP. Field QC measurements will include field blanks, source blanks, trip blanks, and field duplicates. Laboratory QC measurements will include laboratory method blanks, laboratory control samples (LCSs), laboratory duplicate samples, and matrix spike/matrix spike duplicates (MS/MSDs). LCS measurements will include the standard mid-level analyte concentration, plus a QC/method reporting level (MRL) low-level concentration. It is recognized that the laboratory will routinely perform and monitor the QC/MRL; however, guidance check limits will be utilized, as advisory and corrective action will not be required for individual analyte variances. The QC/MRL will be successfully analyzed at the beginning of the analytical sequences. In addition, the laboratory will analyze the QC/MRL sample at the close of the analytical sequence.

4.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in Section 4.3; Tables 4-1 and 4-2 (using updated QSM 5.0 limits as noted above); and Tables 4-4, 4-5, 4-7, and 4-8 of the Facility-Wide QAPP will be imposed for this investigation. As stated above, some of the analytical methods numbers have been updated (refer to Table 2-1 of this QAPP). Quality objectives related to individual method QC protocol also will follow requirements given in the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement.

Laboratories will make all reasonable attempts to meet the program and project reporting levels in the applicable Tables 4-1 through 4-9 of the Facility-Wide QAPP for each individual sample analysis. When samples require dilution, both the minimum dilution and quantified dilution must be reported. Samples may be screened to determine optimum dilution ranges. Dilution runs will be performed to quantify high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, runs will then be performed at the lowest feasible dilution to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analytes, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact Leidos, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

4.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 4.4 and Tables 4-1 and 4-2 of the Facility-Wide QAPP will be imposed for this investigation.

5.0 SAMPLING PROCEDURES

Sampling procedures are described in Section 5.0 of the Facility-Wide SAP, as referenced in Section 4.0 of the FSP of this SAP Addendum.

Tables 5-1 through 5-3 of this QAPP summarize sample container, preservation, and holding time requirements for the sediment and water matrices, and investigation-derived waste (IDW) for this investigation.

As noted in the Facility-Wide QAPP, additional sample volumes will be provided, when necessary, for the express purpose of performing associated laboratory QC (MS/MSD). These laboratory QC samples will be designated by the field and identified for the laboratory on respective chain of custody (COC) documentation.

Table 5-1. Container Requirements for Sediment Samples

Analyte Group	Container[a]	Minimum Sample Size	Preservative	Holding Time
Pesticide Compounds	One 16-oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 days (extraction) 40 days (analysis)
PAH Compounds	Include in Pesticide container	60 g	Cool, 4°C	14 days (extraction) 40 days (analysis)
Explosive Compounds	One 4-oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 days (extraction) 40 days (analysis)
Metals	Include in Pesticide container	50 g	Cool, 4°C	180 days

Note: Sample container requirements are subject to change. When all fractions are being collected and shipped to the same analytical facility, one 16-oz jar should cover all requirements. If analytical groups are sent to separate facilities, then individual containers will be required.

[a]Container sizes may vary due to the laboratory preferences.

PAH = Polycyclic Aromatic Hydrocarbon

Table 5-2. Container Requirements for Surface Water Samples

Analyte Group	Container[a]	Minimum Sample Size	Preservative	Holding Time
Metals Manganese Only	One 1-L poly bottle	500 mL	HNO_3 to pH <2 Cool, 4°C	180 days

[a]Container size may vary due to laboratory preferences.

HNO_3 = Nitric Acid

Table 5-3. Container Requirements for IDW Liquid Samples

Analyte Group	Container[a]	Minimum Sample Size	Preservative	Holding Time
TCLP VOC	Three 40-mL glass vials with Teflon®-lined septum (no headspace)	80 mL	Cool, 4°C	14 days (TCLP extraction) 14 days preserved/7 days unpreserved (analysis)
TCLP SVOCs	Two 1-L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4°C	14 days (TCLP extraction) 7 days (extraction) 40 days (analysis)
TCLP Pesticides	Two 1-L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4°C	14 days (TCLP extraction) 7 days (extraction) 40 days (analysis)
TCLP Herbicides	Two 1-L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4°C	14 days (TCLP extraction) 7 days (extraction) 40 days (analysis)
TCLP Metals	One 1-L poly bottle	500 mL	Cool, 4°C	Metals: 180 days (TCLP extraction) 180 days (analysis) Mercury: 28 days (TCLP extraction) 28 days (analysis)
PCBs	Two 1-L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4°C	7 days (extraction) 40 days (analysis)
Explosive Compounds	Two 1-L amber glass bottle with Teflon®-lined lid	1,000 mL	Cool, 4°C	7 days (extraction) 40 days (analysis)
Sulfide	500-mL glass with no headspace	500 mL	Zinc acetate + NaOH to pH >9 Cool, 4°C	7 days
pH	100-mL poly bottle	100 mL	Cool, 4°C	Immediate
Ignitability	500-mL poly bottle	200 mL	Cool, 4°C	14 days

[a]Container size may vary due to laboratory preferences.

IDW = Investigation-Derived Waste
NaOH = Sodium Hydroxide
PCB = Polychlorinated Biphenyl
TCLP = Toxicity Characteristic Leaching Procedure
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

6.0 SAMPLE CUSTODY

Sample custody procedures will follow those identified in Section 6.0 of the Facility-Wide QAPP.

THIS PAGE INTENTIONALLY LEFT BLANK.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow procedures described in Section 7.1 of the Facility-Wide QAPP. Only water quality meters when collecting surface water samples at Load Line 3 and global positioning system (GPS) units will be used during this investigation.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in Section 7.2 of the Facility-Wide QAPP, Empirical's QA plan, laboratory-specific SOPs, and corporate and facility-specific operating procedures.

THIS PAGE INTENTIONALLY LEFT BLANK.

8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY ANALYSIS

Analytical methods, parameters, and quantitation or detection limits are those listed in Tables 4-3 through 4-9 of the Facility-Wide QAPP with the exception of polycyclic aromatic hydrocarbons (PAHs), which will be analyzed using low level SW-846 method 8270C or 8270 selected ion monitoring (SIM) (i.e., to ensure reporting limits are below the screening criteria). The SW-846 method references in the Facility-Wide QAPP have been revised within this QAPP to reflect the Update III methods, as appropriate. The laboratory will use these versions or later versions. Concurrence with the DoD QSM for Environmental Laboratories (DoD 2013) and the Louisville QSM Supplement is expected. Laboratory analysis procedures are provided in Section 8.1 of the Facility-Wide QAPP.

Empirical facilities will at all times maintain a safe and contaminant free environment for the analysis of samples. The laboratories will demonstrate, through instrument blanks, holding blanks, and analytical method blanks, that the laboratory environment and procedures will not and do not impact analytical results.

Empirical facilities also will implement all reasonable procedures to maintain project reporting levels for all sample analyses. Where contaminant and sample matrix analytical interferences impact the laboratory's ability to obtain project reporting levels, the laboratory will institute sample cleanup processes, minimize dilutions, adjust instrument operational parameters, or propose alternative analytical methods or procedures. Elevated reporting levels will be kept to a minimum throughout the execution of this work. When samples require dilution, both the minimum dilution and quantified dilution must be reported. Empirical may screen samples to determine optimum dilution ranges. Dilution runs will be performed to quantify high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, less diluted runs at the lowest feasible dilution will then be performed to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analyte, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact Leidos, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

8.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for instrument calibration, calibration frequency, and field analysis are identified in Section 7.0 of the Facility-Wide QAPP. The only field screening anticipated for the field investigation is water quality meters for surface water sampling and GPS units.

THIS PAGE INTENTIONALLY LEFT BLANK.

9.0 INTERNAL QUALITY CONTROL CHECK

9.1 FIELD SAMPLE COLLECTION

Field QC sample types, numbers, and frequencies are identified in Table 2-1. In general, field duplicates will be collected at a frequency of 10%. Field equipment rinsates will be collected at a frequency of one per field cycle. Equipment rinsate samples pertain only to samples collected using reusable, decontaminated equipment. This will constitute a process check for the effectiveness of the decontamination procedure. One site source water sample (potable water source) will be collected for the combined field effort. Laboratory grade deionized water will be used; therefore, analysis of this source water is not warranted.

9.2 FIELD MEASUREMENT

Refer to Section 7.0 of the Facility-Wide QAPP for details regarding field measurements.

9.3 LABORATORY ANALYSIS

Analytical QC procedures will follow those identified in the referenced USEPA methodologies. These will include method blanks, LCSs, MSs, MSDs, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards.

Empirical facilities will conform to their QAPP and implement their established SOPs to perform the various analytical methods required by the project. QC frequencies will follow those identified in Section 9.3 of the Facility-Wide QAPP.

Analyses also will be consistent with direction provided by the analytical method, the most recent DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement. The following are clarifications to this guidance relative to this project:

- The QC/MRL will be successfully analyzed at the beginning of the analytical sequences. In addition, the laboratory will analyze the QC/MRL sample at the close of the analytical sequence.
- Analytical method blanks will be considered clean as long as analyte concentrations are below one-half of the limit of quantitation (LOQ). Corrective actions will be performed for any analyte detected above the established criteria. Any analytes detected between the method detection limit and the LOQ will be flagged appropriately.
- LCSs will contain all project target compounds. The marginal exceedances should not exceed the number allowed by the QSM.
- For methods that have multi-responders (i.e., Aroclors and pesticides) within the same analytical process, the laboratory will not include all analytes within the matrix spiking mixture. A representative analyte will be employed for the MS evaluation.

- Inductively coupled plasma (ICP) initial calibration curves will be confirmed through the analysis of a blank and three standards, and this documentation will be reported as part of the analytical data package.
- ICP serial dilution will be performed on a per batch basis. If the serial dilution falls outside acceptance criteria, a post-digestion spike analyses will be performed.
- Sediment samples having moisture levels that preclude soxhlet extraction processes will be extracted by sonication methods.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

Data reduction will follow the established protocols defined in Section 10.1 in the Facility-Wide QAPP. Sample collection and field measurements will follow the established protocols defined in the Facility-Wide QAPP, Facility-Wide SAP, and this SAP Addendum. Laboratory data reduction will follow Empirical's QA plan guidance and will conform to general direction provided by the Facility-Wide QAPP, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement.

10.2 DATA VERIFICATION/VALIDATION

Project data verification and validation will follow direction provided in Figure 10-1 of the Facility-Wide QAPP. Protocol for analytical data verification and validation has been updated to the following references:

- DoD QSM for Environmental Laboratories, July 2013;
- Louisville QSM Supplement;
- USEPA National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October 1999 (USEPA 1999); and
- USEPA National Functional Guidelines for Inorganic Data Review, EPA-540-R-04-004, October 2004 (USEPA 2004).

Data verification and a Level III review will be performed by Leidos in accordance with the Facility-Wide QAPP.

Validation of 10% of the data will follow the direction provided in the Facility-Wide QAPP, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement. A data validator qualified by USACE, Louisville District will perform this data validation. The validator shall document the findings of the review using the checklists in Attachment B of the Louisville Chemistry Guideline (LCG) (USACE 2002). These checklists may be modified to implement QSM criteria.

10.3 DATA REPORTING

Data reports will follow the established protocols defined in Section 10.3 in the Facility-Wide QAPP. Empirical will deliver an EDD that is ADR compatible. All data will be processed by ADR/Environmental Data Management System (EDMS) software using the Ravenna library. All errors in the ADR/EDD found by CHECKER must be corrected by the laboratory prior to transmittal. EDDs with errors will not be accepted.

10.4 DATA QUALITY ASSESSMENT

Data quality will be assessed using the procedures provided in Section 10.4 of the Facility-Wide QAPP.

11.0 PERFORMANCE AND SYSTEM AUDITS

11.1 FIELD AUDITS

One internal surveillance of field activities will be performed by the Leidos QA/QC Officer, the Leidos Field Operations Manager, or another properly trained Leidos surveillance leader for the investigation. This surveillance will encompass the performance of sampling of any environmental medium. The surveillance will follow Leidos QAAP 18.3.

USACE, USEPA Region 5, or Ohio Environmental Protection Agency (Ohio EPA) audits may be conducted at the discretion of the respective agency.

11.2 LABORATORY AUDITS

Empirical is accredited under the DoD Environmental Laboratory Accreditation Program (ELAP). This accreditation is based in part on an on-site audit of the laboratory. Internal performance and systems audits will be conducted by Empirical's QA staff, as defined in their QAPP. USACE, USEPA Region 5, or Ohio EPA audits may be conducted at the discretion of the respective agency. More information regarding laboratory audits can be found in Section 11.2 of the Facility-Wide QAPP.

THIS PAGE INTENTIONALLY LEFT BLANK.

12.0 PREVENTIVE MAINTENANCE PROCEDURES

Maintenance of all field and laboratory sampling and analytical equipment will follow direction provided in Section 12.0 of the Facility-Wide QAPP. Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the contract laboratory QA plan.

THIS PAGE INTENTIONALLY LEFT BLANK.

13.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Field and laboratory data will be assessed as outlined in Sections 13.1 and 13.2, respectively, of the Facility-Wide QAPP.

THIS PAGE INTENTIONALLY LEFT BLANK.

14.0 CORRECTIVE ACTIONS

Field and laboratory activity corrective action protocol will follow directions provided in Sections 14.1 and 14.2, respectively, of the Facility-Wide QAPP. Laboratory corrective actions also will follow the procedures in Empirical's QA plan.

THIS PAGE INTENTIONALLY LEFT BLANK.

15.0 QUALITY ASSURANCE REPORTS

Procedures and reports will follow the protocol identified in Section 15.0 of the Facility-Wide QAPP and those directed by Empirical's QA plan.

THIS PAGE INTENTIONALLY LEFT BLANK.

16.0 REFERENCES

DoD (U.S. Department of Defense) 2013. *Quality Systems Manual for Environmental Laboratories,* Environmental Data Quality Workgroup, Final Version 5. Final. July.

USACE (U.S. Army Corps of Engineers) 2000. *Environmental Data Quality Assurance Guideline, Louisville District*. May. (Draft).

USACE 2011. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, W912QR-08-D-0008, Delivery Order 0016. Final. February.

USACE 2002. *Louisville Chemistry Guideline,* Samir A. Mansey, Environmental Chemistry Branch, Rev. 5, June.

USACE 2011. *Facility-Wide Quality Assurance Project Plan for Environmental Investigation, Ravenna, Ohio,* W912QR-08-D-0008, Delivery Order 0016. Final. February.

USEPA (U.S. Environmental Protection Agency) 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99/008. Final. October.

USEPA 2004. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540-R-04-004. Final. October.

THIS PAGE INTENTIONALLY LEFT BLANK.