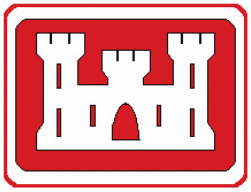
Final

Remedial Investigation Addendum for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area Ravenna Army Ammunition Plant Restoration Program Portage and Trumbull Counties, Ohio

August 07, 2023

Contract No.: W912QR-12-D-0002
Delivery Order: 0003

Prepared by:



U.S. Army Corps of Engineers,
Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202-2267

Prepared for:

National Guard Bureau
Army National Guard
(ARNG- Installations and Environment)
111 South George Mason Drive
Arlington, Virginia 22204-1373

This Page Intentionally Left Blank

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
07-08-2023	Technical	Mar 2021-Aug 2023

4. TITLE AND SUBTITLE

Final
Remedial Investigation Addendum
for CC RVAAP-79 DLA Ore Storage Sites,
Ore Storage Pond Sub-Area
Ravenna Army Ammunition Plant Restoration Program
Portage and Trumbull Counties, Ohio

5a. CONTRACT NUMBER
W912QR-12-D-0002

5b. GRANT NUMBER
NA

5c. PROGRAM ELEMENT NUMBER
NA

6. AUTHOR(S)

Draft version:
Heyse, Edward
Hinger, Jessica
Fields, Karen
Peterlin, Joe
Zahrte, Paul

5d. PROJECT NUMBER
Delivery Order 0003

5e. TASK NUMBER
Task 3

5f. WORK UNIT NUMBER
NA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Parsons Govement Services, Inc.
401 Diamond Drive NW
Huntsville, Alabama 35806

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
Louisville, Kentucky 40202-2232

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

None.

14. ABSTRACT

This Remedial Investigation Addendum presents the results of the Hyalella azteca and Chironomus dilutus 10-day bioassays performed on two sediment composite samples collected from the Ore Storage Pond sub-area of CC RVAAP-79 DLA Ore Storage Sites. The results of this RI Addendum indicate that the bioassays do no show significant toxicity to the ecological receptors; therefore, no further remedial actions are warranted to address ecological risk at the Ore Storage Pond sub-area within the CC RVAAP-79 DLA Ore Storage Sites.

15. SUBJECT TERMS

groundwater, monitoring well, sampling and analysis

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Nathaniel Peters, II
U	U	U	U	174	19b. TELEPHONE NUMBER *(Include area code)* 502.315.2624

This Page Intentionally Left Blank

PLACEHOLDER PAGE FOR:

Documentation of Ohio EPA Approval of the Final Document

(Documentation to be provided once approval is issued.)

This Page Intentionally Left Blank

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons has completed the Draft Remedial Investigation Addendum CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in this 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 the level of data obtained; and the reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Corps of Engineers policy.

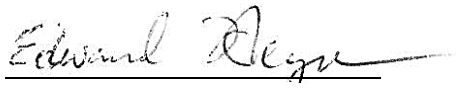
Independent Technical Reviewer:

Dan Griffiths, C.P.G, P.G.  09 June 2021

Technical Director (Signature) (Date)

Parsons

Reviewer:

Edward Heyse, Ph.D., P.E.  08 July 2021

Project Manager (Signature) (Date)

Parsons

This Page Intentionally Left Blank

Final

Remedial Investigation Addendum
CC RVAAP-79 DLA Ore Storage Sites,
Ore Storage Pond Sub-Area
Ravenna Army Ammunition Plant Restoration Program
Portage and Trumbull Counties, Ohio

August 07, 2023

Contract No.: W912QR-12-D-0002
Delivery Order: 0003

Prepared by:

U.S. Army Corps of Engineers, Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202-2267

Prepared for:

National Guard Bureau
Army National Guard
(ARNG- Installations and Environment)
111 South George Mason Drive
Arlington, Virginia 22204-1373

This Page Intentionally Left Blank

DOCUMENT DISTRIBUTION

for the

Final
Remedial Investigation Addendum
CC RVAAP-79 DLA Ore Storage Sites,
Ore Storage Pond Sub-Area

Ravenna Army Ammunition Plant Restoration Program
Camp James A. Garfield, Ohio

Name/Organization	Number of Printed Copies	Number of Electronic Copies
Kevin Sedlak, ARNG	Email Transmittal Letter Only	
Katie Tait, OHARNG	Email Transmittal Letter Only	
Jennifer Tierney, Administrative Record Manager	2	2
Pat Ryan, REIMS	Email Transmittal Letter Only	
Steven Kvaal, USACE – Louisville District	Email Transmittal Letter Only	
Nathaniel Peters, II, USACE – Louisville District	1	1
Ed D'Amato, Ohio EPA DERR-NEDO	Submitted via Ohio EPA Liquid Files	
Tom Schneider, Ohio EPA SWDO	Email transmittal letter only	
Natalie Oryshkewych, Ohio EPA DERR-NEDO	Email transmittal letter only	
Megan Oravec, Ohio EPA DERR-NEDO	Email transmittal letter only	

DERR = Division of Environmental Response and Revitalization
NEDO = Northeast District Office
OHARNG = Ohio Army National Guard
Ohio EPA=Ohio Environmental Protection Agency
RVAAP = Ravenna Army Ammunition Plant
REIMS = Ravenna Environmental Information Management System
SWDO = Southwest District Office
USACE = U.S. Army Corps of Engineers

This Page Intentionally Left Blank

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
AOC	Area of Concern
ARNG	Army National Guard
bgs	below ground surface
CC	Army Environmental Compliance-Related Cleanup Program
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CJAG	Camp James A. Garfield Joint Military Training Center
COCs	chemicals of concern
COPCs	chemicals of potential concern
COPECs	chemicals of potential ecological concern
DERR	Division of Environmental Response and Revitalization
DFFO	Director's Final Findings and Orders
DLA	Defense Logistics Agency
DoD	Department of Defense
DQOs	Data Quality Objectives
DU	Decision Unit
ECC	Environmental Chemical Corporation
EPCs	exposure point concentrations
ERA	Ecological Risk Assessment
ESV	Ecological Screening Value
FD	field duplicate
FS	Feasibility Study
FWCUG	Facility-Wide Cleanup Goal
FWSAP	Facility-Wide Sampling and Analysis Plan
GPS	Global Positioning System
GSA	General Services Administration
HQ	hazard quotient
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicate
NGT	National Guard Trainee
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REIMS	Ravenna Environmental Information Management System
RI	Remedial Investigation
RSL	Regional Screening Level
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SRCs	site-related chemicals

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SRV	Sediment Reference Value
SVOCs	semivolatile organic compounds
TAL	Target Analyte List
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

Field work for this Remedial Investigation (RI) Addendum for CC RVAAP-79 Defense Logistics Agency (DLA) Ore Storage Sites, Ore Storage Pond Sub-Area at the former Ravenna Army Ammunition Plant (RVAAP), in Portage and Trumbull counties, Ohio was conducted by Parsons, contracted by the U.S. Army Corps of Engineers (USACE)–Louisville District. Parsons was contracted by the USACE-Louisville District to complete the RI documentation under Contract No. W912QR-12-D-0002, Delivery Order No. 0003.

This RI Report Addendum was prepared in accordance with Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) guidance and regulations, the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (DFFO, Ohio EPA, 2004), and the National Oil and Hazardous Substances Contingency Plan (U.S. Environmental Protection Agency [USEPA], 1990). This document was prepared in accordance with the *Submission Format Guidelines for the Ravenna Army Ammunition Plant Restoration Program, Version 22* (Vista Sciences Corporation, 2020).

The former RVAAP, now Camp James A. Garfield Joint Military Training Center (CJAG), is located in northeast Ohio. CC RVAAP-79 DLA Ore Storage Sites include the following nine sub-areas:

- Main Storage Area,
- Area West of Railroad,
- East Transportation Yard,
- Concrete Pad Storage Area,
- Ore Storage Pond,
- Route 80 Tank Farm,
- Area 2 Ammunition Storage Area,
- Load Line 3 Building 803 Inert Storage and Tank Storage Area, and
- Area 8 Inert Storage, Building 841.

The RI for eight of the nine areas is complete and documented in the *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020). This RI Addendum only addresses sediment at the Ore Storage Pond sub-area. No further investigation or removal action was recommended for surface water in the RI Report (Parsons, 2020).

This RI Addendum includes a review of the physical site characteristics and operational history for the Ore Storage Pond and information from previous investigations. Sediment was sampled and analyzed for inorganic chemicals related to the historical storage of strategic materials, minerals, and ores at this Area of Concern (AOC). Two bioassays were performed on composite samples consisting of portions from three of the six sediment samples:

- *Hyalella azteca* 10-day bioassay, and
- *Chironomus dilutus (*formerly *tentans)* 10-day bioassay.

The work described in this RI Addendum was conducted in accordance with the *Final Work Plan Addendum Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Ravenna Army Ammunition Plan Restoration Program, Portage and Trumbull Counties, Ohio* (Parsons, 2021) and the Facility-Wide Sampling and Analysis Plan (FWSAP, Science Applications International Corporation [SAIC], 2011a). Bioassays were conducted on sediment samples following the *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000).

The results of this RI Addendum indicate that no further action is required to address ecological risk at the Ore Storage Pond sub-area within the CC RVAAP-79 DLA Ore Storage Sites.

Remedial Investigation Objectives

The following are the CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-area RI Addendum objectives:

- Conduct a field investigation to collect site-related data to determine toxicity of the sediment at the AOC.
- Determine if a Feasibility Study is required to evaluate remedial alternatives.

Area of Concern Background

The nine separate ore storage sub-areas comprising CC RVAAP-79 DLA Ore Storage Sites are all located within CJAG. The RI for eight of the nine areas is complete and documented in the *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020). This RI Addendum only addresses additional sampling for the Ore Storage Pond sub-area.

Five of the sub-areas (Main Storage Area, Area West of the Railroad, East Transportation Yard, Concrete Pad Storage Area, and Ore Storage Pond) are contiguous and are located in the eastern portion of CJAG near the intersection of South Service Road and Irons Road. All five areas comprising these contiguous sub-areas cover approximately 63 acres. The portion of the sub-areas that stored ore is approximately 53 acres, the other 10 acres were added to the sub-areas as delineation decision units (DUs). The DLA stored strategic and critical materials, including chrome ore, ferrochrome ore, and metallurgical manganese ore at these subareas starting in the late 1940's. All ore was removed by 2012. The Ore Storage Pond was reportedly constructed in the mid-1950s to prevent potentially contaminated surface water runoff from nearby manganese and chrome stockpiles from entering surface water. Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed and now functions as a palustrine, emergent, intermittently exposed wetland as mapped by the National Wetland Inventory (U.S. Fish and Wildlife Service, 2018). No buildings or associated infrastructure (e.g., utility lines) are believed to have been located in or near these sub-areas; however, railroad spurs were located in portions of the Main Storage Area and the Concrete Pad Storage Area. The Area West of Railroad, East Transportation Yard, and the Ore Storage Pond are located immediately adjacent to railroad spurs.

Remedial Investigation Activities

Samples used for decision making in this RI Addendum were collected by Parsons in April 2021. Composite and discrete sampling methods were employed to investigate sediment. Bioassays were performed on sediment composite samples. Samples were collected and analyzed according to the FWSAP (SAIC, 2011a) and the Final Ore Storage Pond Sub-area Work Plan Addendum (Parsons, 2021). The bioassays were conducted in accordance with USEPA toxicity and bioaccumulation guidance (USEPA, 2000).

10-Day Bioassays Toxicity Results

The results of the *Hyalella azteca* and *Chironomus dilutus* 10-day bioassays indicate that sediment from composite samples 079SD-416M-0001-SD and 079SD-417M-0001-SD do not show significant toxicity to the ecological receptors.

Recommendations

No further action is required to address ecological risk in surface water or sediment at the Ore Storage Pond sub-area at CC RVAAP-79 DLA Ore Storage Sites.

Because the additional data for the Ore Storage Pond sediments collected for this RI Addendum has concentrations of arsenic that are greater than those used to estimate risks to Human Health Receptors in the CC RVAAP-79 RI, these potential risks need to be reassessed considering the new sediment and pond data. Since the CC RVAAP-79 RI has been finalized, the Army will revise the Draft CC RVAAP-79 Feasibility Study (FS) to include a reassessment of potential human health risks for current and future receptors of the Ore Storage Pond that includes the new data collected for this RI Addendum. The revised HHRA will be incorporated into the Risk Management Portion of the CC RVAAP-79 FS.

This Page Intentionally Left Blank

1. INTRODUCTION

The majority of field work for the Remedial Investigation (RI) for CC RVAAP-79 Defense Logistics Agency (DLA) Ore Storage Sites (Parsons, 2020) was conducted by Environmental Chemical Corporation (ECC). Parsons was contracted by the U.S. Army Corps of Engineers (USACE)-Louisville District to complete the RI documentation under Contract No. W912QR-12-D-0002, Delivery Order No. 0003. The task order was modified (modification 08) on 29 September 2020 for additional field work required by Ohio Environmental Protection Agency (Ohio EPA) and Army National Guard (ARNG) to complete the RI at CC RVAAP-79, Ore Storage Pond sub-area. Field work for this RI Addendum was completed by Parsons. The field work was conducted in accordance with the *Final Work Plan Addendum Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Ravenna Army Ammunition Plan Restoration Program, Portage and Trumbull Counties, Ohio* (Parsons, 2021), the Facility-Wide Sampling and Analysis Plan (FWSAP, Science Applications International Corporation [SAIC], 2011a), and the *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (U.S. Environmental Protection Agency [USEPA], 2000).

This RI Report Addendum was prepared in accordance with Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) guidance and regulations, Ohio EPA Director's Final Findings and Orders (DFFO, Ohio EPA, 2004), and the National Oil and Hazardous Substances Contingency Plan. The former Ravenna Army Ammunition Plant (RVAAP) is not on the USEPA National Priorities List, although it is in the USEPA Superfund Enterprise Management System database. The Ohio EPA is the environmental regulator for the RVAAP restoration program. The DFFOs form the basis for the implementation of a CERCLA-based environmental remediation program at the installation. This document was prepared in accordance with the *Submission Format Guidelines for the Ravenna Army Ammunition Plant Restoration Program, Version 22* (Vista Sciences Corporation, 2020).

The former RVAAP, now Camp James A. Garfield Joint Military Training Center (CJAG), is located in Portage and Trumbull Counties, Ohio (Figure 1-1). CC RVAAP-79 DLA Ore Storage Sites include the following nine sub-areas (Figure 1-2):

- Main Storage Area
- Area West of Railroad
- East Transportation Yard
- Concrete Pad Storage Area
- Ore Storage Pond
- Route 80 Tank Farm
- Area 2 Ammunition Storage Area
- Load Line 3 Building 803 Inert Storage and Tank Storage Area
- Area 8 Inert Storage, Building 841

The RI for eight of the nine areas is complete and documented in the *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant,*

Portage and Trumbull Counties, Ohio (Parsons, 2020). This RI Addendum only addresses the Ore Storage Pond sub-area.

1.1 PURPOSE

The objectives of the CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area RI Addendum are to:

- Conduct a field investigation to collect site-related data to determine toxicity of the sediment at the Area of Concern (AOC).
- Determine if a Feasibility Study is required to evaluate remedial alternatives.

1.2 SCOPE AND OBJECTIVES

This section presents objectives to complete the RI for the Ore Storage Pond sub-area. Arsenic concentrations in sediment exceeded the Ohio EPA Sediment Reference Value (SRV, Ohio EPA, 2018). Ohio Administrative Code (OAC) 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA-Division of Environmental Response and Revitalization [DERR], 2018) require that further evaluation using bioassay or remediation of the sediment be performed if contaminant concentrations in sediment in lentic water bodies exceeds the Ohio EPA SRV. The following objective has been identified to complete the RI for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area:

- Characterize sediment ecotoxicity using bioassays to determine if remedial alternatives should be evaluated for sediment, or if no further action is required to address ecological risk in sediment. Two bioassays were performed on composite sediment samples:
    - *Hyalella azteca* 10-day bioassay, and
    - *Chironomus dilutus (tentans)* 10-day bioassay.

Bioassays followed *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000).

As part of the facility-wide approach to environmental investigation activities at the former RVAAP, facility-wide Data Quality Objectives (DQOs) have been developed consistent with the USEPA DQO process. The overall project DQO is to provide representative, repeatable, high quality data in order to complete a RI Report at the Ore Storage Pond sub-area at CC RVAAP-79 DLA Ore Storage Sites. DQOs specific to the Ore Storage Pond sub-area are presented in the Work Plan Addendum (Parsons, 2021) and Section 3.2.

1.3 REPORT ORGANIZATION

The RI Addendum is organized into the following sections:

- Section 1 (Introduction) - Provides an overview of the purpose and scope of this RI Addendum.
- Section 2 (Background) – Describes CJAG's location, operational history, demography, land use, as well as the AOC site description, operational history, and results and conclusions of previous investigations.

- Section 3 (Remedial Investigation Addendum Activities) – Describes the scope of work completed and the procedures followed during this RI Addendum, including a discussion of the sampling rationale for placement of environmental media sampling locations, field activity procedures, laboratory methods, and protocols. Included in this section are the pre-mobilization activities and the field sampling methods for the sediment composite and discrete sampling. Any deviations from the work plan are outlined in this section.
- Section 4 (Results and Discussion) – Discusses the results of the 10-day bioassays performed on the composite sediment samples collected from the Ore Storage Pond sub-area.
- Section 5 (Summary and Conclusions) – Presents the summary and conclusions for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area based on the observations and toxicity results collected during the RI Addendum.
- Section 6 (Recommendations) – Presents the recommendations for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area based on the observations and toxicity results collected during the RI Addendum.
- Section 7 (References) – Lists references used to prepare this document.

The appendices to this document contain the summarized investigation data, including:

- Appendix A – Field Activity Forms,
- Appendix B – Bioassay Report,
- Appendix C – Site Photographs,
- Appendix D – Ohio EPA Notification of Field Work, and
- Appendix E – Regulatory Correspondence Letters and Comments Response Table.

This Page Intentionally Left Blank

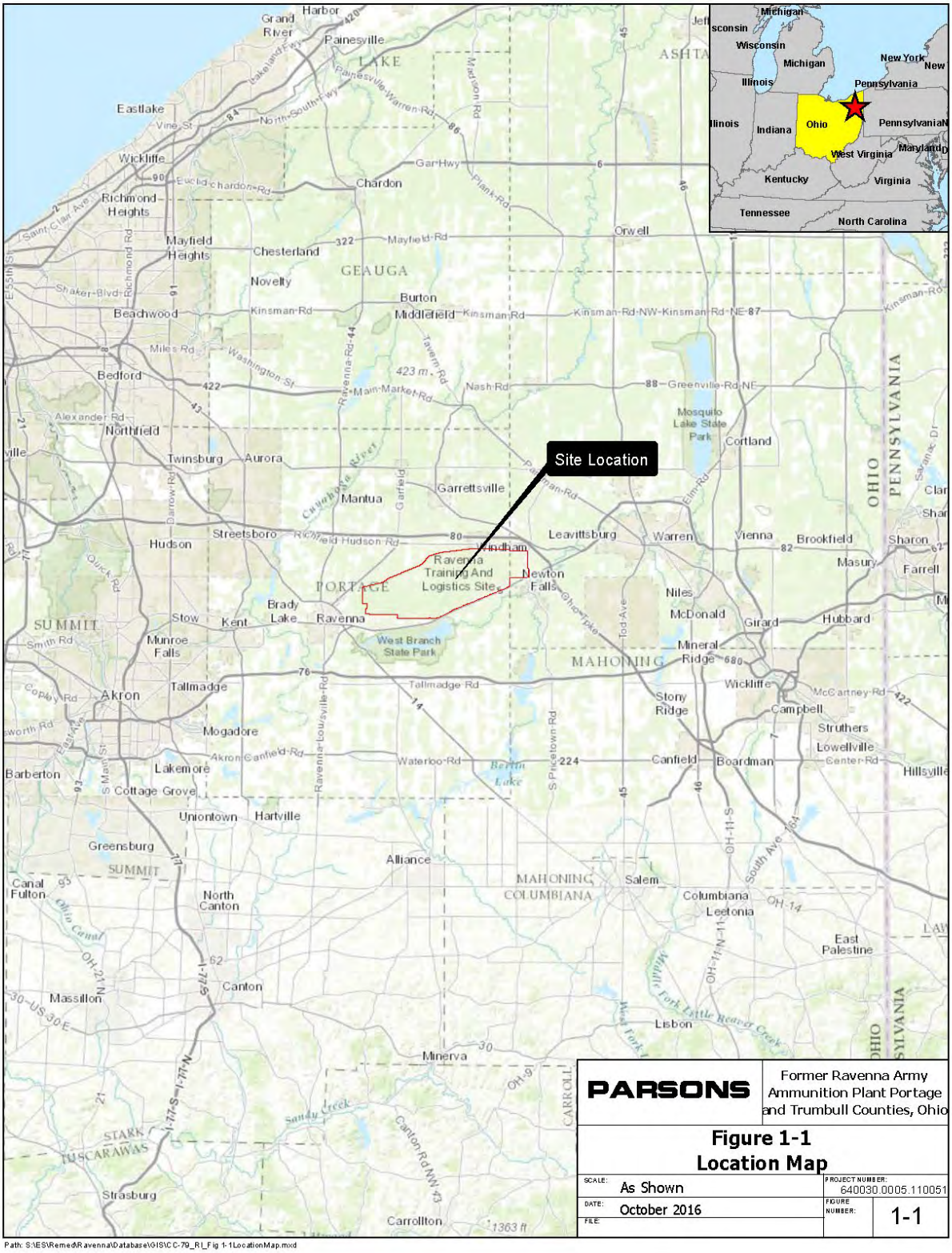


Figure 1-1: Location Map

This Page Intentionally Left Blank

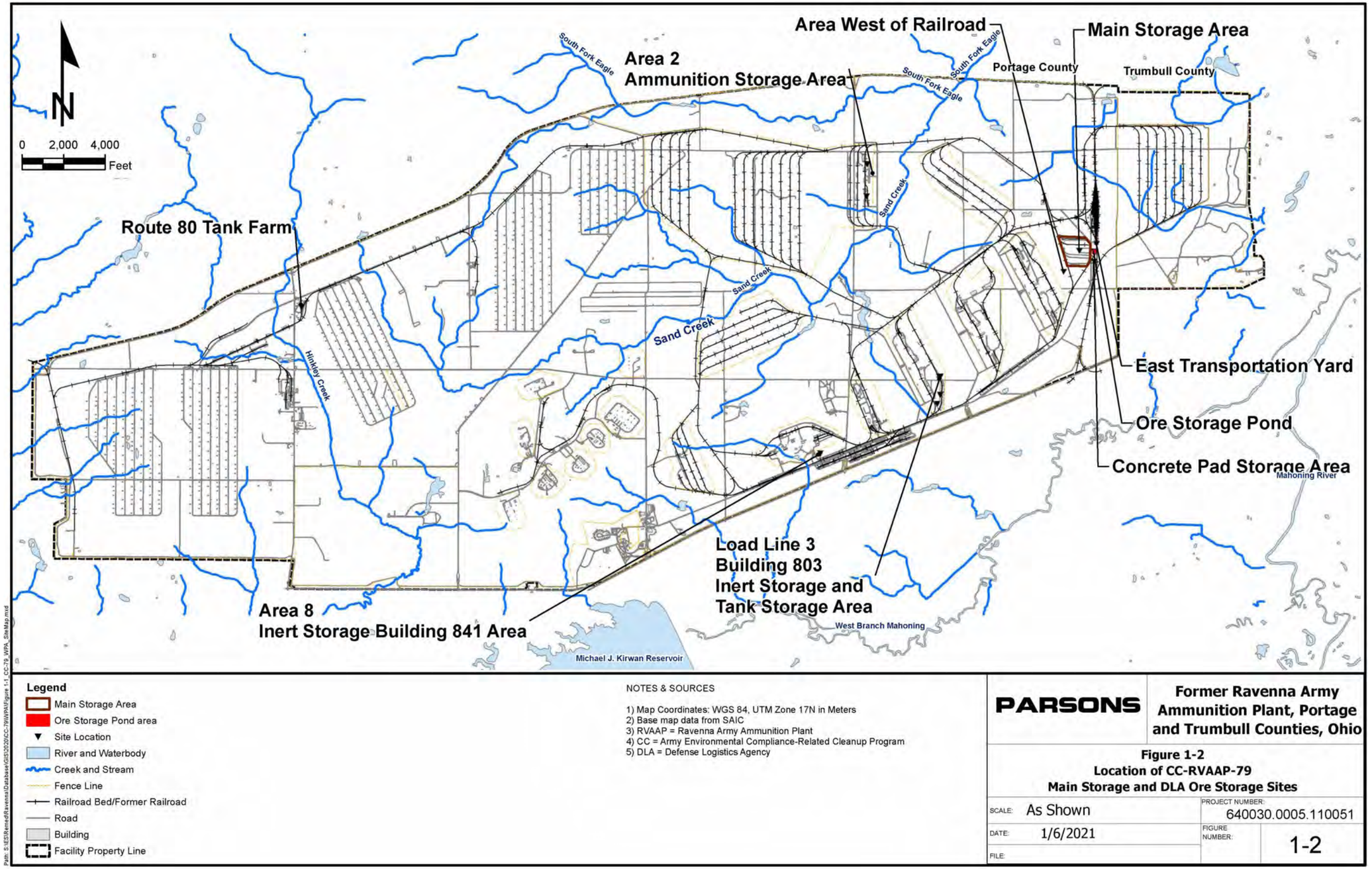


Figure 1-2: Location of CC RVAAP-79 DLA Ore Storage Sites

This Page Intentionally Left Blank

2. BACKGROUND

2.1 FACILITY-WIDE BACKGROUND

2.1.1 Facility Description

The facility description of the former RVAAP, now known as CJAG, is provided in Section 2.1.1 of the Final RI Report (Parsons, 2020).

2.1.2 Demography and Land Use

The 2020 Census reports that the populations of Portage and Trumbull counties are 162,466 and 197,974, respectively. Population centers closest to CJAG are Ravenna, with a population of 11,187, and Newton Falls, with a population of 4,413.

CJAG is located in a rural area and is not close to any major industrial or developed areas. Approximately 55 percent of Portage County, in which the majority of CJAG is located, consists of either woodland or farmland acreage. The closest major recreational area, the Michael J. Kirwan Reservoir (also known as West Branch Reservoir), is south of CJAG.

As of September 2013, administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer for Ohio and the property was subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site now known as CJAG. The RVAAP restoration program involves cleanup of former production/operational areas throughout CJAG related to former activities conducted as the RVAAP.

2.2 ENVIRONMENTAL SETTING

A general description of the physical features, topography, geology, hydrogeology, and environmental characteristics of CJAG is included in Section 2.2 of the Final RI Report (Parsons, 2020). The environmental setting specific to CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area is included in this Section.

2.2.1 Topography

The surface features present at CC RVAAP-79 DLA Ore Storage Sites are generally similar to the rest of CJAG, with mildly undulating topography. Figure 2-1 shows the site features and topography of the five contiguous sub-areas of the AOC, including the Main Storage Area, Area West of the Railroad, East Transportation Yard, Concrete Pad Storage Area, and Ore Storage Pond. These sub-areas are mostly devoid of large or tall vegetation and are surrounded by wooded areas. Railroad spurs formerly either traversed or were located immediately adjacent to each sub-area.

Topographical elevations of the contiguous sub-areas (including the Ore Storage Pond) are between approximately 980 feet above mean sea level (amsl) on the western side and 940 feet amsl on the eastern side (Figure 2-1). Based on area topography, the ground surface slopes to the east across these contiguous sub-areas.

2.2.2 Geology and Soil

The regional geology at CJAG consists of horizontal to gently dipping bedrock strata of Mississippian and Pennsylvanian age overlain by varying thicknesses of unconsolidated glacial deposits. Soils were observed and logged during the RI conducted at the CC RVAAP-79 DLA Ore Storage Sites (Parsons, 2020).

The soil type present at the contiguous sub-areas (including the Ore Storage Pond) consists of disturbed soils that are lacking any original depositional structures or features called Udorthents. No pertinent information regarding Udorthents is available as these soils have been disturbed to a degree that the original soil type at these locations can no longer be identified. Mahoning silt loam (2 to 6 percent slopes) is present in the area surrounding the Ore Storage Pond. Mahoning silt loam is a somewhat poorly drained soil with variable surface runoff and low permeability. The deeper soils observed and documented during the previous RI sampling events are assumed to be Hiram Till glacial deposits or fill material from site construction.

Bedrock was encountered during drilling at depths ranging from 2 to 9 feet in the contiguous sub-areas (including the Ore Storage Pond). In general, the top of bedrock was within four feet of the surface in the Area West of Railroad sub-area (west side of contiguous sub-areas) and from four to nine feet below ground surface (bgs) in the East Transportation Yard sub-area (east side of the contiguous sub-areas). The bedrock is described on boring logs as sandstone and varies in depth of weathering. This sandstone is likely the Sharon Sandstone (Conglomerate) Member of the Pottsville Formation.

2.2.3 Hydrogeology

The potentiometric surface for CJAG aquifers is mapped annually from groundwater elevation measurements in monitoring wells, most recently in the *Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Annual Report for 2019* (Leidos, 2020). One monitoring well, FWGmw-010, is located within the Main Storage Area. This well is completed in unconsolidated deposits and screened from 6 to 16 feet bgs. During the April 2019 groundwater monitoring event, the groundwater in this well was measured at approximately 11.40 feet bgs (Leidos, 2020). The groundwater flow direction within the unconsolidated aquifer beneath the contiguous sub-areas (including the Ore Storage Pond) is to the east.

The nearest bedrock monitoring well is FWGmw-012, located approximately 1,300 feet to the northeast of the contiguous sub-areas (including the Ore Storage Pond), and is screened in the Sharon Shale from 29.5 to 39.5 feet bgs. During the April 2019 groundwater monitoring event, the groundwater in this well was measured at approximately 0.25 feet bgs (Leidos, 2020). The Sharon Shale is not a regional aquifer. It is assumed that the regional bedrock aquifer beneath the vicinity of the contiguous sub-areas (including the Ore Storage Pond) is the Sharon Sandstone. The regional groundwater flow direction in the vicinity of the contiguous sub-areas (including the Ore Storage Pond) within the Sharon Sandstone Aquifer is towards the east- northeast.

2.2.4 Surface Water

Surface water at the contiguous sub-areas occurs intermittently as storm water runoff within ditches or conveyances and toward a wetland area within these contiguous sub-areas (i.e., the Ore Storage Pond). The Ore Storage Pond is approximately 0.36 acres in size and was constructed to control potentially contaminated surface water runoff from the adjacent manganese and chrome stockpiles from leaving the site. During the April 2021 sediment sampling event, the depth of water in the pond at sediment sampling locations ranged between 10 and 16 inches, and the thickness of the sediment ranged between 6 to 11 inches. The pond has not been maintained and therefore has been subject to continuous sedimentation and now is classified as an intermittently exposed, palustrine, emergent wetland versus a small open-water pond. The nearest wetland area downgradient of the Ore Storage Pond is approximately 2,100 to the feet east.

2.3 AREA OF CONCERN DESCRIPTION

CC RVAAP-79 DLA Ore Storage Sites include the following nine sub-areas:

- Main Storage Area
- Area West of Railroad
- East Transportation Yard
- Concrete Pad Storage Area
- Ore Storage Pond
- Route 80 Tank Farm
- Area 2 Ammunition Storage Area
- Load Line 3 Building 803 Inert Storage and Tank Storage Area
- Area 8 Inert Storage, Building 841

The nine separate ore storage sub-areas comprising CC RVAAP-79 DLA Ore Storage Sites are all located within CJAG (Figure 1-1). The RI for eight of the nine areas is complete and documented in the *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020). This RI Addendum only addresses additional sampling for the Ore Storage Pond sub-area.

Five of the sub-areas are contiguous and are located in the eastern portion of CJAG near the intersection of South Service Road and Irons Road (Figure 2-1). All five areas comprising these contiguous sub-areas cover approximately 63 acres. The portion of the sub-areas that stored ore is approximately 53 acres, the other 10 acres were added to the sub-areas as delineation decision units (DUs). The DLA stored strategic and critical materials, including chrome ore, ferrochrome ore, and metallurgical manganese ore at these subareas starting in the late 1940's. All ore was removed by 2012. The Ore Storage Pond was reportedly constructed in the mid-1950s to prevent potentially contaminated surface water runoff from nearby manganese and chrome stockpiles from entering surface water. Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed and now functions as a palustrine, emergent, intermittently exposed wetland as mapped by the National Wetland Inventory (U.S. Fish and Wildlife Service, 2018). No buildings or associated infrastructure (e.g., utility lines) are believed to have been located in or near these sub-areas; however, railroad spurs were located in portions of the Main Storage Area and the Concrete Pad Storage Area. The Area West of Railroad, East Transportation Yard, and the Ore Storage Pond are located immediately adjacent to railroad spurs.

2.3.1 Operational History

Based on the *Final Report for the Assessment of Potential Contamination at the Defense Logistics Agency Outdoor Storage Areas, Ravenna Army Ammunition Plant, Ravenna, Ohio* (SpecPro, Inc., 2003), historical operations conducted at the facility included handling and storage of strategic and critical materials, including various types of ore, for the General Services Administration (GSA). The DLA Defense National Stockpile Center leased space at the facility for the storage of the ore materials on the ground and in above-ground storage tanks since the late 1940's. The following GSA materials were stockpiled on the ground surface in the sub-areas surrounding the Ore Storage Pond: chrome ore, ferrochrome ore, and metallurgical manganese ore

(SpecPro, Inc., 2003). Ore stockpiles were being removed during the 2003 SpecPro, Inc. investigation and were completely removed from the AOC when RI investigations began in 2012.

The Historical Records Review report (SAIC, 2011b) suggested that coal storage may have occurred within the Concrete Pad Storage Area (DU05). If coal was stored within the Concrete Pad Storage Area, it was likely removed by 1979, which is the approximate date that coal piles were removed from the other coal storage areas (CC RVAAP-73 Facility-Wide Coal Storage). No ore or coal was present at the Concrete Pad Storage Area during RI sampling (Parsons, 2020).

2.3.2 Previous Investigations

Timeline for investigations and related documents at CC RVAAP-79 DLA Ore Storage Sites:

- 2003 – Final Report for the Assessment of Potential Contamination at the DLA Outdoor Storage Areas (SpecPro, Inc., 2003)
- November 2010 – Initial Assessment of CC RVAAP-79 DLA Group 2 Ammunition Storage Area (USACE, 2011)
- October 2012 – Site Inspection/RI Work Plan finalized (ECC, 2012)
- October 2012 and March 2013 – RI sampling performed at CC RVAAP-79 DLA Ore Storage Sites
- April 2015 – Additional RI sampling performed at CC RVAAP-79 DLA Ore Storage Sites (except for the Ore Storage Pond and Area 2 Ammunition Storage Area)
- February 2019 – Draft RI Report submitted to Ohio EPA
- April 2019 to February 2020 – Series of comments on Draft RI from Ohio EPA requesting additional sediment sampling and bioassays for the Ore Storage Pond.
- October 2020 – Final RI Report (Parsons, 2020) recommending additional sediment sampling and bioassays at the Ore Storage Pond sub-area.
- March 2021 – Final Work Plan Addendum for Ore Storage Pond (Parsons, 2021)

2.3.2.1 Previous Investigations at the Main Storage Area, Area West of the Railroad, East Transportation Yard, Concrete Pad Storage Area, and Ore Storage Pond

A soil and sediment survey conducted in 1982 by The Mogul Corporation included the collection of 7 soil and 1 pond sediment sample points in the DLA ore pile area (The Mogul Corporation, 1982). The samples were analyzed for 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine, and selected inorganics. Sampling for pollutants in storm water discharges was conducted on a monthly basis upstream (National Pollutant Discharge Elimination System [NPDES] Outfall #800) and downstream (NPDES Outfall #900) from the site in a surface drainage pathway adjacent to the chromium ore piles from November 1992 through February 1997. Available results from this investigation are available in the *Assessment of Potential Contamination at the DLA Outdoor Storage Areas* (SpecPro, Inc., 2003).

SpecPro, Inc. conducted an assessment of DLA outdoor storage areas, including documenting the operational history of ore storage at these contiguous sub-areas, Route 80 Tank Farm, and Load Line 3 DLA Tank Storage Area, summarizing previous investigations, and conducting sampling in 2003 (SpecPro, Inc., 2003). During the 2003 investigation, 86 discrete surface soil samples

(0-1 foot bgs) were collected from the Ore Storage Areas, as well as 14 sediment and 2 surface water samples (SpecPro, Inc., 2003). For soil characterizations purposes, most samples were analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals. A portion of those samples were further characterized using the complete Target Analyte List (TAL) metals list. Detected contaminant concentrations were compared against facility-wide background values developed as part of the Phase II RI for the Winklepeck Burning Grounds (SAIC, 2001).

Three inorganics (arsenic, chromium, and lead) were detected at concentrations greater than background levels in the surface water samples collected from the Ore Storage Pond. Five inorganics were detected at concentrations greater than background levels in the sediment samples. Arsenic and chromium were detected in most sediment samples (71% and 93% of the time, respectively). In general, the occurrence of inorganics in sediment at concentrations greater than background criteria was limited to areas nearest to the chromium piles at the storage area. Inorganics were detected at concentrations greater than the background criterion in 83 out of 86 surface soil samples. Arsenic, barium, and chromium represented most contaminants detected at concentrations greater than background levels in the ore pile storage area; however, the concentrations of inorganics were spatially variable. In general, the occurrence of inorganics at concentrations greater than background criteria in surface soil was limited only to the DLA Ore Pile Storage Area and not the area surrounding the main storage location. Subsurface soil samples were not collected because target analyte Toxicity Characteristic Leaching Procedure maximum contaminant levels were not exceeded in surface soil samples (SpecPro, Inc., 2003). SpecPro, Inc. concluded that surface soil "does not appear to be significantly impacted by storage-related activities". SpecPro, Inc. further concluded that "many of the inorganics found at the DLA Storage Areas may be attributable to sources that have already been removed or are in the process of being removed." Results from this 2003 investigation are available in the *Assessment of Potential Contamination at the DLA Outdoor Storage Areas* (SpecPro, Inc., 2003).

2.3.2.2 Remedial Investigation Activities at the Ore Storage Pond

The following paragraphs summarize the results for the Ore Storage Pond sub-area documented in the *Final Remedial Investigation Report CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (Parsons, 2020).

RI field work at the Ore Storage Pond was conducted in March and April 2013. Field work was conducted in accordance with *Final Site Inspection and Remedial Investigation Work Plan at Compliance Restoration Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio* (ECC, 2012). DUs were designed to represent the operational areas where storage or staging activities could have caused residual contamination in surrounding media. The Ore Storage Pond was designated DU03.

Five discrete collocated sediment and surface water samples (4 primary samples and 1 field duplicate) were collected from 4 sampling locations at the Ore Storage Pond (Figure 2-2). The sediment samples were collected from 0-1 foot below the bottom of the pond. All the samples were analyzed for TAL metals, including mercury. The sediment sample from 79-OSP-DU3-SD3 and surface water sample from 79-OSP-DU3-SW1 were also analyzed for full-suite (including volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], organochlorine pesticides, polychlorinated biphenyls, and explosives/propellants).

Data generated during the CC RVAAP-79 DLA Ore Storage Sites RI for the Ore Storage Pond were screened to identify site-related chemicals (SRCs). A chemical detected at a concentration

greater than the established Background Screening Value, that is not an essential nutrient, and has not been screened out through a frequency of detection evaluation is identified as an SRC. An SRC may, or may not be, related to the former operations at the AOC. Ten inorganics, eleven SVOCs, and three VOCs were identified as SRCs in sediment at the Ore Storage Pond. Five inorganics and one VOC were identified as SRCs in surface water at the Ore Storage Pond.

Receptors and Land Use: The OHARNG-projected future land use for the AOC is Military Training Land Use. The representative receptor for these areas is the National Guard Trainee (NGT) Receptor. Additionally, the Industrial Receptor is representative for the full-time worker at CJAG. Unrestricted (Residential) Land Use is evaluated using the Resident Receptor. The Ore Storage Pond is a small (0.36 acre) former man-made pond and has no permanent inlet. There is an overflow outlet ditch from Ore Storage Pond to the ditch along the railroad to east of the pond. The Ore Storage Pond represents only a small fraction of the total habitat available at CJAG, it does not contain any unique habitats, and it may contain habitat of lower quality than the less developed portions of CJAG property (Parsons, 2020).

Nature and Extent of Contamination: The evaluation of nature and extent of contamination for the Ore Storage Pond sub-area concluded that the extent of detected chemicals in sediment and surface water is confined to the pond itself. Because the Ore Storage Pond was constructed to contain runoff from the Main Storage Area, surface water does not enter or leave the pond, except during periods of heavy precipitation.

Human Health Risk Assessment: Chemicals of potential concern (COPCs) that were carried through the risk assessment were identified by comparing the maximum detected concentration (MDC) of each SRC at each sub-area to the most stringent Resident Receptor Facility-Wide Cleanup Goal (FWCUG) (SAIC, 2010) (or USEPA Residential Receptor Regional Screening Level [RSL] if no FWCUG is established) at a target cancer risk level of 10^{-6} and non-carcinogenic target hazard quotient (HQ) of 0.1. Discrete samples were used to identify COPCs in sediment at the Ore Storage Pond. Grab samples were used to identify COPCs in surface water.

The COPCs in sediment (arsenic and cobalt) and surface water (arsenic) were further evaluated to identify chemicals of concern (COCs). COCs were determined by comparing the exposure point concentrations (EPCs) to FWCUGs or, where not developed, RSLs corresponding to a target cancer risk of 10^{-5} or target HQ of 1. The Human Health Risk Assessment performed for CC RVAAP-79 DLA Ore Storage Sites evaluated Unrestricted (Residential) Land Use (Resident Receptor), which is protective of all receptors. The RI Report (Parsons 2020) concluded that there are no COCs identified in any media in the Ore Storage Pond sub-area.

Ecological Risk Assessment: The RI Report (Parsons, 2020) included a Phase I and Phase II Ecological Risk Assessment (ERA) for all DUs including sediment and surface water at the Ore Storage Pond sub-area. The process included selection of EPCs for all SRCs, and comparison of EPCs to Ohio EPA SRVs and Ecological Screening Values (ESVs, Los Alamos National Laboratory, 2017) to identify and refine chemicals of potential ecological concern (COPECs).

There were no COPECs identified for surface water in the Level II ERA, therefore the RI Report (Parsons, 2020) concluded that no further investigation (e.g., Level III Baseline ERA) for surface water is considered necessary for the protection of ecological receptors at the Ore Storage Pond.

The MDC of arsenic in sediment (300 mg/kg) exceeded the Ohio EPA SRV (25 mg/kg) and ESV (9.79 mg/kg). The Level II ERA identified arsenic as a COPEC in sediment at the Ore Storage

Pond (Figure 2-2). Although the weight of evidence in the ERA showed arsenic was unlikely to cause any ecological impact, the arsenic concentration in sediment exceeded the Ohio EPA SRV. Therefore, in accordance with OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA-DERR, 2018), Ohio EPA indicated that only two options were available for Ore Storage Pond sediment: assess ecotoxicity with bioassays or remediate.

Remedial Investigation Report Recommendations: The Final RI report (Parsons, 2020), consistent with OAC 3745-1 and *Ecological Risk Assessment Guidance Document* (Ohio EPA-DERR, 2018), recommended additional assessment for sediment at the Ore Storage Pond. Specifically, the RI report recommended that six sediment samples should be collected across the pond. Two bioassays should be performed on composite samples consisting of portions from three of the six sediment samples:

- *Hyalella azteca* 10-day bioassay, and
- *Chironomus dilutus (*formerly *tentans)* 10-day bioassay.

Bioassays should follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000). Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed. The decision of whether sediment should be evaluated for remedial alternatives or if no further action is required to address ecological risk based on the results of the bioassays.

In addition, the six sediment samples would be analyzed for standard sediment parameters (total organic carbon, pH, and grain size analysis) and the TAL metals. The results of these analyses would be used to support the evaluation of remedial alternatives, should evaluation be necessary. The results may also be helpful in interpreting the results of the bioassays. No further investigation or removal action was recommended for surface water.

This Page Intentionally Left Blank

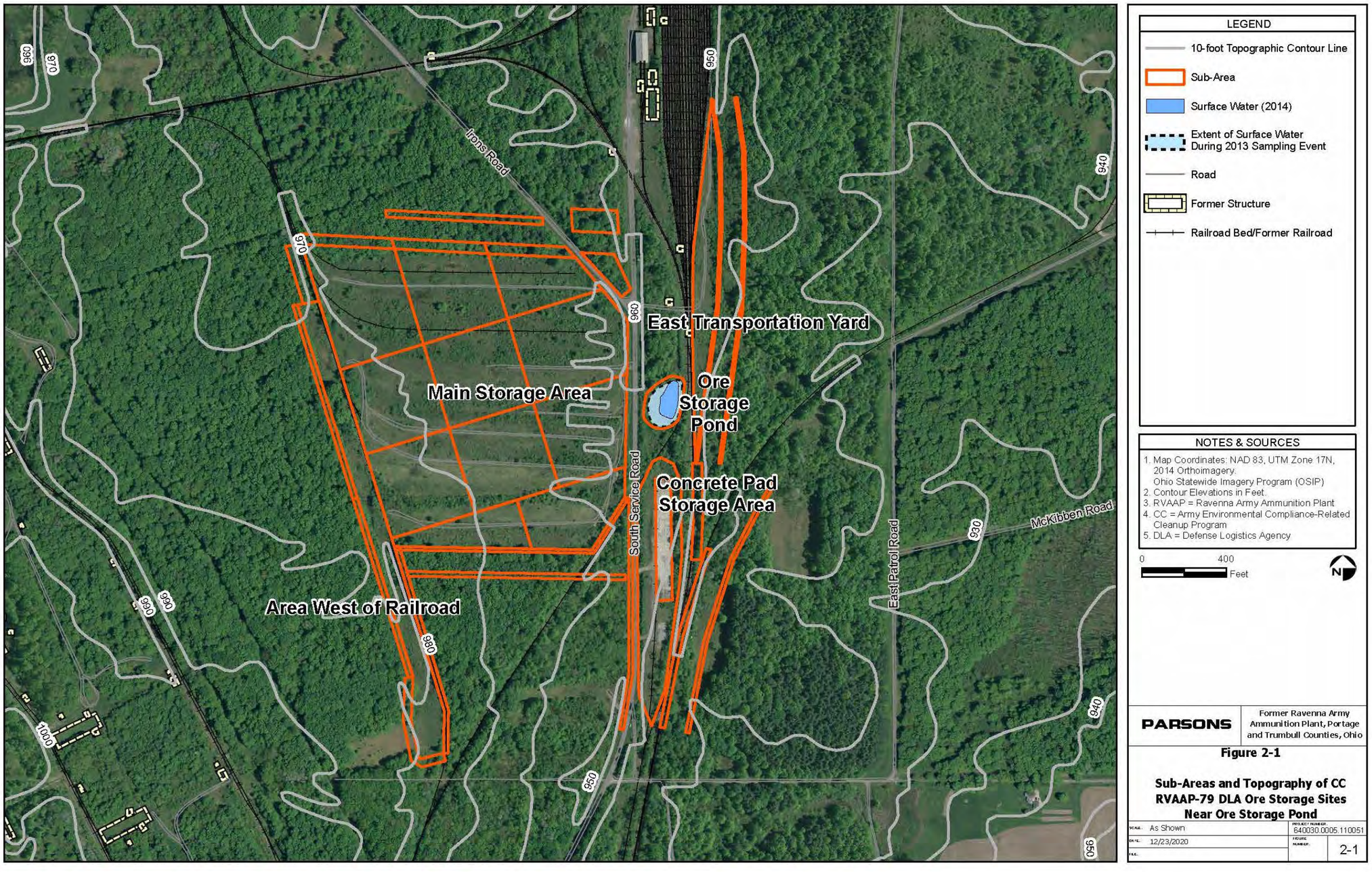
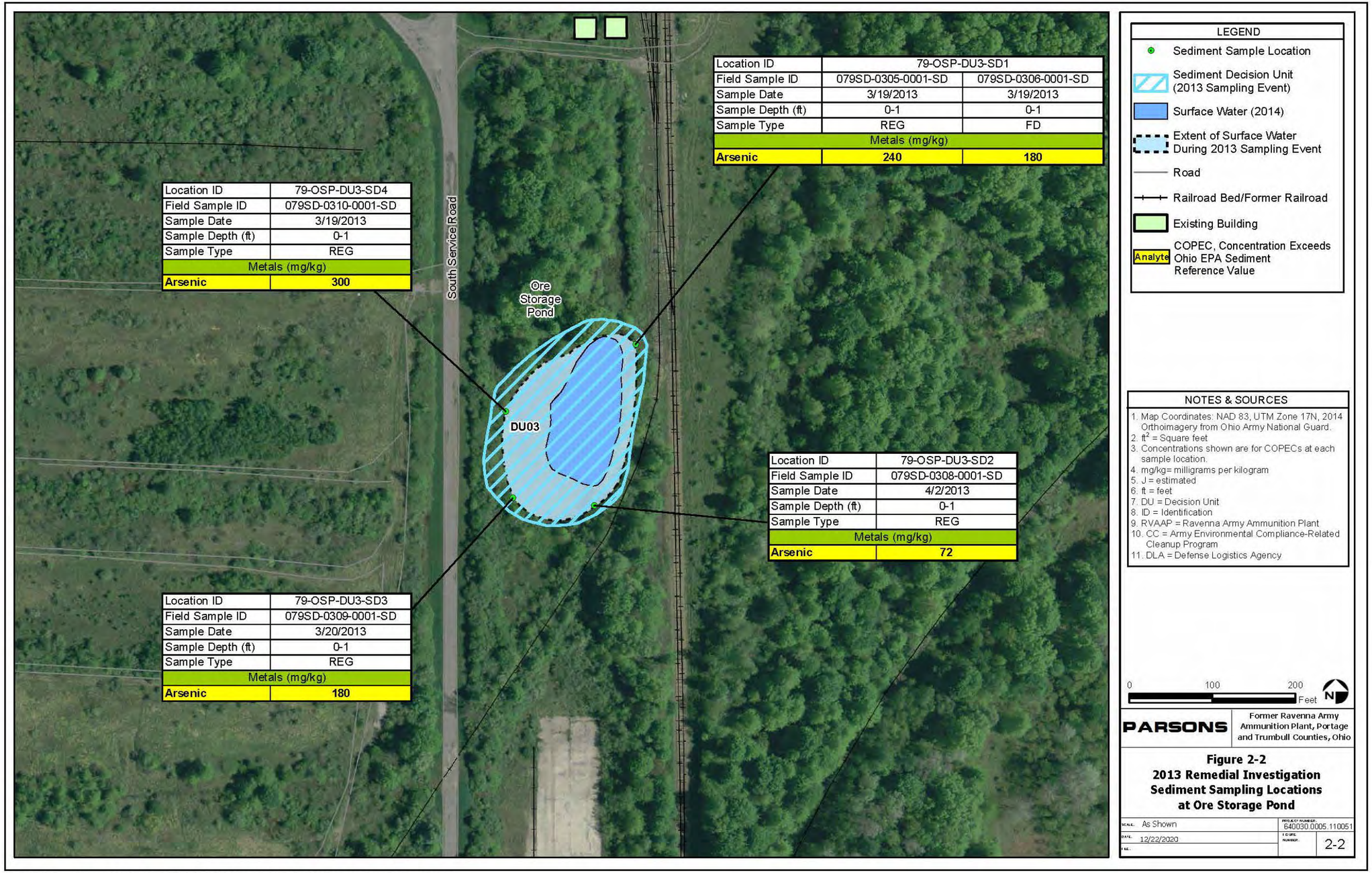


Figure 2-1: Sub-Areas and Topography of CC RVAAP-79 DLA Ore Storage Sites near Ore Storage Pond

This Page Intentionally Left Blank



Path: S:\ES\Remed\Ravenna\Database\GIS\2020\CC-79\WPA\Figure 2-1_CC-79_WPA_Sediment_Samples_Inorganic.mxd

Figure 2-2: 2013 Remedial Investigation Sediment Sampling Locations at Ore Storage Pond Sub-Area

This Page Intentionally Left Blank

3. REMEDIAL INVESTIGATION ADDENDUM ACTIVITIES

This RI Addendum was conducted to characterize sediment ecotoxicity using bioassays to determine if remedial alternatives should be evaluated for sediment, or if sediment is appropriate for no further action to address ecological risk. Samples used for decision making in this RI Addendum were collected by Parsons in April 2021. Work conducted by Parsons for this RI Addendum was performed as specified in the FWSAP (SAIC, 2011a) and the Work Plan Addendum (Parsons, 2020) unless specifically noted herein (Section 3.6).

3.1 SCOPE AND OBJECTIVES

The following objective was identified to complete the RI for CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area:

- Characterize sediment ecotoxicity using bioassays to determine if remedial alternatives should be evaluated for sediment, or if no further action is required to address ecological risk in. Perform two bioassays on composite sediment samples:
    - *Hyalella azteca* 10-day bioassay, and
    - *Chironomus dilutus (tentans)* 10-day bioassay.

Bioassays should follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064* (USEPA, 2000). Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed.

3.2 DATA QUALITY OBJECTIVES

The overall project DQO is to provide representative, repeatable, high quality data to address the primary project objectives (Parsons, 2020). Samples were collected and analyzed according to the FWSAP and the Work Plan Addendum. The FWSAP and Work Plan Addendum provide the organization, objectives, intended data uses, and Quality Assurance/Quality Control (QA/QC) activities to perform in order to achieve the desired DQOs for maintaining the defensibility of the data. Project DQOs were established in accordance with USEPA Region 5 guidance. Requirements for sample collection, handling, analysis criteria, target analytes, laboratory criteria, and data verification criteria for the RI Addendum are consistent with USEPA and U.S. Department of Defense (DoD) requirements. DQOs for this project include analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data. DQOs specific to the Ore Storage Pond sub-area are presented in the Work Plan Addendum (Parsons, 2021) and Table 3-1.

3.3 SAMPLING RATIONALE

At the CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area, discrete and composite sampling methods were employed to investigate the toxicity of sediment. DUs were established in the RI Report (Parsons, 2020) to represent the operational areas where storage or staging activities could have caused residual contamination in the surrounding media (Figure 3-1). The location and size of the Ore Storage Pond DU (DU03) was based on the extent of the Ore Storage Pond. The Work Plan Addendum (Parsons, 2021) included a detailed approach for sampling at the Ore Storage Pond sub-area. Sampling conducted in April 2021 at DU03 represents the area of potential impact

from historical operations. A description of the sampling activities conducted at the Ore Storage Pond sub-area is provided in the following sections and is summarized in detail in Table 3-2.

3.4 PRE-MOBILIZATION ACTIVITIES

Parsons personnel conducted a site walk on January 9, 2020 to scout access to the pond. Parsons personnel mobilized to the pond on April 20, 2021 to collect sediment samples. This included notification of field work to Ohio EPA (Appendix D).

3.5 FIELD SAMPLING

Sediment samples were collected at CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond sub-area. Field sampling forms from April 2021 are provided in Appendix A. The bioassay laboratory report is presented in Appendix B. Photographs of RI Addendum activities from April 2021 are provided in Appendix C. Figure 3-1 depicts the location, size, and sampling locations for the sub-area. Table 3-2 presents a summary of sample identifications, sample collection methods (type), and the rationale for the sampling activities conducted at the Ore Storage Pond sub-area.

3.5.1 Sediment Sampling

Six sediment samples (plus QC including 1 field duplicate and 1 matrix spike/matrix spike duplicate) were collected from 6 sampling locations across two transects that transverse the width of the Ore Storage Pond (from West to East) using discrete sampling methods. A portion of three samples was composited in the field for a total of two composite samples (one composite sample consisting of even-numbered samples, and the other composite sample consisting of odd-numbered samples) for biological analysis (see Section 3.5.2).

Information recorded on the sample forms included station number, depth to bottom, sediment depth (i.e., sampler penetration depth), sediment depth stratum sampled, physical sediment characteristics, and date and time of sample collection (Appendix A). In addition, field measurements for temperature, pH, dissolved oxygen, etc. were collected from the water column within one meter of the sediment prior to sediment sample collection. Photographs were also taken of each sample station (Appendix C). All sediment samples were collected from a depth of at least 0 to 0.5 feet (0 to 15 centimeters) below the sediment surface using a Wildco hand-coring device. Multiple deployments of the corer were necessary to obtain adequate sediment quantity for the sample containers.

The sediment was placed in a plastic container. When sufficient sediment for all analyses had been collected, the sediment in the container was thoroughly homogenized. All sample containers were stored in insulated, ice-filled coolers while in the field prior to shipment. The hand corer was decontaminated between sampling stations by scrubbing with a brush and ambient pond water, followed by a thorough *in situ* rinsing. An equipment blank rinsate sample was collected from the hand corer.

3.5.2 Bioassays

Six sediment samples were collected using two transects across the pond and composited into two samples (three samples for each composite). Sediment was homogenized and split into laboratory containers in the field as described above. Headspace in the bioassay test sample containers was minimized. Bioassays were performed by EA Engineering Science and Technology, Inc. PBC in Hunt Valley, Maryland on each composited sample:

- *Hyalella azteca* (amphipod) 10-day bioassay and

- *Chironomus dilutus* (midge, formerly tentans) 10-day bioassay.

Bioassays followed *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (USEPA, 2000). The tests were performed with 8 replicates per composite sediment sample. The 10-day bioassay tests evaluated survival and growth as endpoints for each test organism and a laboratory control sample was included with the tests. The bioassay samples were performed with a holding time of 14 days or less. Water overlying the test organisms was also field tested for temperature, pH, dissolved oxygen, and conductivity/salinity. The laboratory provided a final report specifying methods, materials, results, statistical determination of toxic concentrations, and unforeseen protocol deviations with an evaluation of the resulting impact. Toxicity testing operations and performance criteria are presented in Appendix B.

The survival and growth results of the organisms toxicity tests were statistically analyzed according to USEPA guidance (USEPA, 2000) to determine if any of the site sediments were significantly different (p=0.05) from the control sediment. If the data were normally distributed, then a t-Test was performed to detect statistically significant differences between test sediments and the control sediment. If the data distribution was non-normal, then a Wilcoxon Two-Sample Test was used to compare the group means. Shapiro-Wilk's Test was used to determine if the data were normally distributed, and the F-Test was used to test for homogeneity of variance.

3.6 DEVIATIONS FROM WORK PLAN

Work performed in April 2021 at the Ore Storage Pond followed the Work Plan Addendum (Parsons, 2021), except for the following deviations:

- 10-day bioassays for *Hyalella azteca* and *Chironomus dilutus* were performed on both composite sediment samples 079SD-416M-0001-SD and 079SD-417M-0001-SD.
- Sediment sampling locations were not recorded using a Trimble Global Positioning System (GPS) unit. The Trimble GPS unit was not operational at the time of sample collection. Instead, the field team used professional judgement and satellite imagery to locate the sampling stations in the pond. The samples were collected as close as possible to the originally proposed sample locations (within 4 meters as specified in the Work Plan Addendum [Parsons, 2021]).

3.7 SURVEYING

The sediment sampling locations within the pond were not surveyed.

3.8 INVESTIGATION-DERIVED WASTE

Sampling conducted at the Ore Storage Pond did not generate any investigation-derived waste.

This Page Intentionally Left Blank

Table 3-1: Data Quality Objectives

State the Problem	Identify Goals of the Study	Identify Information Inputs	Define the Boundaries of the Study	Develop the Analytic Approach	Specify Performance or Acceptance Criteria	Develop the Detailed Plan for Obtaining Data
CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area						
Concentrations of metals were detected in the sediment samples from the Ore Storage Pond that were greater than Ohio EPA SRVs. Although the Army showed there were unlikely to be unacceptable risks to ecological receptors that use the pond using standard ERA tools; the Ohio EPA per their regulations, stated that there were only two options: test the sediment by completing two bioassays or remediate the sediment.	Is the sediment toxic as measured by *Hyalella azteca* 10 day bioassay and /or *Chironomus dilutus* (*tentans*) 10 day bioassay? If bioassays indicate toxicity, report the results, and close the RI phase, then proceed to evaluation of remedial alternatives. If not toxic, report and close the RI phase with conclusion that no further action is required to address ecological risk.	Sediment toxicity is evaluated by survival and growth of in 10-day bioassays. Survival is measured by counting living (moving) organisms at the end of the 10-day test. Growth is measured by average dry weight (for *Hyalella azteca*) or ash-free dry weight (for *Chironomus dilutus*) of surviving organisms. Acceptable tests meet the following criteria in the controls: • *Hyalella azteca* Test Acceptability Criteria: 80% survival and measurable growth in the control • *Chironomus dilutus* Test Acceptability Criteria: 70% survival and a mean ash-free dry weight of 0.48 mg/organism in the control The survival and growth results from the Ore Pond sediment will be compared to those of the control or reference sediment to determine toxicity using statistical methods in accordance with *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000. If the data are normally distributed, then a t-Test will be performed to detect statistically significant ($p = 0.05$) differences between test sediments and the control sediment. If the data distribution is non-normal, then a Wilcoxon Two-Sample Test will be used to compare the group means. Shapiro-Wilk's Test will be used to determine if the data are normally distributed, and the F-Test will be used to test for homogeneity of variance. Should the test results indicate a high degree of statistical strength due to low variability in the data or if the data is highly variable, an indication of biological significance of >20% difference from the control, is sufficient to indicate that a sample may have a substantial impact.	Sediment from within the submerged portions of Ore Storage Pond. The pond is small (0.36 acres). Because the pond has not been maintained, the pond has filled in significantly since it was originally constructed. The size of the pond changes seasonally and with rain events.	Analytic approach is in accordance with *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition*, EPA 617 600/R-99/064, March 2000.	All sampling and analysis will be performed in accordance with the procedures outlined in the UFP-QAPP and the *Work Plan Addendum, Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio.*	Collect six sediment samples across the pond. Prepare field composite samples that each contain portions from three of the six sediment samples) and perform the two bioassays: • *Hyalella azteca* 10 day bioassay and • *Chironomus dilutus (tentans)* 10 day bioassay Bioassays should follow *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, Second Edition, EPA 600/R-99/064, March 2000. Other appropriate organism(s) may be substituted for *Chironomus dilutus (tentans)* if needed. Refer to Section 3.0 for further details.

This Page Intentionally Left Blank

Table 3-2: Sampling Locations and Bioassays at Ore Storage Pond Sub-area CC RVAAP-79 DLA Ore Storage Sites

Location ID	Sample ID	Depth	Matrix	Sample Type		10-Day Bioassay	Notes
079SD-410	079SD-410-0001-SD	0-6 inches	sediment	Discrete	N		Western most end of north transect.
	079SD-410-9001-SD	0-6 inches	sediment	Discrete	FD		
	079SD-410-0001-SD-MS/MSD	0-6 inches	sediment	Discrete	MS/MSD		
079SD-411	079SD-411-0001-SD	0-6 inches	sediment	Discrete	N		Middle of north transect.
079SD-412	079SD-412-0001-SD	0-6 inches	sediment	Discrete	N		Eastern most end of north transect.
079SD-413	079SD-413-0001-SD	0-4 inches	sediment	Discrete	N		Western most end of south transect.
079SD-414	079SD-414-0001-SD	0-6 inches	sediment	Discrete	N		Middle of south transect.
079SD-415	079SD-415-0001-SD	0-6 inches	sediment	Discrete	N		Eastern most end of south transect
079SD-416M	079SD-416M-0001-SD	0-6 inches	sediment	composite	N	Hyalella azteca 10-day bioassay and Chironomus dilutus (tentans) 10-day bioassay	Composite sediment from SD-410, SD-412, and SD-414
079SD-417M	079SD-417M-0001-SD	0-6 inches	sediment	composite	N	Hyalella azteca 10-day bioassay and Chironomus dilutus (tentans) 10-day bioassay	Composite sediment from SD-411, SD-413, and SD-415

Notes:
FD = field duplicate
MS/MSD = matrix spike/matrix spike duplicate
N = normal sample
SD = sediment

This Page Intentionally Left Blank

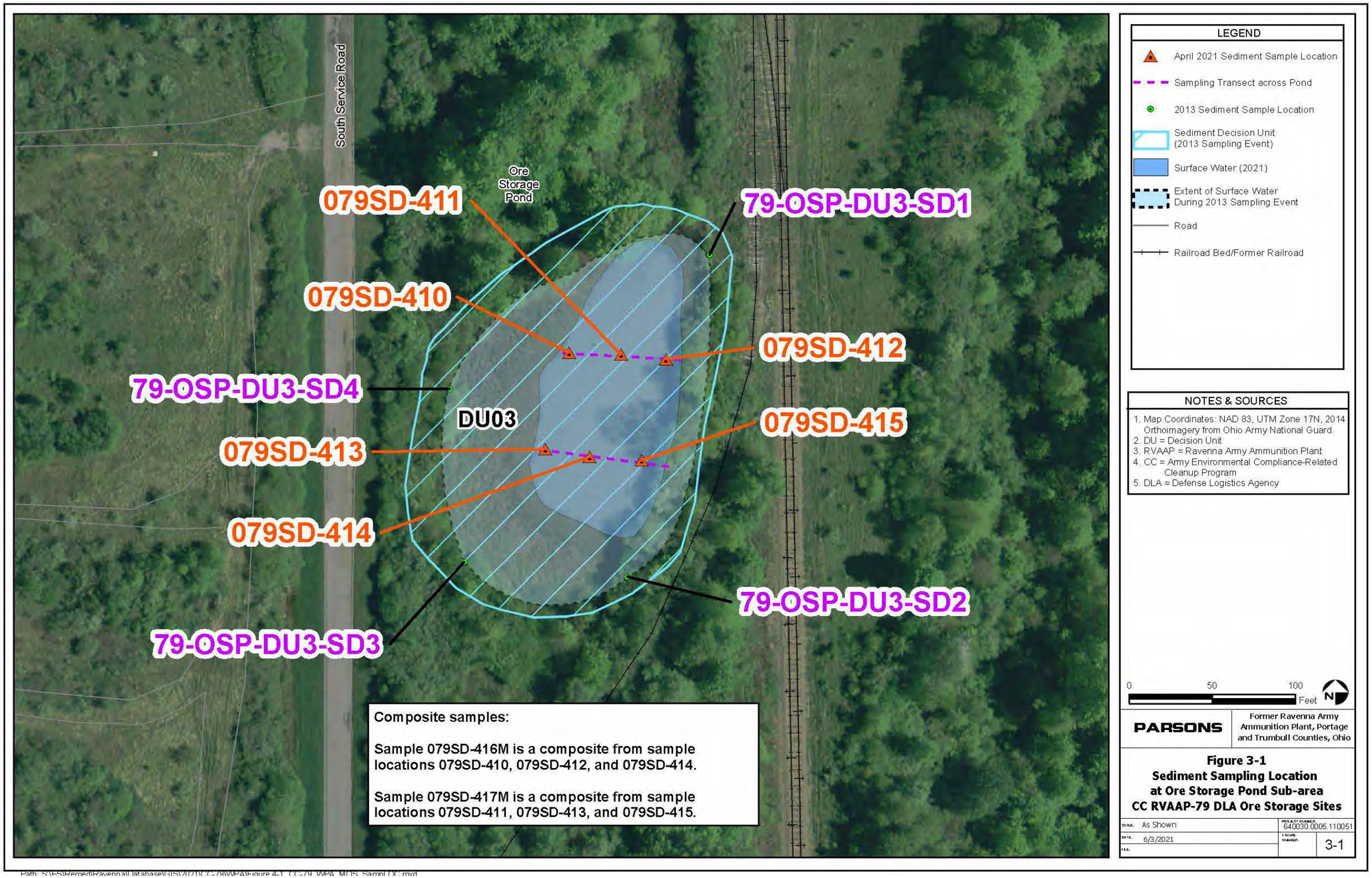


Figure 3-1: Sediment Sampling Locations at Ore Storage Pond Sub-area CC RVAAP-79 DLA Ore Storage Sites

This Page Intentionally Left Blank

4. RESULTS AND DISCUSSION

The Level II Screening ERA performed for the Ore Storage Pond sub-area in the RI Report (Parsons, 2020) concluded that arsenic was identified as a COPEC in the sediment for the Ore Storage Pond, and additional assessment of the sediment at the Ore Storage Pond was required to complete the characterization and ERA of this sub-area. No COPECs were identified for the surface water of the Ore Storage Pond. Field work was performed for additional sampling and bioassays as described in the Work Plan Addendum (Parsons, 2021). This section evaluates the additional samples and bioassays performed for the Ore Storage Pond sub-area. Six sediment samples were collected across the pond, and two bioassays were performed on composite samples consisting of portions from three of the six sediment samples:

- *Hyalella azteca* 10 day bioassay, and
- *Chironomus tentans* 10 day bioassay.

Bioassays followed *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064*, March 2000 (USEPA, 2000).

4.1 *HYALELLA AZTECA* 10-DAY BIOASSAYS

Table 4-1 summarizes the results of the *Hyalella azteca* 10-day survival and growth test. Water quality measurements taken during the test are presented in Appendix B. The survival and growth of *Hyalella azteca* exposed to the site sediments were statistically compared to organisms exposed to the laboratory control. The results indicate that survival and growth of the organisms exposed to site sediments were not statistically different (p=0.05) from the laboratory control sample. The results of the *Hyalella azteca* 10-day bioassay indicate that sediment from composite samples 079SD-416M-0001-SD and 079SD-417M-0001-SD do not show toxicity.

Table 4-1: Results of *Hyalella azteca* 10-Day Toxicity Testing

Sample Identification	10-Day Survival (percent)	Mean Dry Weight as mg/Organism (±SD)	Conclusion
Laboratory Control	80	0.073 (±0.016)	Control meets criteria of 80% survival and measurable growth
079SD-416M-0001-SD	86	0.096 (±0.015)	Survival and growth are not statistically different (p=0.05) from laboratory control
079SD-417M-0001-SD	86	0.083 (±0.021)	Survival and growth are not statistically different (p=0.05) from laboratory control

4.2 *CHIRONOMUS DILUTUS* 10-DAY BIOASSAYS

Table 4-2 summarizes the results of the *Chironomus dilutus* 10-day survival and growth test. Water quality measurements taken during the test are presented in Appendix B. The survival and growth of *Chironomus dilutus* exposed to the site sediments were statistically compared to organisms exposed to the laboratory control. The survival results indicated that the organisms exposed to the site sediments were statistically different (p=0.05) from the laboratory control sample for survivability. Although statistically different, the average survivability of *Chironomus dilutus* in

the two samples was 85.5 percent, compared to 100 percent survivability in the control. This is a 14.5% difference in survival rates relative to the control. Ohio EPA guidance (Ohio EPA-DERR, 2018) indicates that historically laboratory bioassays use a significant difference range of 10 - 20% as being of importance. The DQO in the Work Plan Addendum (Parsons, 2021) indicated that a difference between bioassay results in the samples and control of greater than 20 percent indicates a significant impact. Therefore, the survival rates in the samples, though statistically different from the control, were not sufficiently different to be an important or significant impact. Mean ash free dry weight indicated that growth in both of the sediment samples were not significantly different from the control. The results of the *Chironomus dilutus* 10-day bioassay indicate that sediment from composite samples 079SD-416M-0001-SD and 079SD-417M-0001-SD do not show significant toxicity.

Table 4-2: Results of *Chironomus dilutus* 10-Day Toxicity Testing

Sample Identification	10-Day Survival (percent)	Mean Ash Free Dry Weight as mg/Organism (±SD)	Conclusion
Laboratory Control	100	0.697 (±0.152)	Control meets criteria of greater than 70% survival and a mean ash-free dry weight of at least 0.48 mg/organism
079SD-416M-0001-SD	93(a)	1.074 (±0.209)	Survival rate is statistically different (p=0.05) from laboratory control. Growth is not statistically different from the control.
079SD-417M-0001-SD	78(a)	1.221 (±0.267)	Survival rate is statistically different (p=0.05) from laboratory control. Growth is not statistically different from the control.

Notes:
(a) Significantly different (p=0.05) from laboratory control.

5. SUMMARY AND CONCLUSIONS

This RI addendum was conducted to determine the toxicity of the Ore Storage Pond sub-area and evaluate whether additional remedial actions are warranted. Samples used for decision making in this RI Addendum were collected by Parsons in April 2021. Samples were collected and analyzed according to the FWSAP (SAIC, 2011a) and the Final Ore Storage Pond Sub-area Work Plan Addendum (Parsons, 2021). The bioassays were conducted in accordance with USEPA toxicity and bioaccumulation guidance (USEPA, 2000).

At the Ore Storage Pond sub-area, composite and discrete sampling methods were employed to investigate sediment. Six sediment samples were collected across the pond, and two bioassays were performed on composite samples consisting of portions from three of the six sediment samples:

- *Hyalella azteca* 10 day bioassay, and
- *Chironomus tentans* 10 day bioassay.

Bioassays followed *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition, EPA 600/R-99/064*, March 2000.

The results of the *Hyalella azteca* and *Chironomus dilutus* 10-day bioassays indicate that sediment from composite samples 079SD-416M-0001-SD and 079SD-417M-0001-SD do not show significant toxicity to the ecological receptors.

This Page Intentionally Left Blank

6. RECOMMENDATIONS

Based on the summary and conclusions of this RI Addendum, No Further Action is recommended to address ecological risk in sediment in the Ore Storage Pond sub-area at CC RVAAP-79 DLA Ore Storage Sites.

Because the additional data for the Ore Storage Pond sediments collected for this RI Addendum has concentrations of arsenic that are greater than those used to estimate risks to Human Health Receptors in the CC RVAAP-79 RI, these potential risks need to be reassessed considering the new sediment and pond data. Since the CC RVAAP-79 RI has been finalized, the Army will revise the Draft CC RVAAP-79 FS to include a reassessment of potential human health risks for current and future receptors of the Ore Storage Pond that includes the new data collected for this RI Addendum. The revised HHRA will be incorporated into the Risk Management Portion of the CC RVAAP-79 FS.

This Page Intentionally Left Blank.

7. REFERENCES

Environmental Chemical Corporation (ECC), 2012. *Final Site Inspection and Remedial Investigation Work Plan at Compliance Restorations Sites (Revision 0), Ravenna Army Ammunition Plant, Ravenna, Ohio.*

Leidos, 2020. *Final Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Annual Report for 2019, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio*. June 12.

Los Alamos National Laboratory, 2017. *Ecological Screening Values,* ECORISK Database Release V4.1, September 2017.

Ohio Environmental Protection Agency (Ohio EPA), 2004. *Director's Final Findings and Orders for the Ravenna Army Ammunition Plant.* June 2004.

Ohio EPA – Division of Environmental Response and Revitalization (DERR), 2018. *Ecological Risk Assessment Guidance Document.* July 2018.

Parsons, 2020. *Final Remedial Investigation Report for CC RVAAP-79 DLA Ore Storage Sites, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio.*

Parsons, 2021. *Final Work Plan Addendum Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Ravenna Army Ammunition Plan Restoration Program, Portage and Trumbull Counties, Ohio.*

Science Applications International Corporation (SAIC), 2001. *Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* April.

SAIC, 2010. *Facility-wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna Ohio*. 23 March.

SAIC, 2011a. *Facility-Wide Sampling and Analysis Plan (FWSAP) for Environmental Investigation*. 24 February

SAIC, 2011b. *Historical Records Review Report for the 2010 Phase I Remedial Investigation Services at Compliance Restoration Sites (9 Areas of Concern), Ravenna Army Ammunition Plant, Ravenna, Ohio.* 22 December.

SpecPro, Inc., 2003. *Final Report for Assessment of Potential Contamination at the DLA Outdoor Storage Areas, Ravenna Army Ammunition Plant, Ravenna, Ohio*. Prepared for U.S. Army Joint Munitions Command. August.

The Mogul Corporation, 1982. *Soil and Sediment Analyses Performed for Ravenna Arsenal,* Ravenna, Ohio, 1982.

U.S. Army Corps of Engineers (USACE), 2011. Letter to Base Realignment and Closure Division; Ravenna Army Ammunition Plant, regarding *Results for Initial Assessment of CC-RVAAP-79 DLA Group 2 Ammunition Storage Area,* 22 November.

U.S. Environmental Protection Agency (USEPA), 1990. *National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule,* FR Vol. 55, No. 46, available from U.S. Government Printing Office, Washington, D.C. March.

USEPA, 2000. *USEPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition,* EPA 600/R-99/064, March.

U.S. Fish and Wildlife Service, 2018. Wetlands Mapper, accessed 12/21/2018. www.fws.gov/wetlands/data/mapper.html

Vista Sciences Corporation, 2020. *Ravenna Army Ammunition Plant Deliverable Document Format Guidelines, Version 22*. November.

APPENDICES

This Page Intentionally Left Blank

Appendix A Field Activity Forms

This Page Intentionally Left Blank

APPENDIX A.1

SEDIMENT SAMPLING FORMS

This Page Intentionally Left Blank.

(410)

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zahrt, J. Petrin, K. Fields

Weather: Partly Sunny, 48°, Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): West shore, open water, edge of cattails

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
12.3	7.83	0.140	11.82	—	—	1	0.5

Sediment Collection Information:

Water Depth Above Sample (feet): 1

Sediment Sample Depth: 0.5 Sediment Depth to Refusal: 0.5 ft

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~079~~ 079SD-410

Sample ID: 079SD-410-0001-SD Date Sampled: 4/20/21 Time Sampled: 10:45

Duplicate Sample ID 079SD-~~410~~ 9001-SD Duplicate Time (+5min): 10:45 MS/MSD collected? (Yes) No

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): _____

Clay mixed with silt, heavy organic matter, no odor

Photos: Photos Taken of Sample location and depth of sediment

Sample Preservation: Ice.

Comments: ~10 cores collected from 1 spot

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

✓ TOC by Walkley Black Method

✓ pH by SW9045D

✓ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous diiutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

Sediment Sampling Form

(411)

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zonte, J. Peterlin, K. Fielder

Weather: Cloudy, 45° Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): Center of pond - north edge

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
12	7.86	0.139	13.26	32.3	—	16 inches	0.5

Sediment Collection Information:

Water Depth Above Sample (feet): 16 inches

Sediment Sample Depth: 0.5 Sediment Depth to Refusal: 6 inches

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~SS~~ 0795D-411

Sample ID: 0795D-411-0005 Date Sampled: 4/20/21 Time Sampled: 10:30

Duplicate Sample ID — Duplicate Time (+5min): — MS/MSD collected? Yes (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): Soft silt with heavy organic matter. Slight hydrogen sulfide odor.

Photos: Photos taken of sample location and depth of sediment

Sample Preservation: Ice

Comments: About 10 cores per aliquot

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

✓ % TOC by Walkley Black Method

✓ pH by SW9045D

✓ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

Sediment Sampling Form

412

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zahrte, J. Peterlin, K. F...

Weather: Cloudy, 45°F, Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): _____

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
11.78	7.82	0.139	11.3	3.5	—	1	0.5

Sediment Collection Information:

Water Depth Above Sample (feet): 1'

Sediment Sample Depth: 0.5' Sediment Depth to Refusal: 11 inches

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~412~~ 079SD-412

Sample ID: 079-SD-412-0001-SD Date Sampled: 4/20/21 Time Sampled: 10:00

Duplicate Sample ID — Duplicate Time (+5min): — MS/MSD collected? Yes (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): Soft silt with many organic matter, slight hydrogen sulfide odor

Photos: Photos Taken of sample location and depth of ~~Sample~~ sediment

Sample Preservation: Ice.

Comments: ~10 cores per bucket

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

____ % TOC by Walkley Black Method

____ pH by SW9045D

____ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

(413)

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zahrk, J. Peterlin

Weather: Cloudy, 45°

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude:

Sample Site Description (color, odor, appearance): West side of pond next to containers

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
12.67	7.7	0.137	13.28	-		10"	4 inches

Sediment Collection Information:

Water Depth Above Sample (feet): 10 inches

Sediment Sample Depth: 4" Sediment Depth to Refusal: 4 inches

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other:

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~413~~ 079SD-413

Sample ID: 079SD-413-0001-SD Date Sampled: 4/20/21 Time Sampled: 1140

Duplicate Sample ID — Duplicate Time (+5min): — MS/MSD collected? Yes (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance):

Grayish black, silty with little bit of clay, slight hydrogen sulfide odor.

Photos: Photos taken of sample location and depth of sediment

Sample Preservation: Ice.

Comments:

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

____ % TOC by Walkley Black Method

____ pH by SW9045D

____ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

414

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Barsley, J. Peterson, C. Fiala

Weather: Cloudy 45° Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): Mid Pond

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
12.48	7.77	0.140	13.39	-		1'	0.5

Sediment Collection Information:

Water Depth Above Sample (feet): 1'

Sediment Sample Depth: 0.5 Sediment Depth to Refusal: 6"

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~SS~~ 079-SD-414

Sample ID: 079-SD-414-0001-SD Date Sampled: 4/20/21 Time Sampled: 11:25

Duplicate Sample ID: — Duplicate Time (+5min): — MS/MSD collected? Yes (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): Black, gray silt with clay, hydrogen sulfide smell

Photos: Photos taken of Sample location and depth of Sediment

Sample Preservation: Ice.

Comments: _____

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

✓ % TOC by Walkley Black Method

✓ pH by SW9045D

✓ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

415

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zahrte, J. Peterlin, K. Fields

Weather: Cloudy, 45° Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): East side of pond near stairs

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
12.3	7.6	0.139	13.0	22.5	—	1'	0.5

Sediment Collection Information:

Water Depth Above Sample (feet): 1'

Sediment Sample Depth: 0.5 Sediment Depth to Refusal: 9"

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): (Grab) Composite

Sediment Sample Information:

Station ID: ~~SS~~ 079SD-415

Sample ID: 079SD-415-0001-SD Date Sampled: 4/20/21 Time Sampled: 1115

Duplicate Sample ID: — Duplicate Time (+5min): — MS/MSD collected? Yes (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): Mostly silt, slight oil-like odor, some organic material with sand mixed in

Photos: ~~Samples~~ Photos Taken of sample location and sediment depth.

Sample Preservation: Ice,

Comments: _____

Laboratory Analytical Methods:

____ TAL Metals/Mercury by SW6010C/SW7471B

____ % TOC by Walkley Black Method

____ pH by SW9045D

____ Grain Size by ASTM D 422-63

____ Bioassay Hyalella azteca 10 day

____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zahte, J. Peterlin, K. Fields

Weather: Partly Sunny, 48° calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): Composite of [redacted]079SD-410-0001-SD, 079SD-412-0001-SD, and 079SD-414-0001-SD

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
—	—	—	—	—	—	—	—

Sediment Collection Information:

Water Depth Above Sample (feet): 1 FT

Sediment Sample Depth: 0.5 Sediment Depth to Refusal: 6 To 11 inches

Collection Method (circle one): Scoop Eckman Dredge (Hand Corer) Other: _____

Sample Type (circle one): Grab (Composite)

Sediment Sample Information:

Station ID: 079SD-416M

Sample ID 079SD-416M-0001-SD Date Sampled: 4/20/2021 Time Sampled: 10:00 AM to 11:45 AM

Duplicate Sample ID — Duplicate Time (+5min): — MS/MSD collected? Yes / No

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): See descriptions for 079SD-410-0001-SD, 079SD-412-0001-SD, and 079SD-414-0001-SD

Photos: Photos taken of sample locations and depth of sediment

Sample Preservation: Ice.

Comments: Composite Sample

Laboratory Analytical Methods:

_____ TAL Metals/Mercury by SW6010C/SW7471B

_____ % TOC by Walkley Black Method

_____ pH by SW9045D

_____ Grain Size by ASTM D 422-63

✓ Bioassay Hyalella azteca 10 day

✓ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

Sediment Sampling Form

Project Name: Camp James A. Garfield, OH **Site Location:** CC RVAAP-79, Ore Storage Pond

Contract Number: W912QR-12-D-0002 DO: 0003 Sampled By: P. Zoshke, J. PeTerlin, K. Fields

Weather: Partly Sunny 48° Calm

Sample Location Description:

Water Body Name: Ore Storage Pond Latitude/Longitude: _____

Sample Site Description (color, odor, appearance): Composite of 079SD-411-0001-SD, 079SD-413-0001-SD, and 079-415-0001-SD

Ambient Water Conditions:

Water Temp. (°C)	pH (SU)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity/ Appearance (NTU)	Water Depth Above Sample (feet)	Sediment Sample Depth (feet)
—	~	—	—	—	—	—	—

Sediment Collection Information:

Water Depth Above Sample (feet): 1 FT

Sediment Sample Depth: 4-6" Sediment Depth to Refusal: 4" To 9"

Collection Method (circle one): Scoop ~~Eckman~~ Dredge (Hand Corer) Other: _____

Sample Type (circle one): Grab (Composite)

Sediment Sample Information:

Station ID: 079SD-417M

Sample ID: 079SD-417M-0001-SD Date Sampled: 4-20-2021 Time Sampled: 10:30 To 11:15 Am

Duplicate Sample ID: — Duplicate Time (+5min): — MS/MSD collected? Yes / (No)

Observations (Munsell Soil Color Chart, Texture, Odor, Appearance): See descriptions for 079SD-411-0001-SD, 079SD-413-0001-SD, 079SD-415-0001-SD

Photos: Photos Taken of Sample locations and depth of sediment

Sample Preservation: Ice,

Comments: Composite Sample

Laboratory Analytical Methods:

_____ TAL Metals/Mercury by SW6010C/SW7471B

_____ % TOC by Walkley Black Method

_____ pH by SW9045D

_____ Grain Size by ASTM D 422-63

_____ Bioassay Hyalella azteca 10 day

_____ Bioassay Chironomous dilutus (tentans) 10 day

Notes:

Sand - Particles 0.06-2.0 mm in diameter, possessing a gritty texture when rubbed between fingers. Loose materials (not cohesive) that often cannot be molded into shapes (non-plastic).

Silt - Particles 0.004-0.06 mm in diameter, generally fine material possessing a greasy or smooth, talc-like feel when rubbed between fingers. Non-plastic and not cohesive.

Clay - Particles less than 0.004 mm in diameter, which forms a dense, gummy surface that is difficult to penetrate with tools (hardpan). Clay is both plastic and cohesive.

Marl - Calcium carbonate, usually greyish-white, often containing fragments of mollusc shells.

Detritus - Dead, unconsolidated organic material including sticks, wood, leaves, and other partially decayed coarse plant material.

Peat - Partially decomposed plant materials characterized by an acidic pH; parts of plants such as Sphagnum moss sometimes visible.

Muck - Black, extremely fine, flocculant material composed of completely decomposed organic material (excluding sewage).

Sludge - Organic matter that is decidedly of human or animal origin.

APPENDIX A.2

FIELD NOTES

This Page Intentionally Left Blank.

DAILY ACTIVITY REPORT

Project No:	**640030.0005.110051**	Day:	**Tuesday**	Date:	**4-20-2021**
W912QR-12-D-0002, TO 0003				Report No:	
Project Title:	**Camp James A Garfield OH – Sediment Sampling at CC RVAAP-79 Ore Pond**				

Work Area	Shift	Hours Worked:		Weather:	Coudy
		From:	To:	Temp	45 degrees
	DAY	08:00	3:30pm	Rain/Snow; none	

Contractor Manpower	**Number of Workers**	**Total Onsite Hours**	**Major Equipment**	**Number on Site**	**Total Hours**
PARSONS	3				
Joe Peterlin		7.5	Hand tools		
Paul Zahrte		7.5	Canoe		
Karen Fields		7.5			
Contractors					
None					
Visitors	1				
Kevin Sedlak (8:00-9:00 AM)		1			

HEALTH AND SAFETY TASKS PERFORMED/PPE: Level D

EQUIPMENT ON SITE: Canoe, sediment sampler, water meter, Trimble GPS

QUALITY CONTROL ACTIVITIES (Including Field Calibrations, may include attachment): None

SITE WORK COMPETED
Collected Ore Storage Pond Sediment samples
Completed wetland delineation of Ore Storage Pond
Completed Waste Inspection

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN: none

NOTES/INSTRUCTIONS GIVEN BY GOVERNMENT PERSONNEL: none

PROPOSED SCOPE OF WORK FOR TOMORROW: no work tomorrow. Waste inspection in May 2021.

Date: 4-20-2021	Joe Peterlin

Location RAVENNA, OH Date 3/17/21

Project / Client C-JAG

C. Huey / J. Peterlin REPLACE MANHOLE

0750 ONSITE. CHECKED IN WITH RANGE
CONTROL. TAILGATE MEETING.
REPLACE MANHOLE FOR 069MW-008

0800 GOT STARTED WITH CHIPPING OUT
CONCRETE FROM OLD MANHOLE.

1000 LEFT SITE TO PICK UP MORE
CONCRETE MIX.

1035 BACK ONSITE. FINISH PAD.

1125 CHECK OUT AT RANGE CONTROL.
LEFT CONES AROUND CONCRETE
PAD. JOE TOOK PICTURES.

1130 OFF SITE.

PAD - 6" THICK FOR
069MW-008

3/17/2021

C. Huey

Location Ravenna, OH Date [illegible]

Project / Client C-JAG

7:50 Am: Arrived on site

8:00 Am: Checked in at Range
Control. Kevin Sedlack onsite

Conducted Tailgate safety meeting
with Kevin Sedlack, Paul Zahk,
Karen Fields, Joe Peterlin.

0945 Start setting up rope &
portage canoe for sampling. The
[illegible] rope for North transect
first

10:00 Collect first samples at
07950-412. Place in bucket
for later putting in sample jars

10:30 collect sample at
07950-411.

10:45 collect sample at
07950-410

Location Ravenna Date 4-20-2021

Project / Client C-IAG

11:00 Set up south rope transect

11:15 Collect sample at 079SD-415

11:25 Collect sample at 079SD-414

11:40 Collect sample at 079SD-413

12:00 Break for lunch.

12:15 Start packaging up samples into coolers

13:00 Composite sample 079SD-416M

13:15 Composite sample 079SD-417M

Location Ravenna Date 4-20-2021

Project / Client C-IAG

13:30 - Start wetlands delineation.

14:30 - Finish marking wetland fringe around pond. Trimble not picking up satellite so flagged by boundary points around pond.

15:00 - Conducted Waste Inspection of AOC 69 Groundwater drum.

4-20-2021

Rite in the Rain

DAILY ACTIVITY REPORT

Project No:	**640030.0005.110051**	Day:	**Tuesday**	Date:	**4-27-2021**
W912QR-12-D-0002, TO 0003				Report No:	
Project Title:	**Camp Garfield(Ravenna) OH – replace manhole and pad for 069MW-008**				

Work Area	Shift	Hours Worked:		Weather:	Clear
		From:	To:	Temp	75 degrees
	DAY	08:30	3:00pm	Rain/Snow; none	

Contractor Manpower	**Number of Workers**	**Total Onsite Hours**	**Major Equipment**	**Number on Site**	**Total Hours**
PARSONS	1				
Joe Peterlin		6.5			
Contractors					
None					
Visitors					

HEALTH AND SAFETY TASKS PERFORMED/PPE: Level D

EQUIPMENT ON SITE: Trimble GPS

QUALITY CONTROL ACTIVITIES (Including Field Calibrations, may include attachment): None

SITE WORK COMPETED
Recorded wetland delineation GPS coordinates.

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN: none

NOTES/INSTRUCTIONS GIVEN BY GOVERNMENT PERSONNEL: none

PROPOSED SCOPE OF WORK FOR TOMORROW: Waste inspection in May 2021.

Date: 4-27-2021	Joe Peterlin

Location C-JAG Date 4-27-2021

Project / Client

- Arrived 8:30 Am to Collect GPS Coordinates from Wetlands Area.

- Trimble GPS is Equipment onsite.

- I am unable to see data that appears to be collected in the Trimble. Emailed data files to Koren Fields.

Location C-JAG Date 4-27-2021

Project / Client

Phone	Google Earth GPS	
OP1	41.208024	81.007233
OP2	41.207784	81.007001
OP3	41.207775	81.006993
OP4	41.207913	81.006802
OP5	41.207921	81.006607
OP6	41.208027	81.006463
OP7	41.208006	81.006468
OP8	41.208009	81.006467
OP9	41.207711	81.006535
OP10	41.207578	81.006623
OP11	41.207460	81.006712
OP12	41.207393	81.006739
OP13	41.207384	81.006716
OP14	41.207309	81.006943
OP15	41.207358	81.007098
OP16	41.207413	81.007139
OP17	41.207429	81.007138
OP18	41.207652	81.007152

Plotted Coordinates on Google Earth.

Location C-JAG Date 4-27-2021

Project / Client

Below are coordinates that don't plot to the correct positions.

OP1	41.207707	81.006983
OP2	41.207666	81.006916
OP3	41.207823	81.006795
OP7	41.207853	81.006585
OP8	41.207650	81.006579
OP9	41.207827	81.006628
OP10	41.207609	81.006706
OP13	41.207219	81.006898
OP15	41.207404	81.007074
OP16	41.207446	81.007113
OP17	41.207541	~~81.007446~~ 81.007146

Plotted coordinates on Google Earth. Emailed to Karen Fields. Not all points are plotting correctly.

Location C-JAG Date 4-27-2021

Project / Client

Left site at 3:00 pm to go to Pine Environmental to see if a Pine tech can download data from Trimble.

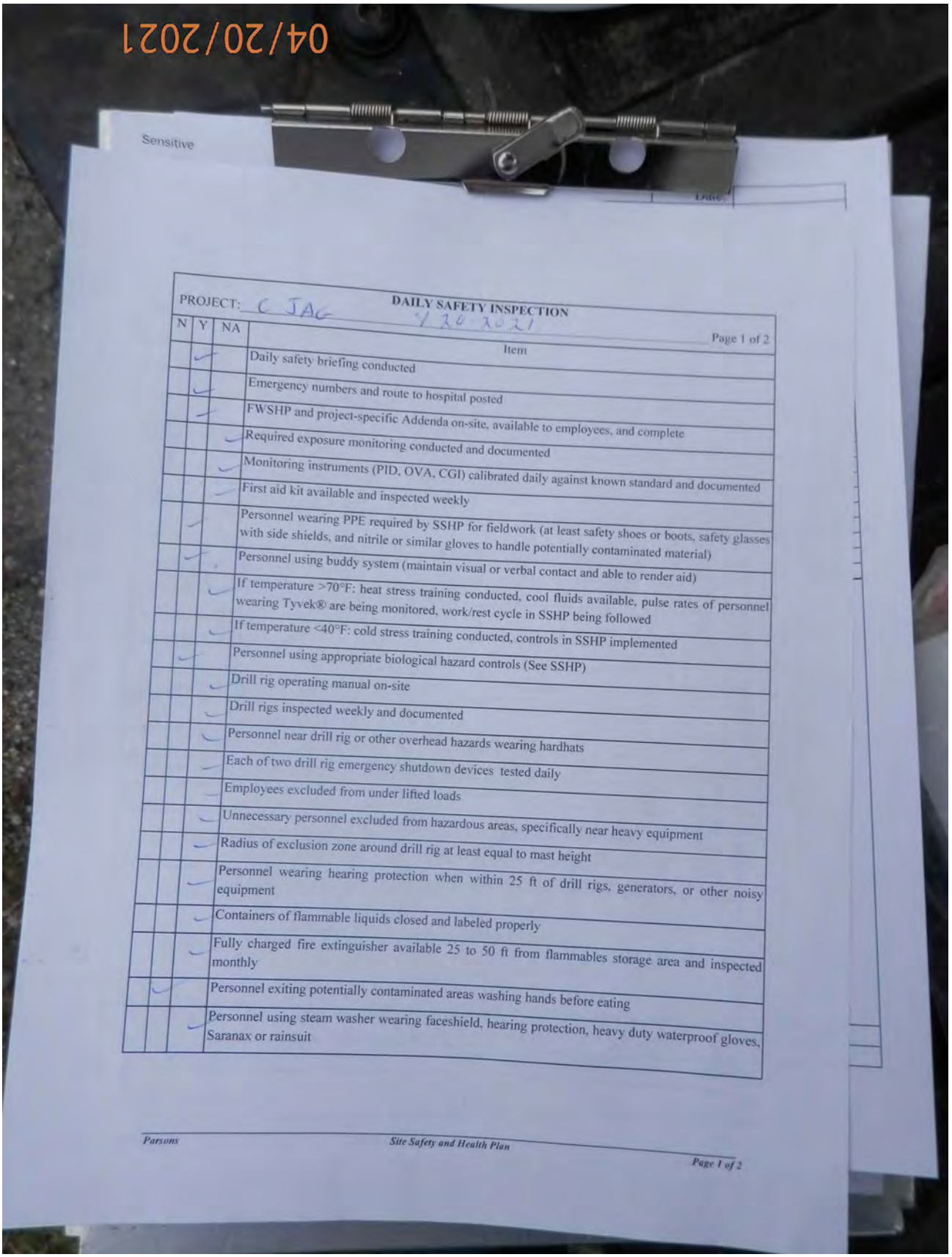
4:00pm: no one at Pine can operate the Trimble.

4-27-2021

APPENDIX A.3

SAFETY FORMS

This Page Intentionally Left Blank.



PROJECT: C JAG 4/20/2021

DAILY SAFETY INSPECTION

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
		✓	Monitoring instruments (PID, OVA, CGI) calibrated daily against known standard 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 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)
		✓	Drill rig operating manual on-site
		✓	Drill rigs inspected weekly and documented
		✓	Personnel near drill rig or other overhead hazards wearing hardhats
		✓	Each of two drill rig emergency shutdown devices tested daily
		✓	Employees excluded from under lifted loads
		✓	Unnecessary personnel excluded from hazardous areas, specifically near heavy equipment
		✓	Radius of exclusion zone around drill rig at least equal to mast height
		✓	Personnel wearing hearing protection when within 25 ft of drill rigs, generators, or other 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)
		✓	Excavations deeper than 5 ft shored or sloped (if personnel will enter) and in compliance with SSHP
		✓	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
		✓	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

Joe Peterlin 4/20/2021

Name Signature Date

04/20/2021

TAILGATE SAFETY MEETING LOG

PROJECT NAME: **PROJECT NO:**

DATE: M Tu W Th F Sa Su TIME: 0830

WEATHER: 40°s cloudy

WORKING CONDITIONS:

PPE: Level D

ITEMS DISCUSSED:

Boat safety, weather, environmental cold exposure, lifting load

THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)

Paul E Johnson		
[illegible]		
[illegible]		

SITE SAFETY AND HEALTH OFFICER

04/20/2021

DAILY SAFETY INSPECTION

PROJECT: C-JAG 4-27-2021

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
		✓	Monitoring instruments (PID, OVA, CGI) calibrated daily against known standard 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 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)
		✓	Drill rig operating manual on-site
		✓	Drill rigs inspected weekly and documented
		✓	Personnel near drill rig or other overhead hazards wearing hardhats
		✓	Each of two drill rig emergency shutdown devices tested daily
		✓	Employees excluded from under lifted loads
		✓	Unnecessary personnel excluded from hazardous areas, specifically near heavy equipment
		✓	Radius of exclusion zone around drill rig at least equal to mast height
		✓	Personnel wearing hearing protection when within 25 ft of drill rigs, generators, or other 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: _____

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)
		✓	Excavations deeper than 5 ft shored or sloped (if personnel will enter) and in compliance with SSHP
		✓	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
		✓	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

Joseph D PeTeRSiN — 4-27-2021

Name Signature Date

C-JAG 4-27-2021

TAILGATE SAFETY MEETING LOG

PROJECT NAME: **PROJECT NO:**

DATE: M (Tu) W Th F Sa Su TIME: 8:30 Am

WEATHER: Clear 70°s

WORKING CONDITIONS: Clear and Dry

PPE: Level D.

ITEMS DISCUSSED: Tick, Slips, Trips, Falls

THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)

4-27-2021		

SITE SAFETY AND HEALTH OFFICER

Appendix B Bioassay Report

This Page Intentionally Left Blank

RESULTS OF TOXICITY TESTING
WITH *Hyalella azteca* and *Chironomus dilutus*
ON SEDIMENT SAMPLES FROM
PARSONS PROJECT NUMBER 640030.110051
RAVENNA, OHIO

Prepared for:

Parsons
3606 Park 42 Drive, Box 13
Sharonville, Ohio 45241

Prepared by:

EA Engineering, Science, and Technology, Inc., PBC
231 Schilling Circle
Hunt Valley, Maryland 21031
For questions, please contact Michael Chanov
ph: 410-584-7000

Results relate only to the items tested or to the samples as received by the laboratory.

This report contains 18 pages plus 4 attachments.

24 May 2021

Michael K. Chanov II
Laboratory Director

Date

EA Project Number 70019.TOX

ACCREDITED IN ACCORDANCE WITH nelac ID# E87550

EA Report Number 8561

1. INTRODUCTION

EA Engineering, Science, and Technology performed toxicity testing on sediment samples for Parsons Project Number 640030.110051, Ravenna, Ohio. The objective of the testing was to evaluate the toxicity of two site sediment samples as compared to control sediment. The testing program consisted of: 1) a 10-day survival and growth toxicity test using the freshwater midge *Chironomus dilutus* (formerly *tentans*); 2) a 10-day survival and growth toxicity test using the freshwater amphipod *Hyalella azteca*.

2. METHODS AND MATERIALS

2.1 SAMPLE DESCRIPTIONS

Two sediment samples were collected for the project by Parsons personnel. The samples were packed on wet ice and transported to EA's Ecotoxicology Laboratory in Hunt Valley, Maryland. Upon receipt at EA, the samples were visually inspected, compared against the chain-of-custody record, and assigned EA laboratory accession numbers. Copies of the chain-of-custody records are included in Attachment I. Table 1 summarizes the collection and receipt data for the site sediments. When not being processed for testing, the samples were stored in the dark at 4°C.

2.2 CONTROL SEDIMENT

The control sediment used in the toxicity tests was a natural sediment from Pretty Boy Reservoir, Maryland which has been routinely utilized in freshwater sediment toxicity testing.

2.3 LABORATORY WATER

Dechlorinated tap water was used as the overlying water for the sediment exposures. The source of the water was the City of Baltimore municipal water system. Upon entering the laboratory, the water passed through a high-capacity, activated-carbon filtration system to remove any possible contaminants such as chlorine and trace organic compounds. This water source has proven safe for aquatic organism toxicity testing at EA as evidenced by maintenance of the multigeneration *Hyalella azteca*, *Lumbriculus variegatus* and fathead minnow cultures with no evident loss of fecundity. Additionally, this water has been routinely utilized in freshwater sediment toxicity testing, which have met test acceptability criteria.

2.4 TEST ORGANISMS

The midges (*Chironomus dilutus*) lot were obtained from Aquatic Research Organisms (Hampton, New Hampshire). Upon receipt at EA, the organisms were gradually acclimated to laboratory water at 23°C. Second instar larvae were used in the toxicity testing.

The amphipods (*Hyalella azteca*) were obtained from Aquatic Research Organisms (Hampton, New Hampshire). Organisms were 8 days old for testing and were gradually acclimated to the testing temperature of 23°C during the holding period.

2.5 TOXICITY TEST OPERATIONS AND PERFORMANCE

Toxicity test methodologies utilized in this study followed EA's standard toxicity testing protocols (EA 2018), and comply with current NELAC standards where applicable.

2.5.1 *Chironomus dilutus* 10-Day Toxicity Tests

Toxicity testing was conducted in accordance with US EPA guidance (US EPA 2000), and test methodologies followed EA's standard toxicity testing protocol CT-AC-06 (EA 2018).

The test chambers used in the *C. dilutus* 10-day survival and growth toxicity test were 300-ml lipless glass beakers, each containing 100 ml of sediment and 175 ml of overlying water. The tests were performed with eight replicates per sediment. The sediments and overlying water were added to the chambers approximately 24 hours prior to introduction of the test organisms. The beakers were left undisturbed overnight to allow any suspended sediment particles in the water column to settle. The introduction of the test organisms to the test chambers marked the initiation of the toxicity tests. Ten organisms were randomly introduced into each replicate beaker for a total of 80 organisms per sediment. The test chambers were placed in a water bath to maintain temperatures at a target range of 23±1°C, with a 16-hour light/8-hour dark photoperiod. The *C. dilutus* were fed 1.5 ml per replicate of a 4 g/L slurry of Tetramin flake food daily.

The overlying water in the exposure chambers was renewed a minimum of twice daily using a water delivery system (Zumwalt et al. 1994). Fresh overlying water was slowly added to each replicate, displacing the water already in the beaker to flow out through a notch cut into the top of the beaker. The notch was sealed with fine mesh screen to prevent loss of organisms during the renewal process.

For the midge toxicity testing, water quality parameters of temperature, pH, dissolved oxygen, and conductivity were recorded daily on the overlying water in one replicate of each sediment. Composite samples of the overlying water of each sediment were also analyzed for alkalinity, hardness, conductivity and ammonia at test initiation and termination.

At the end of the 10-day exposure period, the surviving organisms from each replicate were retrieved from the sediment. The number of surviving organisms from each replicate was recorded. The surviving *C. dilutus* from each replicate were then placed in a dried, pre-weighed ceramic crucible and placed in a drying oven at 100°C for a minimum of 24 hours. The crucibles were then removed from the oven, placed in a desiccator to cool, and weighed. The dry weight of the surviving organisms in each replicate was determined by subtracting the weight of the crucible from the weight of the crucible plus dried organisms. The mean dry weight per organism was obtained by dividing the total organism dry weight per replicate by the number of surviving organisms per replicate.

The ash-free dry weight was determined for the *C. dilutus* by placing the crucibles with oven-dried organisms in a muffle furnace at 550°C for two hours, then weighing the crucibles with organisms following an appropriate cooling period. For each replicate, the weight of the crucible with furnace-dried organisms was subtracted from the weight of the crucible with oven-dried organisms, yielding a total organism ash-free dry weight. A mean ash-free dry weight per organism was obtained by dividing the total organism ash-free dry weight per replicate by the number of surviving organisms per replicate.

The survival and growth results of the *C. dilutus* toxicity tests were statistically analyzed according to US EPA guidance (US EPA 2000) to determine if any of the site sediments were significantly different (p=0.05) from the control sediment. If the data were normally distributed, then a t-Test was performed to detect statistically significant differences between test sediments and the control sediment. If the data distribution was non-normal, then a Wilcoxon Two-Sample Test was used to compare the group means. Shapiro-Wilk's Test was used to determine if the data were normally distributed, and the F-Test was used to test for homogeneity of variance.

Tables, 2 and 3 present the test results and water quality, respectively, for the *C. dilutus* toxicity testing. Copies of the original data sheets and statistical analyses from the sediment toxicity testing are included in Attachment II for *C. dilutus*.

2.5.2 *Hyalella azteca* 10-Day Toxicity Tests

Toxicity testing was conducted in accordance with US EPA guidance (US EPA 2000), and test methodologies followed EA's standard toxicity testing protocol HA-AC-06 (EA 2018).

The test chambers used in the *H. azteca* 10-day survival and growth toxicity test were 300-ml lipless glass beakers, each containing 100 ml of sediment and 175 ml of overlying water (lab water). The tests were performed with eight replicates per sediment. The sediments and overlying water were added to the chambers approximately 24 hours prior to introduction of the test organisms. The beakers were left undisturbed overnight to allow any suspended sediment particles in the water column to settle. The introduction of the test organisms to the test chambers marked the initiation of the toxicity tests. Ten organisms were randomly introduced into each replicate beaker for a total of 80 organisms per sediment. The test chambers were placed in a water bath to maintain temperatures at a target range of 23±1°C, with a 16-hour light/8-hour dark photoperiod.

The *H. azteca* were fed 1.0 ml per replicate of YCT (a suspension of yeast, ground cereal leaves, and trout chow) daily. The overlying water in the exposure chambers was renewed a minimum of twice daily using a water delivery system (Zumwalt et al. 1994). Fresh overlying water was slowly added to each replicate, displacing the water already in the beaker to flow out through a notch cut into the top of the beaker. The notch was sealed with fine mesh screen to prevent loss of organisms during the renewal process.

For the amphipod toxicity testing, water quality parameters of temperature, pH, dissolved oxygen, and conductivity were recorded daily on the overlying water in one replicate of each sediment. Composite samples of the overlying water of each sediment were also analyzed for alkalinity, hardness, conductivity and ammonia at test initiation and termination.

At the end of the 10-day (*H. azteca*) exposure period, the surviving organisms from each replicate were retrieved from the sediment. The number of surviving organisms from each replicate was recorded. The surviving *H. azteca* from each replicate were then placed in a dried, pre-weighed aluminum pan, and placed in a drying oven at 100°C for 24 hours. The pans were then removed from the oven, placed in a desiccator to cool, and weighed. The dry weight of the surviving organisms in each replicate was determined by subtracting the weight of the empty pan from the weight of the pan plus dried organisms. The mean dry weight per organism was obtained by dividing the total organism dry weight per replicate by the number of surviving organisms per replicate.

The survival and growth results of the *H. azteca* toxicity tests were statistically analyzed according to US EPA guidance (2000) to determine if any of the site sediments were significantly different (p=0.05) from the control sediment. If the data were normally distributed, then a t-Test was performed to detect statistically significant differences between test sediments and the control sediment. If the data distribution was non-normal, then a Wilcoxon Two-Sample Test was used to compare the group means. Shapiro-Wilk's Test was used to determine if the data were normally distributed, and the F-Test was used to test for homogeneity of variance.

Table 4 summarizes the results of the *H. azteca* test and Table 5 provides a summary of the water quality measurements recorded during the *H. azteca* toxicity testing. Copies of the original data sheets and statistical analyses from the sediment toxicity testing are included in Attachment III for *H. azteca*.

2.6 REFERENCE TOXICANT TESTS

In conformance with EA's quality assurance/quality control program, reference toxicant tests were performed on *C. dilutus* and *H. azteca*. The *C. dilutus* were exposed to sodium dodecyl sulfate (SDS) to determine the 48-hour LC50. The *H. azteca* were exposed to the reference toxicant copper sulfate ($CuSO_4$) in a graded concentration series to determine the 96-hour median lethal concentration (LC50). The results of the reference toxicant tests were compared to EA's established control chart limits according to US EPA methodology (US EPA 2002). Reference toxicant test data are presented in Table 6.

2.7 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's Office in Hunt Valley, Maryland. These data will be retained for a period of 5 years unless a longer period of time is requested.

3. RESULTS AND DISCUSSION

3.1 *Chironomus dilutus* SEDIMENT TOXICITY TEST

Table 2 summarizes the results of the *C. dilutus* 10-day survival and growth test. Water quality measurements taken during the test are presented in Table 3. The survival and growth of *C. dilutus* exposed to the site sediments were statistically compared to organisms exposed to the laboratory control. The survival results indicated that the organisms exposed to the site sediments were statistically different (p=0.05) from the laboratory control sample. Mean ash free dry weight indicated that neither of the sediment samples were significantly different from the control.

3.2 *Hyalella azteca* SEDIMENT TOXICITY TEST

Table 4 summarizes the results of the *H. azteca* 10-day survival and growth test. Water quality measurements taken during the test are presented in Table 5. The survival and growth of *H. azteca* exposed to the site sediments were statistically compared to organisms exposed to the laboratory control. The results indicated that for survival and growth the organisms exposed to site sediments were not statistically different (p=0.05) from the laboratory control sample.

3.3 REFERENCE TOXICANT TESTS

The results of the reference toxicant tests are summarized in Table 6. All of the reference toxicant test results fell within the established laboratory control chart limits.

4. REFERENCES

EA. 2018. EA Ecotoxicology Laboratory Quality Assurance and Standard Operating Procedures Manual. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., PBC, Hunt Valley, Maryland.

US EPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064. U.S. Environmental Protection Agency, Office of Research and Development, Duluth, Minnesota.

US EPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. EPA-821-R-02-012. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Zumwalt, D.C., F.J. Dwyer, I.E. Greer, and C.G. Ingersoll. 1994. A water-renewal system that accurately delivers small volumes of water to exposure chamber. Environmental Toxicology and Chemistry. 13:1311-1314.

TABLE 1 SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR SEDIMENT SAMPLES - PARSONS PROJECT NUMBER 640030.110051

Sample Identification	EA Accession Number	Sample Date	Receipt Time and Date	Receipt Temperature (ºC)
079SD-417M-0001-SD	AT1-223	1315, 4/20/2021	1200, 4/21/2021	2.3
079SD-416M-0001-SD	AT1-224	1300, 4/20/2021	1200, 4/21/2021	1.4

TABLE 2 RESULTS OF *Chironomus dilutus* 10-DAY TOXICITY TESTING

EA Test Number: TN-21-239
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	10-Day Survival (percent)	Mean Ash Free Dry Weight as mg/Organism (±SD)
Laboratory Control	AT0-593	100	0.697 (±0.152)
079SD-417M-0001-SD	AT1-223	78[(a)]	1.221 (±0.267)
079SD-416M-0001-SD	AT1-224	93[(a)]	1.074 (±0.209)

(a) Significantly different (p=0.05) from laboratory control.

TABLE 3 WATER QUALITY PARAMETERS MEASURED DURING *Chironomus dilutus* 10-DAY TOXICITY TESTING

EA Test Number: TN-21-239
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	Temperature (ºC)		pH (su)		Dissolved Oxygen (mg/L)		Conductivity (µs/cm)	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Laboratory Control	AT0-593	22.0	24.0	7.4	8.2	5.3	8.6	361	404
079SD-417M-0001-SD	AT1-223	22.0	23.9	7.3	8.1	5.0	8.0	365	389
079SD-416M-0001-SD	AT1-224	22.0	23.8	7.3	8.1	4.5	7.8	365	391

EA Test Number: TN-21-239
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	Alkalinity (mg/L)		Hardness (mg/L)		Conductivity (µs/cm)		Ammonia (mg/L)	
		Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Laboratory Control	AT0-593	44	46	96	92	387	377	<0.1	1.6
079SD-417M-0001-SD	AT1-223	34	50	76	84	348	376	1.6	1.4
079SD-416M-0001-SD	AT1-224	42	52	84	84	372	372	1.7	1.5

TABLE 4 RESULTS OF *Hyalella azteca* 10-DAY TOXICITY TESTING

EA Test Number: TN-21-240
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	10-Day Survival (percent)	Mean Dry Weight as mg/Organism (±SD)
Laboratory Control	AT0-593	80	0.073 (±0.016)
079SD-417M-0001-SD	AT1-223	86	0.083 (±0.021)
079SD-416M-0001-SD	AT1-224	86	0.096 (±0.015)

TABLE 5 WATER QUALITY PARAMETERS MEASURED DURING *Hyalella azteca* 10-DAY TOXICITY TESTING

EA Test Number: TN-21-240
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	Temperature (°C)		pH (su)		Dissolved Oxygen (mg/L)		Conductivity (µs/cm)	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Laboratory Control	AT0-593	22.0	23.5	7.4	8.2	6.3	8.6	361	401
079SD-417M-0001-SD	AT1-223	22.0	23.7	7.4	8.1	6.3	7.9	357	399
079SD-416M-0001-SD	AT1-224	22.0	23.8	7.4	8.1	6.5	7.6	361	391

EA Test Number: TN-21-240
Test Initiation: 23 April 2021
Test Termination: 3 May 2021

Sample Identification	EA Accession Number	Alkalinity (mg/L)		Hardness (mg/L)		Conductivity (µs/cm)		Ammonia (mg/L)	
		Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Laboratory Control	AT0-593	44	40	96	92	387	372	<0.1	<0.1
079SD-417M-0001-SD	AT1-223	34	46	76	84	348	379	1.6	0.4
079SD-416M-0001-SD	AT1-224	42	48	84	84	372	366	1.7	0.6

TABLE 6 RESULTS OF REFERENCE TOXICANT TESTING

Test Species	Reference Toxicant	EA Test Number	Test Result	Acceptable Control Chart Limits
Chironomus dilutus (midge)	Sodium dodecyl sulfate (SDS)	RT-21-062	48-Hour LC50: 59 mg/L SDS	16 – 80 mg/L SDS
Hyalella azteca (amphipod)	Copper sulfate ($CuSO_4$)	RT-21-061	96-Hour LC50: 143 µg/L Cu	0.3 – 310 µg/L Cu

ATTACHMENT I

Chain-of-Custody Record
(3 pages)

Chain-of-Custody Record

Parsons Project #640030.11059

EA Engineering, Science, and Technology

EA Ecotoxicology Laboratory
231 Schilling Circle
Hunt Valley, Maryland 21031
Telephone: 410-584-7000
Fax: 410-584-1057

Sample Shipped By: (circle)
Fed. Ex. UPS Other: _____
Tracking #: 786220473004
Fedex Account 1674-0246-i

Client: Parsons Project No.: _____

NPDES Number: _____ Client Purchase Order Number: _____

City/State Collected: Ravenna, OH

PLEASE READ SAMPLING INSTRUCTIONS ON BACK OF FORM

Accession Number (office use only)	Grab	Composite	Collection Start Date/Time	Collection End Date/Time	Sample Description (including Site, Station Number, and Outfall Number)	Number/Volume of Container
ATI-223		X	04/20/21	1315	079SD-417M-0001-SD	2 (2.3°C)

Sampled By:	Date/Time	Received By:	Date/Time
Joe Peterson	4-20-2021 5:30p~	FedEx	
Sampler's Printed Name:	Title:	Relinquished By:	Date/Time
Relinquished By:	Date/Time	Received By Laboratory	Date/Time
		Lois Boyle	4/21/21 1200

Was Sample Chilled During Collection? Yes / No

Comments:

Hyalella azteca 10 day Biossay
Chironomus dilutus (Tentans)
10 Day Biossay

Sample Collection Parameters

Visual Description:

Temperature (°C):

pH:

TRC (mg/L):

Other:

White-Report Production
EA 0534 F&B Rev.11/16

Yellow-Laboratory

Pink-Client/Sampler

Chain-of-Custody Record

EA Engineering, Science, and Technology

EA Ecotoxicology Laboratory
231 Schilling Circle
Hunt Valley, Maryland 21031
Telephone: 410-584-7000
Fax: 410-584-1057

Parsons Project # 646030.110051

Sample Shipped By: (circle)
Fed. Ex. UPS Other: _____

Tracking #: 7862 2062 1886

Fedex Account 1674-0246-1

Client: Parsons Project No.: _____

NPDES Number: _____ Client Purchase Order Number: _____

City/State Collected: Ravenna, OH

PLEASE READ SAMPLING INSTRUCTIONS ON BACK OF FORM

Accession Number (office use only)	Grab	Composite	Collection Start Date/Time	Collection End Date/Time	Sample Description (including Site, Station Number, and Outfall Number)	Number/Volume of Container
ATI-224		X	04/20/21	13:00	~~079SD-416M-0001-SD~~ 079SD-416M-0001-SD	2 (1.4°C)

Sampled By:	Date/Time	Received By:	Date/Time
Joe Peterlin	4-20-2021 5:30pm	Fedex	
Sampler's Printed Name:	Title:	Relinquished By:	Date/Time
Relinquished By:	Date/Time	Received By Laboratory	Date/Time
			4/21/21 1000

Was Sample Chilled During Collection? Yes / No

Comments:

Sample Collection Parameters

Visual Description:

Temperature (°C):

pH:

TRC (mg/L):

Other:

Hyalella azteca 10 day Bioassay
Chironomus dilutus (Tentans)
10 day Bioassay

White-Report Production
EA 0534 F&B Rev.11/16

Yellow-Laboratory

Pink-Client/Sampler

ATTACHMENT II

Data Sheets and Statistical Analyses
from *Chironomus dilutus* Toxicity Tests
(18 pages)

SEDIMENT TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

TEST ORGANISM INFORMATION

Common Name: Midge

Scientific Name: *C. dilutus*

Lot Number: CH - 094

Source: EA ARO GM 4/13/21

Adults Isolated (Time, Date): _____

Neonates Pulled (Time, Date): _____

Acclimation: 2 2Y+) Age: 2nd instar

Culture Water (T/S): 23.1 °C 6 ppt

TEST INITIATION

Date	Time	Initials	Activity
4/22/21	1535	AJ	Sediment Added to Chambers
↓	1540	↓	Overlying Water Added to Chambers
4/23/21	1014	M	Organisms Transferred

TEST SET-UP

Sample Number(s): AT0-593, AT1-223, AT1-224

~~Overlying~~ Water Number: Dechlor

overlying (b) ASB 5/24/24

Treatment	Volume Test Sediment	Volume Overlying Water
Pretty Boy Control (AT0-593)	100 ml	175 ml
AT1-223	↓	↓
AT1-224		

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-239
Test Material(s): Sediment
Accession Number(s): AT0-593, AT1-223, AT1-224
Overlying Water: Dechlor
Accession Number: N/A

TEST ORGANISM
Common Name: Midge
Scientific Name: *C. dilutus*

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal
Photoperiod: 16l, 8d Light Intensity: 50 - 100 fc

Beginning Date: 4/23/24 Time: 1016
Ending Date: 5/3/24 Time: 1224

Test Container: 300ml lipless beakers
Test Volume: 100ml sediment
Test Duration: 10 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date 4/23	Day Date	Day 10 Date 5/3	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date
Pretty Boy Control	A	10		10								
(AT0-593)	B	10		10								
	C	10		10								
	D	10		10								
	E	10		10								
	F	10		10								
	G	10		10								
	H	10		10								
AT1-223	A	10		8								
	B	10		8								
	C	10		8								
	D	10		6								
	E	10		6								
	F	10		9								
	G	10		9								
	H	10		8								
Time / Initials		1016		1224 M								

EPA Test Method: (FW) EPA 600-R-99-064/SW EPA-600-R-94-025 (CHECK ONE)

Hyalella: (100.1) _____ Chironomus (100.2) X Lumbriculus (100.3) _____ Leptocheirus, Eohaustorius & Ampelisca (100.4) _____

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-239
Test Material(s): Sediment
Accession Number(s): AT0-593, AT1-223, AT1-224
Overlying Water: Dechlor
Accession Number: N/A

TEST ORGANISM
Common Name: Midge
Scientific Name: *C. dilutus*

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal
Photoperiod: 16l, 8d Light Intensity: 50 - 100 fc

Beginning Date: 4/23/24 Time: 1016
Ending Date: 5/3/24 Time: 1324

Test Container: 300ml lipless beakers
Test Volume: 100ml sediment
Test Duration: 10 days

Treatment	Rep	Number of Surviving Organisms M(10) 5/3/24											
		Day 0 Date 4/23	Day Date	Day 10 Date 5/3	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date
AT1-224	A	10	~~8~~	8								
	B	10		9								
	C	10		10								
	D	10		9								
	E	10		9								
	F	10		9								
	G	10		10								
	H	10		10								
Time / Initials		1016 ~		1324 M								

EPA Test Method: (FW) EPA 600-R-99-064/SW EPA-600-R-94-025 (CHECK ONE)

Hyalella: (100.1) _____ Chironomus (100.2) X Lumbriculus (100.3) _____ Leptocheirus, Eohaustorius & Ampelisca (100.4) _____

ASH-FREE DRY WEIGHT DATA (Test Species: *C. dilutus*)

Project Number: 70019.TOX Client: Parsons QC Test Number: TN-21-239

	Date	Time	Initials		Date	Time	Initials
Loaded pans in oven:	5/3/21	1225	AM	Loaded pans in furnace:	5/10/21	1000	~
Loaded pans out oven:	5/4/21	1342	RSB	Loaded pans out furnace:	5/10/21	1500	~
Loaded pans weighed:	5/4/21	1402	NB	Loaded pans weighed:	5/11/21	1300	JA

Oven Temp (°C): 105 Furnace Temp (°C): 550

Test Concentration	Rep	Pan #	A Weight of Pan (mg)	B Weight of Pan and Oven-Dried Organisms (mg)	C Weight of Pan and Furnace-Dried Organisms (mg)	B-C Total Ash-Free Dry Weight (mg)	D Number of Organisms Weighed	(B-C)/D Mean Ash-Free Dry Organism Weight (mg)
Control	A	15	4786.50	4793.74	4789.06	4.68	10	0.468
	B	42	4644.08	4654.20	4647.27	6.93	10	0.693
	C	49	4281.35	4289.52	4284.52	5.00	10	0.500
	D	87	5159.07	5173.13	5164.87	8.26	10	0.826
	E	88	5246.70	5260.93	5252.29	8.64	10	0.864
	F	103	5146.29	5160.79	5152.20	8.59	10	0.859
	G	107	4605.14	4615.88	4609.09	6.79	10	0.679
	H	109	5407.99	5419.76	5412.89	6.87	10	0.687
AT1-223	A	114	4721.12	4736.51	4726.27	10.24	8	1.280
	B	122	5764.74	5781.00	5770.25	10.75	8	1.344
	C	147	4783.12	4797.75	4788.64	9.11	8	1.139
	D	178	5046.90	5061.60	5051.52	10.08	6	1.680
	E	188	5267.95	5281.92	5273.21	8.71	6	1.452
	F	191	5227.05	5241.04	5232.15	8.89	9	0.988
	G	192	5348.17	5360.55	5352.19	8.36	9	0.929
	H	213	5213.33	5224.16	5216.50	7.66	8	0.958

Dry wt. calculations checked (date, initials): 5/23/2021, JR Ash-Free calculations checked (date, initials): 5/23/2021, JR

ASH-FREE DRY WEIGHT DATA (Test Species: *C. dilutus*)

Project Number: 70019.TOX Client: Parsons QC Test Number: TN-21-239

	Date	Time	Initials		Date	Time	Initials
Loaded pans in oven:	5/3/21	1225	AT	Loaded pans in furnace:	5/10/21	1000	
Loaded pans out oven:	5/4/21	1342	RSB	Loaded pans out furnace:	5/10/21	1500	
Loaded pans weighed:	5/4/21	1402	RSB	Loaded pans weighed:	5/11/21	1300	JA
Oven Temp (°C):	105			Furnace Temp (°C):	550		

⑥ HM 5/4/21

Test Concentration	Rep	Pan #	A Weight of Pan (mg)	B Weight of Pan and Oven-Dried Organisms (mg)	C Weight of Pan and Furnace-Dried Organisms (mg)	B-C Total Ash-Free Dry Weight (mg)	D Number of Organisms Weighed	(B-C)/D Mean Ash-Free Dry Organism Weight (mg)
AT1-224	A	215	4761.98	4780.22	4769.04	11.18	8	1.398
	B	254	4800.19	4817.98	4807.23	10.75	9	1.194
	C	282	4618.43	4637.79	4624.79	13.00	10	1.300
	D	290	5134.73	5147.90	5139.06	8.84	9	0.982
	E	302	4712.38	4724.17	4716.69	7.48	9	0.831
	F	310	5245.83	5259.31	5249.87	9.44	9	1.049
	G	323	4981.97	4994.55	4986.36	8.19	10	0.819
	H	328	5510.21	5526.42	5516.21	10.21	10	1.021

Dry wt. calculations checked (date, initials): 5/23/2021, JR

Ash-Free calculations checked (date, initials): 5/23/2021, JR

⑦ RSB 5/21/21

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-239

TEST ORGANISM
Common Name: Midge
Scientific Name: *C. dilutus*

Beginning Date: 4/23/21 Time: 1016
Ending Date: 5/3/21 Time: 1224

TARGET VALUES: Temp: 23±1 °C pH: 6.0 - 9.0 DO: >4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Control (AT0-593)		23.0							8.2							8.6							401						
		23.0							8.1							7.9							389						
AT1-223		↓							↓							↓							↓						
AT1-224		23.0							8.1							7.6							391						
Meter Number		651							651							651							651						
Time		0907							0907							0907							0907						
Initials		✓							✓							✓							✓						

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-239

TEST ORGANISM
Common Name: Midge
Scientific Name: *C. dilutus*

Beginning Date: 4/23/21 Time: 1016
Ending Date: 5/3/21 Time: 1224

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control (AT0-593)		22.3	22.5	22.3	23.0	23.3	23.2	24.0	7.5	8.0	7.5	8.0	8.0	7.8	7.8	6.0	8.4	7.5	5.3	6.0	5.9	6.5	388	393	389	404	386	379	361
AT1-223		22.5	22.7	22.6	23.0	23.5	23.4	23.9	7.5	7.9	7.5	7.8	7.8	7.5	7.6	6.3	8.0	6.7	5.0	5.0	5.0	6.6	370	384	382	389	368	367	365
AT1-224		22.4	22.8	22.5	23.0	23.4	23.7	23.8	7.4	7.8	7.4	7.7	7.7	7.5	7.3	6.3	7.8	6.5	5.2	5.0	4.5	4.7	383	389	388	397	367	365	367
Meter Number		680	681	687	681	680	680	681	680	687	687	687	680	680	681	680	687	687	687	680	680	681	680	687	687	687	680	680	681
Time		1005	0930	1040	1057	1150	1200	1005	1005	0930	1040	1057	1150	1200	1005	1005	0930	1040	1057	1150	1200	1005	1005	0930	1040	1057	1150	1200	1005
Initials		AT	AT	AT	A	AT	AT	LMD	AT	AT	AT	AT	AT	AT	LMD	AT	AT	AT	AT	AT	AT	LMD	AT	AT	AT	AT	AT	AT	LMD

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-239

TEST ORGANISM
Common Name: Midge
Scientific Name: *C. dilutus*

Beginning Date: 4/23/21 Time: 1016
Ending Date: 5/3/21 Time: 1224

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14
Control (AT0-593)		23.1	23.0	22.0					7.5	7.4	7.5					5.9	7.0	5.9					362	366	377				
AT1-223		23.3	23.0	22.0					7.6	7.3	7.5					6.1	7.0	5.6					366	365	365				
AT1-224		23.4	23.0	22.0					7.6	7.3	7.4					6.1	6.9	5.5					366	365	368				
Meter Number		650	681	680					650	681	680					650	681	680					650	681	680				
Time		0735	1446	0908					0735	1446	0908					0735	1446	0908					0735	1446	0908				
Initials		~	JA	JA					~	JA	JA					~	JA	JA					~	JA	JA				

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

Day	Date		Time	Initials
0	4/23/21	AM	0800	
		PM	1430	RJB
1	4/24/21	AM	0900	AJ
		PM	1315	AJ
2	4/25/21	AM	0905	AJ
		PM	1335	JA
3	4/26/21	AM	0855	AJ
		PM	1455	JA
4	4/27/21	AM	0858	AJ
		PM	1446	JA
5	4/28/21	AM	0845	AJ
		PM	1605	CAD
6	4/29/21	AM	0830	AJ
		PM	1421	JA
7	4/30/21	AM	0951	CAD
		PM	1522	TP
8	5/1/21	AM	0705	
		PM	1220	TP
9	5/2/21	AM	0630	JR
		PM	1429	JA
10		AM		
		PM		

TOXICOLOGY LABORATORY BENCH SHEET - TESTING LOCATION

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

Day	Testing Location	Date	Time	Initials
0	52A	4/23/21	1016	[illegible]
1	52A	4/24/21	1005	AJ
2	52A	4/25/21	0932	AJ
3	52A	4/26/21	1040	AJ
4	52A	4/27/21	1057	AJ
5	52A	4/28/21	1152	AJ
6	52A	4/29/21	0830	AJ
7	52A	4/30/21	1523	TP
8	52A	5/1/21	0705	[illegible]
9	52A	5/2/21	0630	JR
10	52A	5/3/21	1003	AJ
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

TOXICOLOGY LABORATORY BENCH SHEET - FEEDING RECORD

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

Food: 1.5 ml Tetramin Slurry

Day	Date	Time	Initials
0	4/23/21	1500	RSA
1	4/24/21	1335	AM
2	4/25/21	1357	DA
3	4/26/21	1625	CAD
4	4/27/21	1500	AM
5	4/28/21	1611	CAD
6	4/29/21	1500	AD
7	4/30/21	1545	P
8	5/1/21	1048	P
9	5/2/21	1509	DA
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

Date/Time/Initials	Comments/Activity

TOXICOLOGY LABORATORY CORRECTION BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-239

Correction Explanations

(a) Technician Error-Mathematical

(b) Technician Error-Manual Data Recording

(c) Technician Error-Head Count Observation

(d) Technician Error-Overwrite

(e) Technician Error-Missing Data

(f) Technician Error-Lost Organism

(g) Technician Error-Transcription Error

(h) Technician Error-Other:

(i) Meter Malfunction

Midge Growth and Survival Test-10 Day Survival

Start Date:	4/23/2021	Test ID:	TN-21-239	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	CT-C. dilutus
Comments:					

Conc-	1	2	3	4	5	6	7	8
Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT1-223	0.8000	0.8000	0.8000	0.6000	0.6000	0.9000	0.9000	0.8000
AT1-224	0.8000	0.9000	1.0000	0.9000	0.9000	0.9000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	8		
*AT1-223	0.7750	0.7750	1.0874	0.8861	1.2490	12.766	8	36.00	51.00
AT1-224	0.9250	0.9250	1.2924	1.1071	1.4120	8.514	8		

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.74321	0.844	-0.699	2.0213
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates significant differences				

Reviewed by: JR

Midge Growth and Survival Test-10 Day Survival

Start Date:	4/23/2021	Test ID:	TN-21-239	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	CT-C. dilutus
Comments:					

Conc-	1	2	3	4	5	6	7	8
Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT1-223	0.8000	0.8000	0.8000	0.6000	0.6000	0.9000	0.9000	0.8000
AT1-224	0.8000	0.9000	1.0000	0.9000	0.9000	0.9000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	8		
AT1-223	0.7750	0.7750	1.0874	0.8861	1.2490	12.766	8		
*AT1-224	0.9250	0.9250	1.2924	1.1071	1.4120	8.514	8	48.00	51.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.81935	0.844	-0.2789	1.92704
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates significant differences				

Reviewed by: SR

Midge Growth and Survival Test-10 Day Growth

Start Date:	4/23/2021	Test ID:	TN-21-239	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	CT-C. dilutus
Comments:					

Conc-	1	2	3	4	5	6	7	8	s.d.
Control	0.4680	0.6930	0.5000	0.8260	0.8640	0.8590	0.6790	0.6870	0.15235
AT1-223	1.2800	1.3438	1.1387	1.6800	1.4517	0.9878	0.9289	0.9575	0.26682
AT1-224	1.3975	1.1944	1.3000	0.9822	0.8311	1.0489	0.8190	1.0210	0.20912

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.6970	1.0000	0.6970	0.4680	0.8640	21.857	8			
AT1-223	1.2210	1.7519	1.2210	0.9289	1.6800	21.852	8	-4.824	1.761	0.1913
AT1-224	1.0743	1.5413	1.0743	0.8190	1.3975	19.466	8			

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94807		0.844		0.3782	-0.1895
F-Test indicates equal variances (p = 0.16)	3.06748		8.88539			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.19133	0.27451	1.09848	0.0472	2.7E-04	1, 14

Midge Growth and Survival Test-10 Day Growth

Start Date:	4/23/2021	Test ID:	TN-21-239	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	CT-C. dilutus
Comments:					

Conc-	1	2	3	4	5	6	7	8	s.d.
Control	0.4680	0.6930	0.5000	0.8260	0.8640	0.8590	0.6790	0.6870	0.15235
AT1-223	1.2800	1.3438	1.1387	1.6800	1.4517	0.9878	0.9289	0.9575	0.26682
AT1-224	1.3975	1.1944	1.3000	0.9822	0.8311	1.0489	0.8190	1.0210	0.20912

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.6970	1.0000	0.6970	0.4680	0.8640	21.857	8			
AT1-223	1.2210	1.7519	1.2210	0.9289	1.6800	21.852	8			
AT1-224	1.0743	1.5413	1.0743	0.8190	1.3975	19.466	8	-4.124	1.761	0.1611

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94954		0.844		0.08891	-0.8967
F-Test indicates equal variances (p = 0.42)	1.88422		8.88539			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.16111	0.23115	0.56933	0.03347	0.00103	1, 14

Reviewed by: JR

ATTACHMENT III

Data Sheets and Statistical Analyses
from *Hyalella azteca* Toxicity Tests
(18 pages)

SEDIMENT TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

TEST ORGANISM INFORMATION

Common Name: Amphipod

Scientific Name: *H. azteca*

Lot Number: HA-048

Source: ~~EA~~ ARO 5/24 GSM

Adults Isolated (Time, Date): _____

Neonates Pulled (Time, Date): _____

Acclimation: <24 hrs Age: 8 days

Culture Water (T/S): 23.2 °C 6 ppt

TEST INITIATION

Date	Time	Initials	Activity
4/22/21	1535	AT	Sediment Added to Chambers
↓	1540	↓	Overlying Water Added to Chambers
4/23/21	1016	RJB	Organisms Transferred

TEST SET-UP

Sample Number(s): AT0-593, AT1-223, AT1-224

~~Overyling~~ Water Number: Dechlor

overlying RJB 5/24/21

Treatment	Volume Test Sediment	Volume Overlying Water
Pretty Boy Control (AT0-593)	100 ml	175 ml
AT1-223	↓	↓
AT1-224		

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70019.TOX | TEST ORGANISM | Beginning Date: 4/27/21 | Time: 1016

Client: Parsons | Common Name: Amphipod | Ending Date: 5/3/21 | Time: 1345

QC Test Number: TN-21-240 | Scientific Name: *H. azteca*

Test Material(s): Sediment

Accession Number(s): AT0-593, AT1-223, AT1-224 | TEST TYPE: (Static) / Flowthrough | Test Container: 300ml lipless beakers

Overlying Water: Dechlor | (Renewal) / Non-renewal | Test Volume: 100ml sediment

Accession Number: N/A | Photoperiod: 16l, 8d | Light Intensity: 50 - 100 fc | Test Duration: 10 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date 4/27/21	Day Date	Day 10 Date 5/3	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date
Pretty Boy Control	A	10		8								
(AT0-593)	B	10		8								
	C	10		8								
	D	10		8								
	E	10		8								
	F	10		8								
	G	10		8								
	H	10		8								
AT1-223	A	10		10								
	B	10		8								
	C	10		9								
	D	10		8								
	E	10		8								
	F	10		9								
	G	10		9								
	H	10		8								
Time / Initials		~~4/27~~ 1016 RJO		1345 AM								

(b) RJO 4/26/21

EPA Test Method: (FW) EPA 600-R-99-064/SW EPA-600-R-94-025 (CHECK ONE)

ATS-T12
06/15/10

Hyalella: (100.1) X Chironomus (100.2) _____ Lumbriculus (100.3) _____ Leptocheirus, Eohaustorius & Ampelisca (100.4) _____

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-240
Test Material(s): Sediment
Accession Number(s): AT0-593, AT1-223, AT1-224
Overlying Water: Dechlor
Accession Number: N/A

TEST ORGANISM
Common Name: Amphipod
Scientific Name: *H. azteca*

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal
Photoperiod: 16l, 8d Light Intensity: 50 - 100 fc

Beginning Date: 4/23/21 Time: 1016
Ending Date: 5/3/21 Time: 1345

Test Container: 300ml lipless beakers
Test Volume: 100ml sediment
Test Duration: 10 days

Treatment	Rep	Number of Surviving Organisms										
		Day 4/23 Date 0	Day Date	Day 10 Date 5/3	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date	Day Date
AT1-224	A	10		8								
	B	10		8								
	C	10		9								
	D	10		9								
	E	10		9								
	F	10		8								
	G	10		10								
	H	10		8								
Time / Initials		1016 RSB		1345 AM								

EPA Test Method: (FW) EPA 600-R-99-064/SW EPA-600-R-94-025 (CHECK ONE)

Hyalella: (100.1) X Chironomus (100.2) _____ Lumbriculus (100.3) _____ Leptocheirus, Eohaustorius & Ampelisca (100.4) _____

ATS-T12
06/15/10

WEIGHT DATA (Test Species: *H. azteca*)

Project Number: 70019.TOX

Client: Parsens

QC Test Number: TN-21-240

Tin Lot: Navy 253

Oven Temp (°C): Start: 107 End: 100

	Date	Time	Initials
Loaded tins placed in oven:	5/3/21	1355	AT
Loaded tins removed from oven:	5/4/21	1350	RJB
Loaded tins weighed:	5/4/21	1400	RJB

Oven Number: BLM-01 / G4-009646 Balance Number: TS-L-225.C / P0115825

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
Pretty Boy Res.	A	158	28.93	29.60	0.67	8	0.084	0.067
(AT0-593)	B	346	29.56	30.12	0.56	8	0.070	0.056
	C	290	29.37	29.79	0.42	8	0.053	0.042
	D	141	28.60	29.42	0.82	8	0.103	0.082
	E	109	28.47	29.14	0.67	8	0.084	0.067
	F	189	27.79	28.34	0.55	8	0.069	0.055
	G	115	29.32	29.87	0.55	8	0.069	0.055
	H	42	29.12	29.56	0.44	8	0.055	0.044
AT1-223	A	341	29.01	29.85	0.84	10	0.084	0.084
	B	380	30.23	31.29	1.06	8	0.133	0.106
	C	5	29.08	29.65	0.57	9	0.063	0.057
	D	43	30.40	~~30~~ 31.04	0.64	8	0.080	0.064
	E	69	30.00	30.63	0.63	8	0.079	0.063
	F	294	29.00	29.65	0.65	9	0.072	0.065
	G	324	30.68	31.34	0.66	9	0.073	0.066
	H	145	27.59	28.24	0.65	8	0.081	0.065

Dry wt. calculations checked (date, initials): 5/24/2021, JR

Biomass calculations checked (date, initials): 5/24/2021, JR

(b) RJB 5/4/21

WEIGHT DATA (Test Species: *H. azteca*)

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Tin Lot: Nova 253

Oven Temp (°C): Start: 107 End: 100

	Date	Time	Initials
Loaded tins placed in oven:	5/3/21	1355	AJ
Loaded tins removed from oven:	5/4/21	1350	KSB
Loaded tins weighed:	5/4/21	1400	KSB

(5) KJD 5/4/21

Oven Number: BLM-01 / G4-009646 Balance Number: TS-L-225.C / P0115825

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
(6) JA 5/3/21 AT1-224	A	335	28.77	29.78	1.01	8	0.126	0.101
	B	304	29.37	30.10	0.73	8	0.091	0.073
	C	216	29.84	30.81	0.97	9	0.108	0.097
	D	76	29.36	30.11	0.75	9	0.083	0.075
	E	354	29.06	29.81	0.75	9	0.083	0.075
	F	239	29.66	30.39	0.73	8	0.091	0.073
	G	326	29.24	30.07	0.83	10	0.083	0.083
	H	259	29.74	30.54	0.80	8	0.100	0.080

Dry wt. calculations checked (date, initials): 5/24/2021, JR

Biomass calculations checked (date, initials): 5/24/2021, JR

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-240

TEST ORGANISM
Common Name: Amphipod
Scientific Name: *H. azteca*

Beginning Date: 4/23/21 Time: 1516
Ending Date: 5/3/21 Time: 1345

TARGET VALUES: Temp: 23±1 °C pH: 6.0 - 9.0 DO: >4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6	0	1	2	3	4	5	6
Control (AT0-593)		23.0							8.2	8.1						8.6							401						
AT1-223		23.0							8.1							7.9							388						
AT1-224		23.0							8.1							7.6							391						
Meter Number		681							681							681							681						
Time		0907							0907							0907							0907						
Initials																													

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-240

TEST ORGANISM
Common Name: Amphipod
Scientific Name: *H. azteca*

Beginning Date: 4/23/21 Time: 1016
Ending Date: 5/3/21 Time: 1345

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Control (AT0-593)		22.2	22.7	23.8	23.0	23.4	23.5	23.4	7.5	8.0	7.5	7.8	7.8	7.7	7.5	8.0	8.0	8.0	6.3	7.4	6.7	6.4	398	398	397	395	372	366	367
AT1-223		22.3	22.8	23.5	23.0	23.5	23.6	23.7	7.5	7.8	7.5	7.7	7.7	7.7	7.4	7.5	7.8	6.9	6.4	7.3	6.8	6.6	379	388	389	393	366	362	364
AT1-224		22.3	22.8	23.5	23.0	23.7	23.8	23.7	7.4	7.8	7.4	7.6	7.6	7.7	7.4	7.0	7.6	6.5	6.5	7.2	6.7	6.6	375	387	389	391	363	362	364
Meter Number		680	681	681	681	680	680	681	680	681	681	681	680	680	681	680	681	681	681	680	680	681	680	681	681	681	680	680	681
Time		1008	0932	1044	1058	1151	1300	1006	1008	0932	1044	1058	1151	1300	1006	1008	0932	1044	1058	1151	1300	1006	1008	0932	1044	1058	1151	1300	1006
Initials		AT	AT	AT	AT	AT	AT	LAD	AT	AT	AT	AT	AT	AT	LAD	AT	AT	AT	AT	AT	AT	LAD	AT	AT	AT	AT	AT	AT	LAD

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70019.TOX
Client: Parsons
QC Test Number: TN-21-240

TEST ORGANISM
Common Name: Amphipod
Scientific Name: *H. azteca*

Beginning Date: 4/23/21 Time: 1018
Ending Date: 5/3/21 Time: 1345

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: 0 ppt Photoperiod: 16 *l*, 8 *d* Light Intensity: 50 - 100 fc

Test Conc	Rep	Temperature (°C)							pH							Dissolved Oxygen (mg/L)							Conductivity (µS/cm) Salinity (ppt)						
		8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14
Control (AT0-593)		23.1	23.0	22.0					7.6	7.4	7.7					6.6	7.1	6.9					361	367	384				
AT1-223		22.9	23.0	22.0					7.6	7.4	7.6					6.5	7.1	6.3					360	366	357				
AT1-224		23.0	23.0	22.0					7.6	7.4	7.5					6.5	7.2	6.6					366	364	361				
Meter Number		680	681	680					680	681	680					680	681	680					680	681	680				
Time		0732	1447	0905					0732	1447	0905					0732	1447	0905					0732	1447	0905				
Initials			JK	JA						JK	JA						JK	JA						JK	JA				

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Day	Date	Time		Initials
0	4/23/21	AM	0800	
		PM	1430	RD
1	4/24/21	AM	0900	AT
		PM	1315	AT
2	4/25/21	AM	0905	AT
		PM	1335	JA
3	4/26/21	AM	0855	AT
		PM	1455	JA
4	4/27/21	AM	0858	AT
		PM	1446	JA
5	4/28/21	AM	0845	AT
		PM	1605	LAD
6	4/29/21	AM	0830	AT
		PM	1421	JA
7	4/30/21	AM	0951	LAD
		PM	1522	TP
8	5/1/21	AM	0705	
		PM	1220	
9	5/2/21	AM	0630	JR
		PM	1429	JA
10		AM		
		PM		

TOXICOLOGY LABORATORY BENCH SHEET - TESTING LOCATION

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Day	Testing Location	Date	Time	Initials
0	52A	4/23/21	1017	KSB
1	52A	4/24/21	1008	AJ
2	52A	4/25/21	0932	AJ
3	52A	4/26/21	1044	AJ
4	52A	4/27/21	1058	AJ
5	52A	4/28/21	1152	AJ
6	52A	4/29/21	0830	AJ
7	52A	4/30/21	1523	TP
8	52A	5/1/21	0705	~
9	52A	5/2/21	0630	JR
10	52A	5/3/21	1003	AJ
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

TOXICOLOGY LABORATORY BENCH SHEET - FEEDING RECORD

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Food: 1 ml YCT per beaker daily

Day	Date	Time	Initials
0	4/23/21	1500	MD
1	4/24/21	1335	AM
2	4/25/21	1357	JA
3	4/26/21	1625	JAD
4	4/27/21	1500	AM
5	4/28/21	1610	JAD
6	4/29/21	1500	TP
7	4/30/21	1545	TP
8	5/1/21	1048	TP
9	5/2/21	1509	JA
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Date/Time/Initials	Comments/Activity

TOXICOLOGY LABORATORY CORRECTION BENCH SHEET

Project Number: 70019.TOX

Client: Parsons

QC Test Number: TN-21-240

Correction Explanations

(a) Technician Error-Mathematical

(b) Technician Error-Manual Data Recording

(c) Technician Error-Head Count Observation

(d) Technician Error-Overwrite

(e) Technician Error-Missing Data

(f) Technician Error-Lost Organism

(g) Technician Error-Transcription Error

(h) Technician Error-Other:

(i) Meter Malfunction

Amphipod Growth and Survival Test-10 Day Survival

Start Date:	4/23/2021	Test ID:	TN-21-240	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	HA-H. azteca
Comments:					

Conc-	1	2	3	4	5	6	7	8
Control	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000
AT1-223	1.0000	0.8000	0.9000	0.8000	0.8000	0.9000	0.9000	0.8000
AT1-224	0.8000	0.8000	0.9000	0.9000	0.9000	0.8000	1.0000	0.8000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control	0.8000	1.0000	1.1071	1.1071	1.1071	0.000	8		
AT1-223	0.8625	1.0781	1.1985	1.1071	1.4120	9.283	8	84.00	51.00
AT1-224	0.8625	1.0781	1.1985	1.1071	1.4120	9.283	8		

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.80517	0.844	1.22901	3.39213
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)				
Wilcoxon Two-Sample Test indicates no significant differences				

ToxCalc v5.0.23

Reviewed by: JR

Amphipod Growth and Survival Test-10 Day Survival

Start Date:	4/23/2021	Test ID:	TN-21-240	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	HA-H. azteca
Comments:					

Conc-	1	2	3	4	5	6	7	8
Control	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000	0.8000
AT1-223	1.0000	0.8000	0.9000	0.8000	0.8000	0.9000	0.9000	0.8000
AT1-224	0.8000	0.8000	0.9000	0.9000	0.9000	0.8000	1.0000	0.8000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
Control	0.8000	1.0000	1.1071	1.1071	1.1071	0.000	8		
AT1-223	0.8625	1.0781	1.1985	1.1071	1.4120	9.283	8		
AT1-224	0.8625	1.0781	1.1985	1.1071	1.4120	9.283	8	84.00	51.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.80517	0.844	1.22901	3.39213
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

Amphipod Growth and Survival Test-Growth

Start Date:	4/23/2021	Test ID:	TN-21-240	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	HA-H. azteca
Comments:					

Conc-	1	2	3	4	5	6	7	8	s.d.
Control	0.0838	0.0700	0.0525	0.1025	0.0838	0.0688	0.0688	0.0550	0.01643
AT1-223	0.0840	0.1325	0.0633	0.0800	0.0787	0.0722	0.0733	0.0812	0.02097
AT1-224	0.1263	0.0913	0.1078	0.0833	0.0833	0.0913	0.0830	0.1000	0.01514

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.0731	1.0000	0.0731	0.0525	0.1025	22.474	8			
AT1-223	0.0832	1.1374	0.0832	0.0633	0.1325	25.210	8	-1.067	1.761	0.0166
AT1-224	0.0958	1.3097	0.0958	0.0830	0.1263	15.807	8			

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.84736		0.844		1.5501	2.79323
F-Test indicates equal variances (p = 0.54)	1.62778		8.88539			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.01659	0.22687	0.0004	0.00035	0.30409	1, 14

Reviewed by: JR

Amphipod Growth and Survival Test-Growth

Start Date:	4/23/2021	Test ID:	TN-21-240	Sample ID:	Parsons
End Date:	5/3/2021	Lab ID:		Sample Type:	Sediment
Sample Date:		Protocol:		Test Species:	HA-H. azteca
Comments:					

Conc-	1	2	3	4	5	6	7	8	s.d.
Control	0.0838	0.0700	0.0525	0.1025	0.0838	0.0688	0.0688	0.0550	0.01643
AT1-223	0.0840	0.1325	0.0633	0.0800	0.0787	0.0722	0.0733	0.0812	0.02097
AT1-224	0.1263	0.0913	0.1078	0.0833	0.0833	0.0913	0.0830	0.1000	0.01514

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
Control	0.0731	1.0000	0.0731	0.0525	0.1025	22.474	8			
AT1-223	0.0832	1.1374	0.0832	0.0633	0.1325	25.210	8			
AT1-224	0.0958	1.3097	0.0958	0.0830	0.1263	15.807	8	-2.867	1.761	0.0139

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91282	0.844	0.78854	-0.0037
F-Test indicates equal variances (p = 0.83)	1.17841	8.88539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.01391	0.19028	0.00205	0.00025	0.01243	1, 14

ATTACHMENT IV

Report Quality Assurance Record
(2 pages)

REPORT QUALITY ASSURANCE RECORD

Client: Parsons | Project Number: 70019.Tox

Author: Michael Chaney | EA Report Number: 8561

REPORT CHECKLIST

QA/QC ITEM	REVIEWER	DATE
1. Samples collected, transported, and received according to study plan requirements.	MC	5/21/21
2. Samples prepared and processed according to study plan requirements.	MC	5/21/21
3. Data collected using calibrated instruments and equipment.	MC	5/21/21
4. Calculations checked:		
- Hand calculations checked	MC	5/21/21
- Documented and verified statistical procedure used.	MC	5/21/21
5. Data input/statistical analyses complete and correct.	Jessica M Redfern	5/24/2021
6. Reported results and facts checked against original sources.	Jessica M Redfern	5/24/2021
7. Data presented in figures and tables correct and in agreement with text.	Jessica M Redfern	5/24/2021
8. Results reviewed for compliance with study plan requirements.	MC	5/21/21

	AUTHOR	DATE
9. Commentary reviewed and resolved.	MC	5/24/21

10. All study plan and quality assurance/control requirements have been met and the report is approved:

PROJECT MANAGER	5/24/21 DATE
Jessica M Redfern QUALITY CONTROL OFFICER	5/24/2021 DATE
SENIOR TECHNICAL REVIEWER	5/24/2021 DATE

This Page Intentionally Left Blank.

Appendix C Site Photographs

(April 20, 2021)

This Page Intentionally Left Blank

1. Photograph of Ore Storage Pond, facing east, setting up northern transect.

2. Photograph of Ore Storage Pond, facing north from southern end of pond.

3. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-410.

4. Photograph of depth of sediment at sampling location 079SD-410 located on the West end of the North Transect

5. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-411.

6. Photograph of depth of sediment at sampling location 079SD-411 located from the middle of the North Transect

7. Photograph of Ore Storage Pond, facing northwest, view of the northern portion of the pond from shore near sediment sampling location 079SD-412

8. Photograph of Ore Storage Pond, facing southwest, view of the southern portion of the pond from shore near sediment sampling location 079SD-412.

9. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-412.

10. Photograph of Depth of sediment at sampling location 079SD-412 located on the East end of the North Transect

11. Photograph of hand corer used to collect sediment sample from sampling location 079SD-112.

12. Photograph of sediment sample from sampling location 079SD-412 located on the East end of the North Transect

13. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-413.

14. Photograph of Depth of sediment at sampling location 079SD-413 located on the West end of the South Transect

15. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-414.

16. Photograph of Depth of sediment at sampling location 079SD-414 located in the middle of the South Transect

17. Photograph of Ore Storage Pond, facing east, sampling at location 079SD-415.

18. Photograph of Depth of sediment at sampling location 079SD-415 located on the East end of the South Transect

19. Photograph of filling sample jars with collected sediment.

20. Photograph of wetland delineation

21. Photograph of Ore Storage Pond, soil test pit TP-1.

22. Photograph of Ore Storage Pond, soil test pit TP-2.

23. Photograph of Ore Storage Pond, soil test pit TP-3.

Appendix D Ohio EPA Notification of Field Work

This Page Intentionally Left Blank

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

March 26, 2021

Ohio Environmental Protection Agency
DERR-NEDO
Attn: Mr. Ed D'Amato
2110 East Aurora Road
Twinsburg, OH 44087-1924

Subject: Notification of Field Work, Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Portage/Trumbull Counties, Additional Sampling for CC RVAAP-79 Defense Logistics Agency (DLA) Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, Ohio EPA ID # 267-000859-258

Dear Mr. D'Amato:

In accordance with the Director's Final Findings and Orders, Section XIII, #28, for the RVAAP Restoration Program, the Army National Guard (ARNG) is providing notification of field activities at Camp James A. Garfield / former RVAAP 15 days prior to the scheduled start date. Parsons will be conducting sediment sampling at Ore Storage Pond sub-area within CC RVAAP-79 DLA Ore Storage Sites during the week of 19 April 2021 (anticipate two days of sampling, 20 through 21 April 2021).

For additional information on the field activities, please refer to the *Final Work Plan Addendum Additional Sampling for CC RVAAP-79 DLA Ore Storage Sites Remedial Investigation, Ore Storage Pond Sub-Area, RVAAP Restoration Program, Portage and Trumbull Counties, Ohio* submitted to Ohio EPA on 23 March 2021.

Please contact the undersigned at (614) 336-6000 Ex 2053 or kevin.m.sedlak.ctr@mail.mil if there are issues or concerns with this submission.

Sincerely,
SEDLAK.KEVIN.MICHAEL.1254440171
Digitally signed by SEDLAK.KEVIN.MICHAEL.1254440171
Date: 2021.03.26 09:05:16 -04'00'
Kevin Sedlak
RVAAP Restoration Program Manager

cc: Bob Princic, Ohio EPA, DERR-NEDO
Tom Schneider, Ohio EPA, SWDO
Natalie Oryshkewych, Ohio EPA, DERR-NEDO
Megan Oravec, Ohio EPA, DERR-NEDO
Mark Leeper, ARNG
Katie Tait, OHARNG, CJAG
Steven Kvaal, USACE Louisville
Kevin Mieczkowski, USACE Louisville
Jennifer Tierney, Vista Sciences
Edward Heyse, Parsons

This Page Intentionally Left Blank.

Appendix E Regulatory Correspondence Letters and Comments Response Table

This Page Intentionally Left Blank

NATIONAL GUARD BUREAU
111 SOUTH GEORGE MASON DRIVE
ARLINGTON VA 22204-1373

August 25, 2021

Ohio Environmental Protection Agency
DERR-NEDO
Attn: Edward J. D'Amato
2110 East Aurora Road
Twinsburg, OH 44087-1924

Subject: Former Ravenna Army Ammunition Plant (RVAAP) Restoration Program Draft RI Addendum/ Draft Feasibility Study, CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area Portage/Trumbull Counties, Ohio EPA ID # 267-000859-211

Dear Mr. D'Amato:

The Army appreciates the recent opportunity during the August 20, 2021 Conference Call to discuss the Ohio EPA's concerns regarding the Draft Remedial Investigation (RI) Addendum for the CC RVAAP-79 DLA Ore Storage Sites, Ore Storage Pond Sub-Area. Additionally, Ohio EPA expressed concern that new sediment data from the Ore Storage Pond collected for the bioassays may impact the conclusions of the Human Health Risk Assessment for the Ore Storage Pond in the Final 2020 RI (*approved December 17, 2020)*.

The Army proposes the following approach to continue to make progress on this Area of Concern (AOC) while providing a process to address the Ohio EPA's concerns that were provided for discussion on August 20, 2021. The Army plans to address all the concerns provided by the Ohio EPA, in the proposed following approach.

1.) CC RVAAP-79 RI Addendum for Ore Storage Pond

- Ohio EPA should stop review of the Draft CC RVAAP-79 RI Addendum.
- Army will revise the RI Addendum as follows:

  1.) The findings will be revised to state that the "No Further Action" determination only applies for ecological receptors and that no further remedial actions are warranted to address ecological risk.

  2.) A statement, where appropriate, will be added to state:
  "Because the additional data for the Ore Storage Pond sediments collected for this RI Addendum, has concentrations of arsenic that are greater than those used to estimate risks to Human Health Receptors in the CC RVAAP-79 RI, these potential risks need to be reassessed considering the new sediment and pond data. Since the CC RVAAP-79 RI has been finalized, the Army will revise the Draft CC RVAAP-79 Feasibility (FS) to include a reassessment of potential human health risks for current and future receptors of the Ore Storage Pond that includes the new data collected for this RI Addendum. The revised HHRA will be incorporated into the Risk Management Portion of the CC RVAAP-79 FS."

2.) CC RVAAP-79 RI (*approved December 17, 2020)*

- • No change proposed.

3.) CC RVAAP-79 FS (draft and under review by the Ohio EPA)

- Ohio EPA should stop review of this Draft document.
- Army will revise the FS to include a revised Baseline Human Health Risk Assessment for the Ore Storage Pond using all available data (previously and newly collected for CC RVAAP-79 RI Addendum).
- Army will revise the FS to address the applicable Ohio EPA's comments provided on August 20, 2021.
- Army will redevelop Alternatives.
- Army will resubmit revised Draft FS.

If this approach is acceptable, please provide a notification of agreement and the Army will proceed as proposed. Please contact the undersigned at kevin.m.sedlak.ctr@mail.mil or (614) 336-6000 ext 2053 if there are concerns or if you would like to discuss the proposed approach.

Sincerely,

SEDLAK.KEVIN.MICHAEL.1254440171

Digitally signed by SEDLAK.KEVIN.MICHAEL.1254440171
Date: 2021.08.25 13:16:29 -04'00'

Kevin Sedlak
RVAAP Restoration Program Manager
Army National Guard Directorate

cc: Tom Schneider, Ohio EPA, SWDO
Bob Princic, Ohio EPA, DERR-NEDO
Megan Oravec, Ohio EPA, DERR-NEDO
Mark Leeper, ARNG
Katie Tait, OHARNG, Camp James A. Garfield
Steve Kvaal, USACE Louisville
Angela Schmidt, USACE Louisville
Chenega Tri-Services, LLC
Patrick Ryan, Leidos