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September 3, 2013

Mr. Richard Meadows
U.S. Army Corps of Engineers
Huntington District (CELRH-PP-P)
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Huntington, WV 25701-2070

via FedEx

SUBJECT: SUBMITTAL OF FINAL SITE INSPECTION REPORT FOR FORMERLY USED DEFENSE SITES – MILITARY MUNITIONS RESPONSE PROGRAM
SITE: **WEST VIRGINIA MANEUVER AREA (WVMA)**
MRS05 BEARDEN KNOB FIRING RANGE
GRANT AND TUCKER COUNTIES, WEST VIRGINIA
FUDS PROPERTY NO.: G03WV0013
FUDS PROJECT NO.: G03WV001309
CONTRACT NO. W912PP-11-C-0007, TASK ORDER 0001

Dear Mr. Meadows:

Please find enclosed six (6) paperbound copies along with six (6) copies in PDF on CD-ROM of the Final Site Inspection Report for the WVMA MRS05 Bearden Knob Firing Range in Grant and Tucker Counties, WV for your records.

This document is prepared by Eco & Associates, Inc. (Eco) in conjunction with Parsons Infrastructure and Technology Group, Inc. (Parsons) under U.S. Army Corps of Engineers (USACE) Contract W912PP-11-C-0007, Task Order 0001.

Please do not hesitate to contact me at (714) 289-0995 with any questions you may have.

Sincerely,
ECO & ASSOCIATES, INC.

Mohammad Estiri, PhD
Project Director

cc: Mr. Brian Jordan, USACE, Albuquerque (1 hard copy & CD)
Ms. Laura Kelley, Parsons (1 hard copy & CD)
Ms. Lauren Ranker, Parsons (1 hard copy & CD)

Enclosures

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SITE INSPECTION REPORT

FORMERLY USED DEFENSE SITE
MILITARY MUNITIONS RESPONSE PROGRAM
SITE INSPECTION PHASE

•FINAL•

September 2013

West Virginia Maneuver Area
MRS05 Bearden Knob Firing Range
Grant and Tucker Counties, West Virginia

Contract No.: W912PP-11-C-0007
Task Order: 0001

FUDS Property No.: G03WV0013
FUDS Project No.: G03WV001309

Prepared for:
United States Army Corp of Engineers
Huntington District
502 8th Street
Huntington, West Virginia 25701

and

United States Engineering and Support Center
Hunstville, Alabama

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Eco & Associates, Inc. (Eco) has completed the Final Site Inspection Report for the MRS05 Bearden Knob Firing Range in Grant and Tucker Counties, WV. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. The independent technical review verified compliance with established policy principles and procedures, using justified and valid assumptions. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

September 3, 2013

Eco Team Member(s)

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

None

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

September 3, 2013

Eco Program Manager(s)

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS ..... **vii**
GLOSSARY OF TERMS ..... **x**
EXECUTIVE SUMMARY **ES-1**
CHAPTER 1 INTRODUCTION **1-1**
1.1 BACKGROUND 1-1
1.2 PROJECT OBJECTIVES 1-2
1.3 PROJECT SCOPE 1-2
CHAPTER 2 PROPERTY DESCRIPTION AND HISTORY **2-1**
2.1 SITE DESCRIPTION 2-1
2.2 SITE LOCATION AND SETTING 2-1
2.2.1 TOPOGRAPHY AND VEGETATION *2-1*
2.2.2 SOIL *2-2*
2.2.3 CLIMATE *2-2*
2.2.4 SIGNIFICANT AND INHABITED STRUCTURES *2-2*
2.2.5 DEMOGRAPHICS *2-2*
2.2.6 CURRENT AND FUTURE LAND USE *2-3*
2.3 SITE OWNERSHIP AND HISTORY 2-3
2.4 SITE OPERATIONS AND WASTE CHARACTERISTICS 2-4
2.4.1 MUNITIONS RESPONSE SITE-SPECIFIC DESCRIPTIONS AND OPERATIONS *2-4*
2.4.2 REGULATORY COMPLIANCE *2-4*
2.5 PREVIOUS INVESTIGATIONS 2-4
2.5.1 PRELIMINARY ASSESSMENT – FEBRUARY 2009 ..... *2-5*
2.5.2 INVENTORY PROJECT REPORT – DECEMBER 2010 ..... *2-5*
2.5.3 ADDITIONAL WVMA ACTIVITIES *2-6*
CHAPTER 3 SITE INSPECTION TASKS **3-1**
3.1 HISTORICAL RECORD REVIEW 3-1
3.2 TECHNICAL PROJECT PLANNING 3-1
3.3 NON-MEASUREMENT DATA COLLECTION 3-2
3.4 SITE-SPECIFIC WORK PLAN 3-3
3.5 DEPARTURES FROM PLANNING DOCUMENTS 3-4
CHAPTER 4 MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS **4-1**
4.1 GENERAL INFORMATION 4-1
4.1.1 QUALITATIVE RECONNAISSANCE AND SAMPLE LOCATIONS *4-1*
4.1.2 DATA QUALITY OBJECTIVES *4-5*
4.1.2.1 Introduction 4-5
4.1.2.2 Munitions and Explosives of Concern Data Quality Objective 4-5
4.1.2.3 Munitions Constituents Data Quality Objective 4-5
4.1.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective 4-6
4.1.2.5 Hazard Ranking System Data Quality Objective 4-6

4.2 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE 4-12
4.2.1 HISTORICAL USE OF MILITARY MUNITIONS 4-12
4.2.2 INSPECTION ACTIVITIES 4-12
CHAPTER 5 EXPOSURE PATHWAYS AND RECEPTORS 5-1
5.1 INTRODUCTION 5-1
5.2 GENERAL INFORMATION 5-1
5.2.1 REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING 5-1
5.2.2 REGIONAL GROUNDWATER USE 5-2
5.2.3 REGIONAL HYDROLOGIC SETTING 5-3
5.2.4 REGIONAL SENSITIVE ENVIRONMENTAL RESOURCES 5-3
5.2.5 SAMPLING LOCATIONS AND ANALYTICAL METHODS 5-4
5.2.6 DATA QUALITY ASSESSMENT 5-5
5.2.7 BACKGROUND/AMBIENT CONCENTRATIONS 5-6
5.2.8 ESTABLISHING AN OBSERVED RELEASE 5-15
5.3 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE 5-15
5.3.1 HISTORICAL MUNITIONS CONSTITUENTS INFORMATION 5-15
5.3.2 GROUNDWATER EXPOSURE PATHWAY 5-15
5.3.2.1 Geologic and Hydrogeologic Setting 5-15
5.3.2.2 Releases and Potential Releases to Groundwater 5-15
5.3.2.3 Groundwater Exposure Pathway and Receptors 5-16
5.3.2.4 Groundwater Sampling Locations and Methods 5-17
5.3.2.5 Groundwater Sampling Analytical Results 5-17
5.3.2.6 Groundwater Exposure Pathway Conclusions 5-17
5.3.3 SURFACE WATER AND SEDIMENT EXPOSURE PATHWAYS 5-17
5.3.4 HYDROLOGIC SETTING 5-17
5.3.4.1 Releases and Potential Releases to Surface Water and Sediment 5-17
5.3.4.2 Surface Water and Sediment Exposure Pathway and Receptors 5-17
5.3.4.3 Surface Water and Sediment Sampling Locations and Methods 5-18
5.3.4.4 Surface Water and Sediment Sampling Analytical Results 5-18
5.3.4.5 Surface Water and Sediment Exposure Pathway Conclusions 5-28
5.3.5 SOIL EXPOSURE PATHWAY 5-28
5.3.5.1 Physical Source Access Conditions 5-28
5.3.5.2 Actual or Potential Contamination Areas 5-29
5.3.5.3 Soil Exposure Pathways and Receptors 5-29
5.3.5.4 Soil Sampling Locations and Methods 5-29
5.3.5.5 Soil Sampling Analytical Results 5-30
5.3.6 SOIL EXPOSURE PATHWAY CONCLUSIONS 5-35
5.3.7 AIR EXPOSURE PATHWAY 5-35
5.3.7.1 Climate 5-35
5.3.7.2 Releases and Potential Releases to Air 5-35
5.3.7.3 Air Exposure Pathways and Receptors 5-35
5.3.7.4 Air Sampling and Monitoring Locations and Methods 5-35
5.3.7.5 Air Sampling Analytical Results 5-35
5.3.7.6 Air Exposure Pathway Conclusions 5-35
CHAPTER 6 SCREENING-LEVEL RISK ASSESSMENT 6-1

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT 6-1
6.1.1 INTRODUCTION 6-1
6.1.2 CONCEPTUAL SITE MODEL 6-1
6.1.3 QUALITATIVE RISK EVALUATION 6-1
6.1.4 MUNITIONS AND EXPLOSIVES OF CONCERN RISK ASSESSMENT: BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE 6-3
6.1.5 RISK SUMMARY 6-4
6.2 MUNITIONS CONSTITUENTS HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT 6-4
6.2.1 CONCEPTUAL SITE MODEL 6-4
6.2.2 AFFECTED MEDIA 6-4
6.2.3 HUMAN HEALTH SCREENING VALUES 6-4
6.2.4 RISK CHARACTERIZATION 6-4
6.2.5 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE 6-5
6.2.6 DISCUSSION 6-6
6.3 MUNITIONS CONSTITUENTS SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT 6-6
6.3.1 CONCEPTUAL SITE MODEL 6-6
6.3.2 AFFECTED MEDIA 6-6
6.3.3 ECOLOGICAL SCREENING VALUES 6-6
6.3.4 ECOLOGICAL RISK CHARACTERIZATION 6-6
6.3.5 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE 6-7
6.3.6 DISCUSSION 6-7
CHAPTER 7 SUMMARY AND CONCLUSIONS 7-1
7.1 SUMMARY 7-1
7.2 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS 7-1
7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENTS EXPOSURE PATHWAYS 7-1
7.3.1 ELEMENTS CONSTITUTING COMPLETE EXPOSURE PATHWAY 7-1
7.3.2 CONCLUSIONS REGARDING EXPOSURE PATHWAYS 7-2
CHAPTER 8 RECOMMENDATIONS 8-1
8.1 RECOMMENDATION 8-1
8.2 REVISION OF MRS BOUNDARY 8-1
CHAPTER 9 REFERENCES 9-1

LIST OF APPENDICES

A PERFORMANCE WORK STATEMENT
B TPP SESSION DOCUMENTATION/MEETING MINUTES
C INTERVIEW DOCUMENTATION
D FIELD NOTES AND FIELD FORMS
E PHOTOGRAPH DOCUMENTATION LOG
F ANALYTICAL DATA
G ANALYTICAL DATA QA/QC REPORT
H GEOGRAPHIC INFORMATION SYSTEMS DATA
I GEOPHYSICAL DATA
J CONCEPTUAL SITE MODEL
K MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL EVALUATION
L REFERENCE COPIES

LIST OF TABLES

ES.1 SUMMARY OF RESULTS ES-3
2.1 POPULATION WITHIN 4-MILE BUFFER OF THE BEARDEN KNOB FIRING RANGE MRS 2-3
2.2 SUSPECTED MUNITIONS 2-7
4.1 CHEMICAL COMPOSITION OF POTENTIAL MEC AND L MUNITIONS CONSTITUENTS 4-2
4.2 SUMMARY OF QUALITATIVE RECONNAISSANCE OBSERVATIONS 4-5
4.3 MEC DATA QUALITY OBJECTIVE WORKSHEET 4-7
4.4 MC DATA QUALITY OBJECTIVE WORKSHEET 4-8
4.5 MRSPP DATA QUALITY OBJECTIVE WORKSHEET 4-10
4.6 HRS DATA QUALITY OBJECTIVE WORKSHEET 4-11
5.2 SAMPLING RATIONALE 5-8
5.3 SUMMARY OF BACKGROUND CONCENTRATIONS IN SURFACE WATER 5-13
5.4 SUMMARY OF BACKGROUND CONCENTRATIONS IN SEDIMENT 5-14
5.5 SUMMARY OF BACKGROUND CONCENTRATIONS IN SOIL 5-14
5.6 GROUNDWATER WELLS WITHIN 4-MILE BUFFER OF THE BEARDEN KNOB FIRING RANGE MRS 5-16
5.7 SUMMARY OF SURFACE WATER ANALYTICAL RESULTS 5-19
5.8 SUMMARY OF SEDIMENT ANALYTICAL RESULTS 5-22
5.9 SURFACE WATER SOURCE EVALUATION 5-24
5.10 SEDIMENT SOURCE EVALUATION 5-26
5.11 SUMMARY OF SOIL ANALYTICAL RESULTS 5-31
5.12 SOIL SOURCE EVALUATION 5-33
6.1 CATEGORIES OF MEC PRESENCE 6-2
6.2 CATEGORIES OF MEC TYPE 6-2
6.3 CATEGORIES OF SITE ACCESSIBILITY 6-3
6.4 MEC RISK EVALUATION 6-4
6.5 HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT FOR SURFACE WATER WITHIN THE MRS 6-5
6.6 HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT FOR SEDIMENT WITHIN THE MRS 6-7
8.1 RECOMMENDATIONS 8-2

LIST OF FIGURES

ES.1 GENERAL SITE OVERVIEW ES-4
1.1 MRS LOCATION MAP 1-3
1.2 SITE LOCATION 1-4
2.1 SITE SETTING 2-9
2.2 CENSUS DATA 2-10
4.1 QUALITATIVE RECONNAISSANCE AND FIELD OBSERVATIONS 4-14
5.1 WATER WELLS WITHIN 4-MILE BUFFER 5-36
5.2 QUALITATIVE RECONNAISSANCE AND SAMPLE LOCATIONS 5-37

ABBREVIATIONS AND ACRONYMS

‘	foot
“	inch
°	degree
µg/L	micrograms per liter
APPL, Inc.	Agriculture & Priority Pollutants Laboratories, Inc.
ASR	Archives Search Report
bgs	below ground surface
C	Celsius
CELRD	USACE Great Lakes and Ohio River Division
CELRH	USACE Huntington District
CELRL	USACE Louisville District
CENWW	USACE Walla Walla District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRREL	Cold Regions Research and Engineering Laboratory
CSEM	conceptual site exposure model
CSM	conceptual site model
CVI	Canaan Valley Institute
CVNWR	Canaan Valley National Wildlife Refuge
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DQO	data quality objective
e.g.	*exempli gratia* (Latin, “for the sake of example”)
Eco	Eco & Associates, Inc.
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratories Accreditation Program
ER	Engineer Regulation
ESL	Ecological Screening Level
ESV	ecological screening value
et seq.	*et sequentes* (Latin, “and the following”)
F	Fahrenheit
FUDS	Formerly Used Defense Site
GPS	Geographic Positioning System
HE	high explosive
HQ	hazard quotient
HRS	Hazard Ranking System
i.e.	*id est* (Latin, “that is”)
INPR	Inventory Project Report
J	Analyte detected, estimated concentration.

LANL	Los Alamos National Laboratory
MC	munitions constituents
MCL	Maximum Contaminant Levels
MD	munitions debris
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MNF	Monongahela National Forest
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NCDC	National Climate Data Center
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NELAC	National Environmental Laboratory Accreditation Conference
NOAA	National Oceanic and Atmospheric Administration
PA	Preliminary Assessment
Parsons	Parsons Government Services.
pH	negative log of hydrogen ion concentration
PQL_sa	sample-specific practical quantitation limit
PSAP	Programmatic Sampling and Analysis Plan
PWP	Programmatic Work Plan
QA	quality assurance
QC	quality control
QR	qualitative reconnaissance
RBC	Risk-Based Concentration
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS	remedial investigation and feasibility study
ROE	right-of-entry
RSL	Regional Screening Level
SI	site inspection
SLERA	Screening Level Ecological Risk Assessment
SLRA	screening-level risk assessment
SS-WP	Site-Specific Work Plan
SVT	site visit team
TAG	Technical Advisory Group
T&E	Threatened and Endangered
TCRA	time-critical removal action
TPP	technical project planning
U	Analyte was analyzed for but not detected above the sample-specific practical quantitation limit
U.S.	United States
UJ	Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
USACE	U.S. Army Corps of Engineers
USC	U.S. Code

USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance
WVDCH	West Virginia Division of Culture and History
WVDEP	West Virginia Department of Environmental Protection
WVDHHR	West Virginia Department of Health and Human Resources
WVDNR	West Virginia Division of Natural Resources
WVGES	West Virginia Geological and Economic Survey
WVMA	West Virginia Maneuver Area

GLOSSARY OF TERMS

inhabited structure	Permanent or temporary structures, other than military munitions related structures that are routinely occupied by one or more persons for any portion of a day.
military munitions	All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof.
munitions and explosives of concern (MEC)	Military munitions that may pose unique explosives safety risks, including unexploded ordnance, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive or other health hazard.
munitions constituents (MC)	Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.
munitions debris (MD)	Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.
munitions response	Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required.
munitions response area	Any area on a defense site that is known or suspected to contain unexploded ordnance, discarded military munitions, or munitions constituents. Examples include former ranges and munitions burial areas. A munitions response area includes one or more munitions response sites.

munitions response site (MRS)	A discrete location within a munitions response area that is known to require a munitions response.
projectile	Object projected by an applied force and continuing in motion by its own inertia. This includes bullets, bombs, shells, grenades, guided missiles, and rockets.
unexploded ordnance (UXO)	Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and that remain unexploded whether by malfunction, design, or any other cause.

EXECUTIVE SUMMARY

OBJECTIVE

The objective of this site inspection (SI) is to determine whether the West Virginia Maneuver Area (WVMA) Bearden Knob Firing Range Munitions Response Site (MRS) located within the WVMA/Dolly Sods Formerly Used Defense Sites (FUDS) (FUDS Property No. G03WV0013, FUDS Project No. G03WV001309), Bearden Knob Firing Range ["MRS05"]) in Grant and Tucker Counties, West Virginia, warrants further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The boundary of the 8,000-acre Bearden Knob Firing Range MRS (MRS05) overlaps with the boundary of the adjacent 16,000-acre Brown/Cabin Mountain Firing Ranges MRS [MRS06]). The overlap consists of approximately 1,863 acres and includes portions of the Canaan Valley, Middle Ridge, and Cabin Mountain. Two items identified as munitions and explosives of concern (MEC), potentially unexploded ordnance (UXO) or discarded military munitions (DMM), have historically been identified within this area of overlap: a 105mm Howitzer round found along the base of Cabin Mountain in 2007, and an 81mm mortar found by hunters in 2011, also along the base of Cabin Mountain. Both the Bearden Knob Firing Range and the Cabin Mountain Firing Range reportedly served as firing points and target locations for 105mm Howitzer rounds. However, only the Brown/Cabin Mountain Firing Range served as firing points and target locations for 81mm mortars. During the 2011 site visit, the site visit team identified more than 10 craters at the northern extent of Middle Ridge, further supporting the use of mortars at the Brown/Cabin Mountain Firing Ranges MRS. Additionally, ground scarring that is suspected to be craters can be seen in historical aerial photographs within the wetland areas at the base of Cabin Mountain. The majority of the craters are within the Brown/Cabin Mountain Firing Range MRS. In order to accurately account for the area of each MRS, the overlapping portion of the ranges must be attributed to only one of the MRSs. Based on the results of the SI and the evidence available from the 2009 Preliminary Assessment (PA), the MEC found within the area of overlap are associated with the Brown/Cabin Mountain Firing Ranges MRS; therefore, the overlapping 1,863 acres are included with the Brown/Cabin Mountain Firing Ranges MRS. The revised boundary of the Bearden Knob Firing Range MRS is 6,137 acres. The SI at the former Bearden Knob Firing Range MRS was performed to confirm the MRS location and to evaluate evidence for the presence of MEC, munitions debris (MD), and the presence of elevated metals concentrations that are consistent with the identified munitions constituents (MC) contaminants of concern at the FUDS. To accomplish this objective, qualitative reconnaissance (QR) and metals sampling were performed at the Bearden Knob Firing Range MRS within the WVMA FUDS.

TECHNICAL PROJECT PLANNING MEETING

The technical project planning (TPP) process determined that the collection of seven surface soil samples and two surface water/sediment samples would be sufficient to meet the SI project objectives. The TPP team also concluded that biased samples would be collected using Cold Regions Research and Engineering Laboratory (CRREL) "seven-point wheel" composite sampling technique and also established the screening levels to be used for human health and ecological risk assessment. Based on MRS boundary revisions, one of the surface soil samples collected will be used in the evaluation of the Brown/Cabin Mountain Firing Range MRS and will not be included within this SI.

The TPP Team agreed that a single ambient sample (per media) would be collected for the MRS. The sample would be collected from a location of no apparent Department of Defense (DoD) impact, and the

detected concentrations from that ambient sample would be used to estimate the background metals concentrations for the MRS. Subsequent discussions with the TPP Team were conducted and due to the variability of the naturally occurring metals in the area, the single ambient sample was augmented with additional data to include West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual Version 2.1, Table 2-3: Natural Background Levels of Inorganics in Soil in West Virginia and Surrounding Areas and U.S. Geological Society county-specific background values.

EVALUATION AND FINDINGS

The SI evaluation included soil, surface water, and sediment sampling within the MRS boundary along 19.5 miles of QR (Figure ES.1). Agriculture & Priority Pollutants Laboratories, Inc. (APPL. Inc.) in Clovis, California analyzed the samples for explosives and selected metals. The maximum detected concentrations of the metals within the surface soil and sediment samples collected did not exceed background concentrations; therefore, surface soil and sediment exposure pathways are incomplete for all receptors. The maximum detected concentrations of aluminum, copper, lead and zinc did not exceed background concentrations in the surface water samples collected; however, antimony was detected in a single biased surface water sample. Antimony was not detected in the ambient surface water sample resulting in complete exposure pathways for all receptors. Antimony did not exceed the human health screening values and did not exceed the ecological screening values resulting in no unacceptable human health and ecological risk. In addition, there was a low-level detection of RDX (explosive compound) right at the method detection limit within the surface water ambient sample collected on October 4, 2011. RDX was not detected in the associated sediment ambient sample. Since explosives are not naturally occurring, the sample was not used as an ambient sample for comparison of biased samples and another surface water/sediment ambient sample couple was collected on May 17, 2012. There were no RDX detections in the second surface water/sediment ambient sample results. Since no munitions source was identified at the MRS (either during the SI or historically), this low-level concentration is considered anomalous and is not attributed to DoD use. As a conservative measure, the RDX was carried through the risk evaluation during the SI. The RDX did not exceed human health or ecological screening values and was determined to pose no unacceptable risk.

The site visit team (SVT) did not find UXO/DMM or MD during the QR at the Bearden Knob Firing Range MRS. The SVT did not observe any indications of DoD training activity within the revised Table ES.1 and Figure ES.1 summarize the results of the SI.

The types of ordnance represented by the potential munitions have the potential to harm human receptors if they are contacted and are still functional. However, no MEC and no MD have been found at the MRS. No explosive safety risks are considered to be present at this MRS. Therefore, the MEC exposure pathway is incomplete at the Bearden Knob Firing Range MRS.

An exposure pathway for a chemical release is not considered complete unless all four of the following elements are present (U.S. Environmental Protection Agency [USEPA] 1989):

1. A source and mechanism for chemical release
2. An environmental transport and/or exposure medium
3. A receptor exposure point
4. A receptor and a likely route of exposure at the exposure point

Based on the analytical results, metals exposure pathways are considered incomplete for all receptors. None of the detected analyte concentrations exceeded human health or ecological screening levels

TABLE ES.1
SUMMARY OF RESULTS
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MRS	ACREAGE	MEC ASSESSMENT(1)	METALS ASSESSMENT(2)	RECOMMENDATION
Bearden Knob Firing Range	8000 (revised to 6137 based on removing the portion of the MRS that overlaps with the Brown/Cabin Mountain MRS).	**No** No UXO/DMM have been found during previous field visits, and no UXO/DMM were observed during the 2011 site visit and the 2012 site visit	**No** No metals exceeded background concentrations within the surface soil and sediment samples collected. Antimony exceeded background concentrations in a surface water sample collected; however, the maximum detection did not exceed ecological and human health screening criteria. RDX (not attributed to DoD use) was detected in a surface water sample; however, the concentration did not exceed ecological or human health criteria.	No Further Action

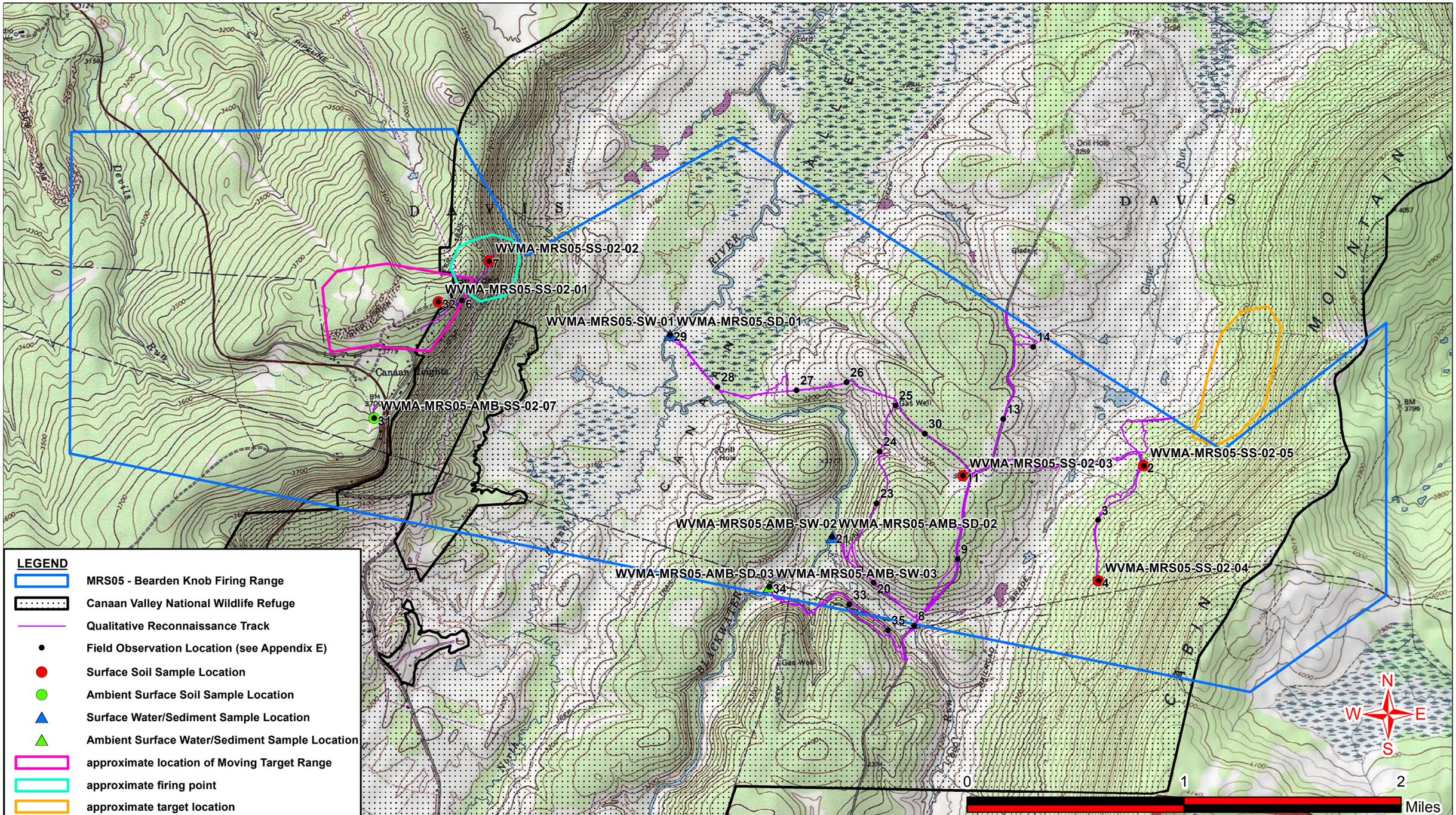
Notes:

(1) No" in this column indicates no confirmed MD indicative of potential MEC presence, resulting in a no further action recommendation for this MRS.

(2) "No" in this column indicates the absence of metals at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for further metals sampling for the MRS.

RECOMMENDATIONS

Based on the analytical results and exposure pathways evaluated during this SI, further sampling of surface soil, sediment, and surface water is not recommended. No explosives were detected in the surface soil or sediment samples. No metals were detected in the surface soil or sediment at concentrations exceeding the selected background concentrations. One explosive compound (RDX) was detected in one surface water sample (although it is not attributed to DoD use). As a conservative measure, the RDX detection was carried through the risk evaluation, but the concentration was below the human health and ecological screening values. Antimony was detected in one biased surface water sample, but was not detected in the ambient surface water sample. The detected concentration of antimony did not exceed the human health and ecological screening values. No other metals were detected in the surface water at concentrations exceeding the selected background values. Therefore, based on the analytical results presented in this report, no unacceptable human health or ecological risk is expected from exposure surface water due to former munitions-related activities at this MRS and as a result, no further action is necessary. No MEC or MD indicative of potential MEC has been identified within the revised boundary of the Bearden Knob MRS. No MEC is suspected to remain at the MRS; therefore, no further action is recommended. Since there is no explosive risk, no removal action is necessary.



Prepared by:

Eco & Associates, Inc.
and
PARSONS

GENERAL SITE OVERVIEW

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
ES.1

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Eco and Associates, Inc. (Eco) received Contract No. W912PP-11-C-0007, Task Order No. 0001, from the United States Army Corps of Engineers (USACE) Engineering and Support Center, Huntsville to perform a site inspection (SI) of the West Virginia Maneuver Area (WVMA) Bearden Knob Firing Knob Munitions Response Site (MRS), Property No. G03WV0013 one of seven MRSs identified within the WVMA/Dolly Sods Formerly Used Defense Site (FUDS). The 6,137-acre (reduced from 8000 due to overlap with an adjacent MRS) Bearden Knob Firing Range (MRS05: FUDS Project No. G03WV001309) is located in Grant and Tucker Counties, West Virginia, approximately 2.5 miles southeast of the town of Davis, West Virginia. The U.S. Geological Survey (USGS) map coordinates for the subject MRS are 39° 5' 50.69" N and 79° 23' 25.15" W. Figure 1.1 shows the location of the MRS in relation to the WVMA FUDS, and Figure 1.2 shows the site location.

The Department of Defense (DoD) established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, the DoD's executive agent for the FUDS program.

Pursuant to USACE Engineer Regulation (ER) 200-3-1 (USACE 2004b) and the Management Guidance for the Defense Environmental Restoration Program (DERP) (March 2012), the USACE is conducting FUDS response activities. All work is performed in accordance with the following:

- The DERP statute (10 U.S. Code [USC] 2701 et seq.)
- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; 42 USC 9601 et seq.)
- Executive Orders 12580 and 13016
- The National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] Part 300).

The USACE is conducting SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

While not all MEC and MC constitute CERCLA hazardous substances, pollutants, or contaminants, the DERP statute authorizes the DoD to respond to releases of MEC and MC. DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

This report summarizes the work performed during the SI on Bearden Knob MRS and describes any MEC and metals contamination identified at the FUDS. The SI is limited exclusively to MEC and metals contamination issues and does not consider unrelated hazardous and toxic waste concerns that the FUDS may pose. Per ER 200-3-1 guidance for conducting an SI, "The SI is not intended as a full-scale study of the nature and extent of contamination or explosive hazards"; it only requires collection of sufficient and appropriate information as defined in the Technical Project Planning (TPP) Memorandum for this site (Appendix B).

1.2 PROJECT OBJECTIVES

The primary objective of the MMRP SI is to determine whether a FUDS project warrants further response action under CERCLA. The SI collects sufficient and appropriate information necessary to make this determination. The SI Report also provides the following:

1. Determination of the potential need for a removal action
2. Collection or development of additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (USEPA)
3. Collection of data, as appropriate, to characterize the release for effective and rapid initiation of the remedial investigation and feasibility study (RI/FS)

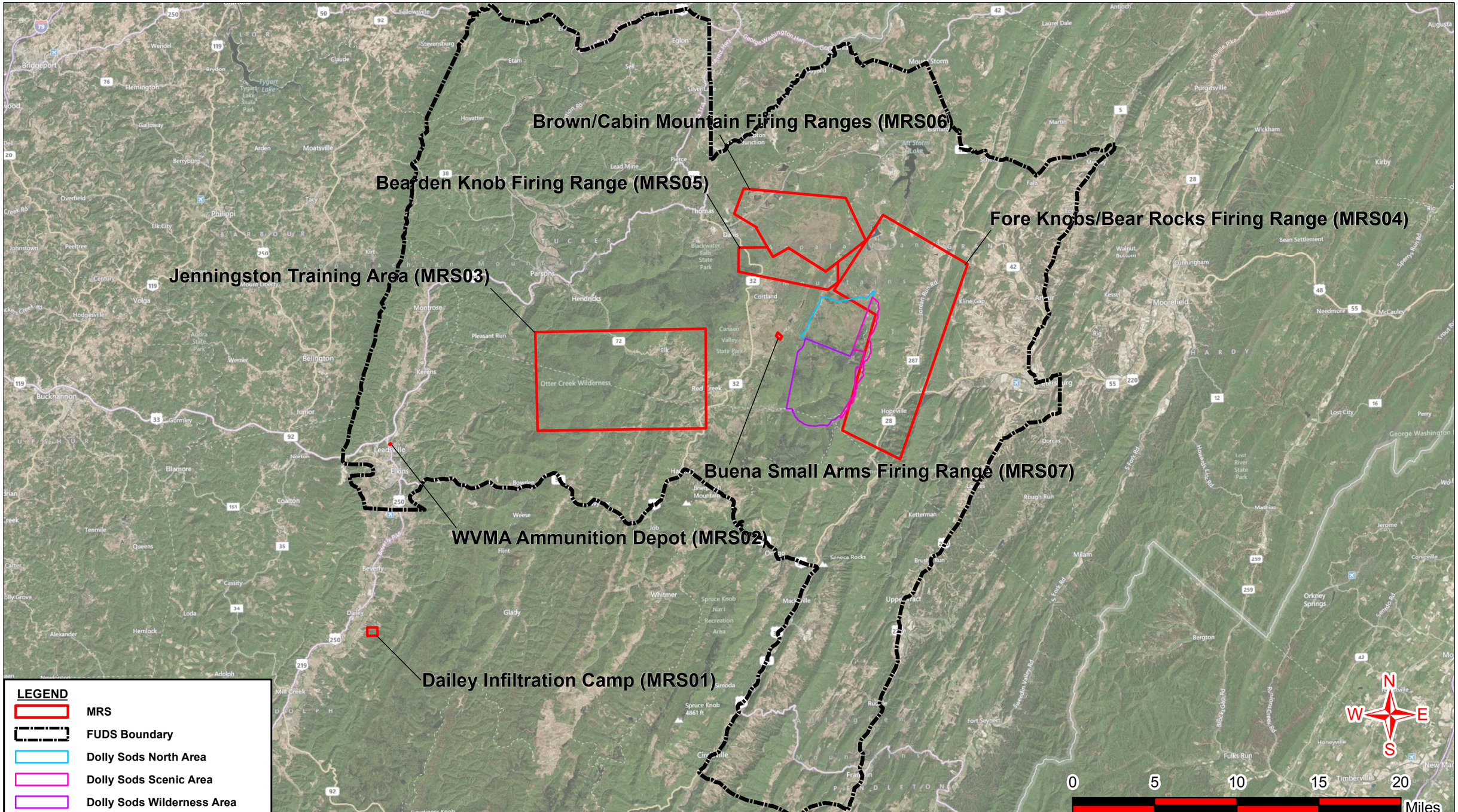
An additional objective of the MMRP SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSPP).

1.3 PROJECT SCOPE

The primary project planning documents used to perform the SI include the Site-Specific Work Plan (SS-WP) Addendum for the Bearden Knob Firing Range MRS (Eco 2011b), the South Pacific Division Range Support Center Programmatic Work Plan (Parsons Infrastructure and Technology Group, Inc. [Parsons] 2010), and the Programmatic Sampling and Analysis Plan (PSAP) (USACE 2005). The performance work statement for this project is provided in Appendix A.

The USACE Huntington District (CELRH) held a TPP meeting on April 7, 2011, that included representatives of the CELRH, the USACE Walla Walla District (CENWW), the West Virginia Department of Environmental Protection (WVDEP), the United States Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), the Canaan Valley Institute (CVI), Eco, and Parsons. A final TPP Memorandum was issued on September 22, 2011 (Eco 2011a).

The TPP Team determined that the comparison criteria for soil sample results would be the WVDEP Risk-Based Concentrations (RBCs), Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) supplemented with USEPA regional screening levels (RSLs) for residential soil. The comparison criteria for surface water samples would be the WVDEP Requirements Governing Water Quality Standards supplemented with USEPA RSLs for tap water. The comparison criteria for groundwater samples would be WVDEP Requirements Governing Water Quality Standards then WVDEP RBCs supplemented with USEPA maximum contaminant levels (MCLs), National Primary Drinking Water Standards, and USEPA RSLs for tap water.



Prepared by:
Eco & Associates, Inc.
and
PARSONS

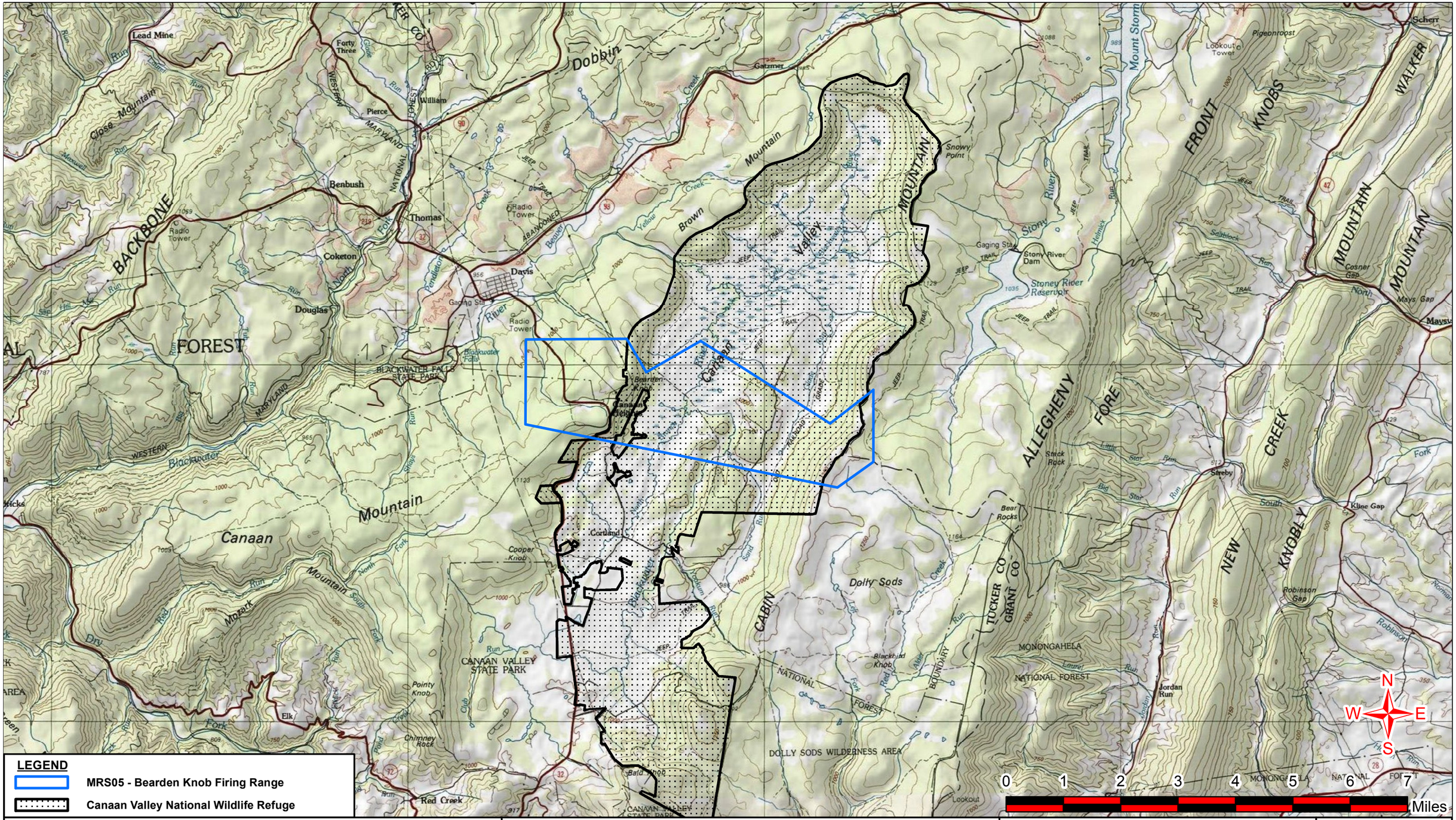
MRS Location Map

West Virginia Maneuver Area
FUDS Property No. G03WV0013

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
1.1



Prepared by:

Eco & Associates, Inc.
and
PARSONS

SITE LOCATION

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
1.2

CHAPTER 2
PROPERTY DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

The Bearden Knob Firing Range MRS is located in Grant and Tucker Counties, West Virginia. The site is located approximately 2.5 miles southeast of the town of Davis, in the northeast portion of the WVMA/Dolly Sods FUDS (Figure 1.2). The total FUDS acreage is 2,180,367 acres, including the revised 6,137-acre Bearden Knob Firing Range MRS. The FUDS acreage also includes six other MRSs, each covered by a different SI but listed under the same FUDS Property No. G03WV0013. The Bearden Knob Firing Range MRS was used from 1943 to 1944 and was returned to the various private landowners and USFS in 1950. The majority of land comprising the Bearden Knob Firing Range MRS is owned by the USFWS and is managed as part of the Canaan Valley National Wildlife Refuge (CVNWR). The site is used for outdoor recreation including hiking, cycling, cross-country skiing, horseback riding, hunting, fishing, and wildlife viewing. The remaining parcels consist of privately-owned residences (USACE 2009).

2.2 SITE LOCATION AND SETTING

2.2.1 TOPOGRAPHY AND VEGETATION

The Bearden Knob Firing Range MRS is located in the Appalachian Plateau physiographic province (West Virginia Geological and Economic Survey [WVGES] 2004). Figure 2.1 shows the site elevation, which ranges from approximately 4,140 to 3,140 feet above mean sea level. The MRS extends across the Canaan Valley, a large northeast trending valley containing the largest freshwater wetland in West Virginia (approximately 8,475 acres). The MRS is contained within the Blackbird Knob, Blackwater Falls, Davis, and Mount Storm Lake 7.5-minute topographic quadrangles (USGS 1995A, 1995B, 1995C, 1995D). The former firing range extended east across the valley from Canaan Heights on the west side to the west face of Cabin Mountain on the east side. The central portion of the site is drained by the Blackwater River with the eastern portion of the site drained by Glade Run. The floor of the valley contains numerous swamps, marshes, and ponds and is generally flat except for a low ridge in the center of the valley. The eastern and western portions of the MRS are located on the wooded slopes of Cabin Mountain and Bearden Knob, respectively.

The Canaan Valley contains a unique ecosystem consistent with more northern latitudes. The ecosystem contains at least 580 species of plants, 109 of which are representative of latitudes of Maine (USFWS 2011d). Vegetation on the valley floor includes Sphagnum moss (*Sphagnaceae*), hair-cap moss (*Polythichum*), cotton grass (*Eriophorum virginicum L.*), and cranberries (*Vaccinium*). Shrubs found in the area include Azaleas (*Rhododendron*), Mountain holly (*Ilex Montana*), Winterberry (*Ilex verticillata*), and Mountain laurel (*Kalmia latifolia*). Trees found in the wooded areas include Balsam fir (*Abies balsamea*), Hemlock (*Tsuga canadensis*), Red spruce (*Picea rubens*), Norway spuce (*Picea abies*), White ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), and Red maple (*Acer rubrum*) (Keating 2010). Vegetation observed during the SI was consistent with these descriptions, as shown in site photographs taken during the site visit (see Appendix E).

2.2.2 SOIL

A wide variety of soil types are in the Canaan Valley. The soil types underlying the soil sampling locations consist of Cateache channery silt loam, Dekalb channery loam, Dekalb very cobbly loam, Lickdale silt loam, and Leetonia very cobbly loamy sand. The Cateache channery silt loam is primarily located on the face of Cabin Mountain. The soil is composed of an organic layer within the upper 1 inch and channery silt loam down to 3 inches. The remaining soil units are composed of channery or cobbly loam or silt loam with the exception of the Leetonia which is composed of very cobbly loamy sand (Web Soil Survey 2011). In all cases, the soils sampled consisted of silty loam at the sample depths.

2.2.3 CLIMATE

The nearest weather station to the Bearden Knob Firing Range MRS is in Canaan Valley, West Virginia; approximately 1.5 miles south of the MRS (National Climatic Data Center [NCDC] 2012). Climate data for the area are based on monthly or yearly averages derived from readings collected at this station. Significant rainfall occurs throughout the year but is slightly higher in the late spring and early summer, with the most precipitation occurring in May (5.21 inches), June (5 inches), and July (4.84 inches). The climate is generally driest in autumn, with 3.47 inches of precipitation occurring in October. The hottest month is July, with an average maximum temperature of 76.8°F and an average minimum of 53.9°F. The coldest month is January, with an average maximum of 34.1°F and an average minimum of 14.9°F (Climate-Charts.com 2011). Daytime temperatures when field work was performed ranged from 35°F in October to 77°F in May.

Winds are highest in the late winter and early spring, averaging greater than 7 miles per hour. Sunshine in the Davis, West Virginia area is below the U.S. average, averaging approximately 45 percent sunshine in the spring and summer with less than 30 percent sunshine occurring in December and January (City-Data.com 2011).

2.2.4 SIGNIFICANT AND INHABITED STRUCTURES

Several unpaved roads and numerous foot trails are present within the MRS, as well as Highway 32 (Figure 2.1). The site visit team (SVT) identified abundant inhabited structures (26 or more) within the MRS, and observed many more within two miles of the MRS. The inhabited structures observed within the MRS consist of residential structures in the community of Canaan Heights. The inhabited structures observed within two miles of the MRS consisted of residential and commercial buildings in and around the town of Davis. Inhabited structures are permanent or temporary structures, other than military munitions-related structures, that are routinely occupied by one or more persons for any portion of a day.

2.2.5 DEMOGRAPHICS

The Bearden Knob Firing Range MRS is located in Grant and Tucker Counties, West Virginia, approximately 2.5 miles southeast of the town of Davis, West Virginia. According to U.S. Census 2010, the population density of Tucker County is 17 persons per square mile, and the population density of Grant County is 25 persons per square mile. The census data indicate that 1,992 people live within an approximate 4-mile buffer of the Bearden Knob Firing Range MRS, with 32 of those people living within the census blocks covering the western portion of the MRS (Table 2.1). The SVT observed numerous inhabited structures within the western portions of the MRS and within 2 miles of the MRS, mainly within and surrounding the town of Davis and the community of Canaan Heights. However, the SVT did not identify any residences within the central or eastern portions of the MRS (Figure 2.2).

TABLE 2.1
POPULATION WITHIN 4-MILE BUFFER OF THE
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

RANGE	ON SITE	0 TO ¼ MILE	¼ TO ½ MILE	½ TO 1 MILE	1 TO 2 MILES	2 TO 3 MILES	3 TO 4 MILES	TOTAL
Bearden Knob Firing Range	32	51	181	201	454	241	832	1,992

Source: U.S. Census 2010 data. The population within the FUDS, MRS, or any buffer area is determined using a conservative approach to calculate the population of an area by including the total number of people for any census block that falls within or overlaps the site boundary, MRS boundary, or buffer line.

2.2.6 CURRENT AND FUTURE LAND USE

The majority of the Bearden Knob Firing Range MRS is owned by the USFWS and is managed as part of the CVNWR. The land is currently used for outdoor recreation and wildlife preservation. The remainder of the former firing range consists of small privately-owned parcels located in the community of Canaan Heights. No change in land use is expected at the Bearden Knob Firing Range MRS, especially the portion within the CVNWR.

During the site visit, the team observed ongoing construction of two new bridges across the Blackwater River to the north and south of the Bearden Knob Firing Range MRS. The USFWS indicated that this is part of a new plan to upgrade trails and access to the wildlife refuge. The SVT also observed that a new house was being constructed in the community of Canaan Heights in the general location of the reported moving target range.

2.3 SITE OWNERSHIP AND HISTORY

According to the 2009 Preliminary Assessment (PA), the WVMA consisted of approximately 2,180,367 acres of land covering portions of Grant, Pendleton, Preston, Randolph, and Tucker counties in northeastern West Virginia generally near the town of Davis. Maneuver rights, secured by the Rents and Claims Board, Fifth Service Command, secured 350,416 acres of public lands (all part of the Monongahela National Forest [MNF]), 48,557 acres of leased property for inclusion in the Impact Area, and 1,781,394 acres of so-called "lesser interests". According to a warning order notice, dated March 26, 1945, these "lesser interests" were covered by "trespass agreements". The land owners had granted use of these lands to the Army verbally; there are no records that describe the "trespass agreements" or the areas that they covered (USACE 1990). A letter, dated July 15, 1943 from the Secretary of War to the Secretary of Agriculture stated that there is a military necessity for the use of portions of the MNF for Army Maneuver purposes. In a response letter dated August 4, 1943 from the Secretary of Agriculture to the Secretary of War, the Department of Agriculture grants permission for the Army to use all MNF land in Preston, Grant, Randolph, Tucker, and Pendleton counties in West Virginia, a total coverage of 341,266 acres (USACE 2009).

Based upon lease records and other information contained in the PA, areas where live artillery fire was conducted were informally designated the WVMA Impact Area. Therefore, the Bearden Knob Firing Range MRS is within the WVMA Impact Area (USACE 2009).

According to the 2009 PA, the Bearden Knob Firing Range served as firing points and targets for 105mm and 155mm howitzer rounds and a possible anti-tank firing range. However, it was noted during the initial TPP Meeting that antitank rounds were not found in this MRS, but were listed in the PA mistakenly. A plate included in the PA indicates that a firing point was located on Bearden Knob at the west end of the MRS, and rounds were fired eastward toward the Cabin Mountain Firing Range.

Currently, the Brown/Cabin Mountain Firing Range MRS (MRS06) boundary overlaps the northern boundary of the Bearden Knob Firing Range MRS. Research conducted for the PA also indicated that the range was utilized by the 628th Tank Destroyer Battalion. Radio controlled targets were fired on by .30 caliber and .50 caliber machine guns on tank destroyers. M-10s were also utilized on the range (USACE 2009). Based on information contained in the PA, the munitions potentially present at the MRS include: .30 caliber cartridges (includes carbine), .50 caliber cartridges, machine gun, 105mm, high explosive (HE) cartridges (M1), 155mm, and HE projectiles (M102) (Table 2.2). Because the MRS is no longer believed to have been used as an anti-tank range, all of the anti-tank ordnance has been removed from the list of proposed munitions that was presented in the TPP Memo.

The boundary of the original 8,000-acre Bearden Knob Firing Range MRS (MRS05) overlaps with the adjacent 16,000-acre Brown/Cabin Mountain Firing Ranges MRS [MRS06]). The overlap consists of approximately 1,863 acres and includes portions of the Canaan Valley, Middle Ridge, and Cabin Mountain. Two items identified as MEC have historically been identified within this area of overlap: a 105mm Howitzer round found along the base of Cabin Mountain in 2007, and an 81mm mortar (UXO) found by hunters in 2011, also along the base of Cabin Mountain. Both the Bearden Knob Firing Range and the Cabin Mountain Firing Range reportedly served as firing points and target locations for 105mm Howitzer rounds. However, only the Brown Mountain Firing Range reportedly served as firing points and target locations for 81mm mortars. During the 2011 site visit, the site visit team identified more than 10 craters at the northern extent of Middle Ridge, further supporting the use of mortars at the Brown/Cabin Mountain Firing Ranges MRS. Additionally, ground scarring that is suspected to be craters can be seen in historical aerial photographs within the wetland areas at the base of Cabin Mountain. The majority of the craters are within the Brown/Cabin Mountain Firing Range MRS. In order to accurately account for the area of each MRS, the overlapping portion of the ranges can only be attributed to one of the MRSs. Based on the results of the SI and the evidence available from the 2009 PA, the UXO/DMM found within the area of overlap are associated with the Brown/Cabin Mountain Firing Ranges MRS; therefore, the overlapping 1,863 acres is included with the Brown/Cabin Mountain Firing Ranges MRS.

2.4 SITE OPERATIONS AND WASTE CHARACTERISTICS

2.4.1 MUNITIONS RESPONSE SITE-SPECIFIC DESCRIPTIONS AND OPERATIONS

The revised Bearden Knob Firing Range MRS boundary consists of 6,137 acres within the 2,180,367-acre WVMA/Dolly Sods FUDS (USACE 2009). The majority of the land is currently owned by the USFWS and is managed as part of the CVNWR. The remainder of the land is divided into small parcels owned by private individuals. These parcels comprise the community of Canaan Heights. The PA indicates a MRSPP score of 3 for the Bearden Knob Firing Range MRS.

2.4.2 REGULATORY COMPLIANCE

The USACE is conducting the SI at the Bearden Knob Firing Range MRS as part of FUDS response activities pursuant to and in accordance with the guidance, regulations, and legislation listed in Subchapter 1.1.

2.5 PREVIOUS INVESTIGATIONS

Ordnance clearance operations began almost immediately after military use of the FUDS ended in 1944. Initial clearance operations in 1946 focused on known target areas that were located in the Dolly Sods region, a high plateau located in the eastern central portion of the WVMA. The property was returned to the private landholders and the USFS upon completion of the initial clearing operations. A follow-up operation in 1953 found and destroyed six live rounds but determined that the previous clearance operations were “good”. However, members of the public have been reported to have found munitions at this MRS twice, once in 2007 (MD) and once in 2011 (UXO). Subsequent site reconnaissance and

clearance operations conducted in 1984, 1991, and 1997 to 1998 continued to encounter ordnance. As before, the clearance operations were focused in the Dolly Sods Region in publicly used areas such as trails and campgrounds. Since then, recurring reviews of the clearance operations have been conducted to ensure that the previous operations continue to protect the safety of the public (USACE 2009). It should be noted that no clearance operations have ever been conducted in the area of the Bearden Knob Firing Range MRS.

As part of the USACE DERP FUDS program, a PA of the entire WVMA was prepared by the CELRH in 2009. Information used to prepare the PA included military records, historical documents, historical newspaper reports, interviews with local residents, interviews with former Army officials stationed at the site, and historic aerial photographs. Based upon a review of the information above, the CELRH identified a total of 7 MRSs warranting further investigation, including the Bearden Knob Firing Range MRS that is the subject of this SI Report.

In December 2010, an Inventory Project Report (INPR) was prepared by the USACE Louisville District (CELRL) requesting approval of the on-going Dolly Sods MMRP project and proposing the 7 MRSs identified in the PA. The USACE Great Lakes and Ohio River Division (CELRD) granted approval of the Dolly Sods MMRP project and the 7 new MRSs in December 2010, including the Bearden Knob Firing Range MRS.

2.5.1 PRELIMINARY ASSESSMENT – FEBRUARY 2009

A PA of the entire WVMA was prepared by the CELRH in 2009. Information used to prepare the PA included military records, interviews with former Army officials stationed at the site, historical documents, historical newspaper reports, interviews with local residents, and historic aerial photographs. Based upon a review of the information above, the CELRH identified a total of 7 MRSs warranting further investigation including the Bearden Knob Firing Range MRS, the subject of this SI Report.

As discussed above, according to the PA the purpose of the Bearden Knob Firing Range MRS was to serve as firing points and targets for 105mm and 155mm howitzer rounds and as a possible anti-tank firing range. These determinations were made based on historical mapping, historical documentation, aerial photography, interviews, and an UXO find on Cabin Mountain (105mm howitzer round). According to the PA, historical records document a 105mm Howitzer round (MEC) that was found in the Cabin Mountain in 2007, in the northeast portion of the MRS. The Technical Advisory Group (TAG) Review Sheet in Appendix O of the PA states that anti-tank rockets have also been found within the MRS. However, these are most likely the 3.25-inch rockets that were used as targets for the training of anti-aircraft gun crews. It was noted during the initial TPP Meeting that antitank rounds were not found in this MRS, but were listed in the PA mistakenly. Therefore, it is no longer believed that this MRS was used as an anti-tank firing range. As previously discussed in Section 2.3, based on the overlapping boundaries between the Bearden Knob Firing Range MRS and the Brown/Cabin Mountain Firing Range MRS, these previous findings as reported within the PA are now related to the Brown/Cabin Mountain Firing Ranges MRS only.

The PA indicates a MRSPP score of 3 for the former Bearden Knob Firing Range MRS. MRS Priority scoring ranges from 1 (highest priority, reserved for CWM sites) through 8 (lowest priority).

2.5.2 INVENTORY PROJECT REPORT – DECEMBER 2010

An INPR for the WVMA was prepared by the CELRL in December 2010. The INPR requested “after the fact” approval for the Dolly Sods MMRP project and proposed 7 new MRSs including the Bearden Knob Firing Range MRS described in this SI Report.

In December 2010, the CELRD granted “after the fact” approval for the Dolly Sods MMRP project and approved the 7 new MRSs including the Bearden Knob Firing Range MRS.

2.5.3 ADDITIONAL WVMA ACTIVITIES

Please note that additional activities, including site visits, removal actions, and studies have been conducted for portions of the WVMA which did not include the area of the Bearden Knob MRS, as follows:

- Findings and Determination of Eligibility/Inventory Project Report 1984 to 1992
- Site Visit for Preparation of the Feasibility Study Work Plan – 1991
- Feasibility Study Site Visit – 1991
- Archives Search Report – September 1995
- Environmental Assessment of Ordnance Removal Action in the Dolly Sods Wilderness Area – September 1995
- Environmental Assessment of Ordnance Removal Action in the Dolly Sods North Area – September 1997
- Action Memoranda for OE Removal Actions – 1996 to 1997
- Ordnance Removal Actions – Dolly Sods Wilderness Area, Dolly Sods North, and Dolly Sods Scenic Area – 1997 to 1998
- OE Recurring Review – June to August 2004

TABLE 2.2
Suspected Munitions
Bearden Knob Firing Range MRS

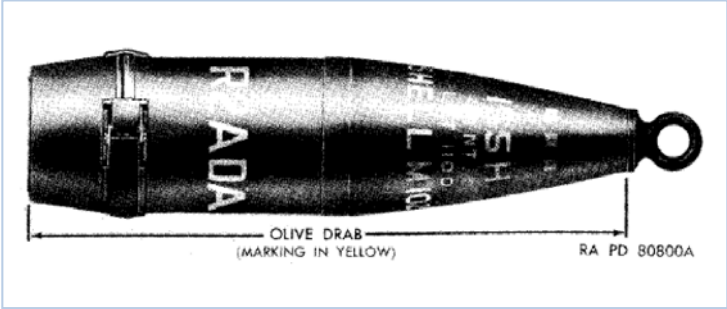
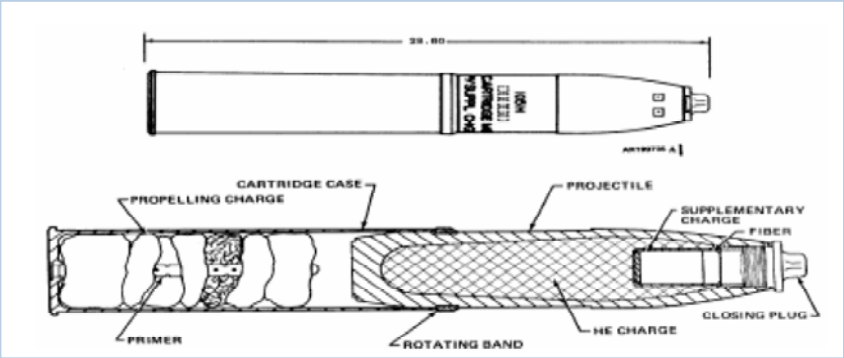
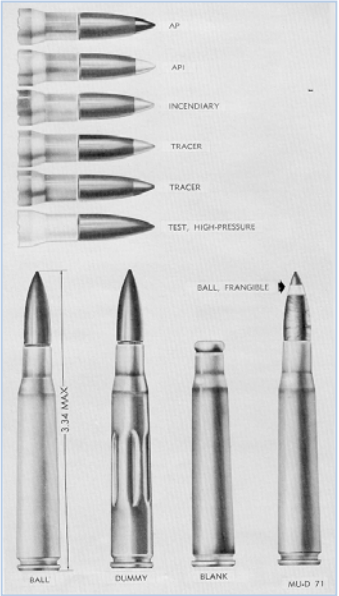
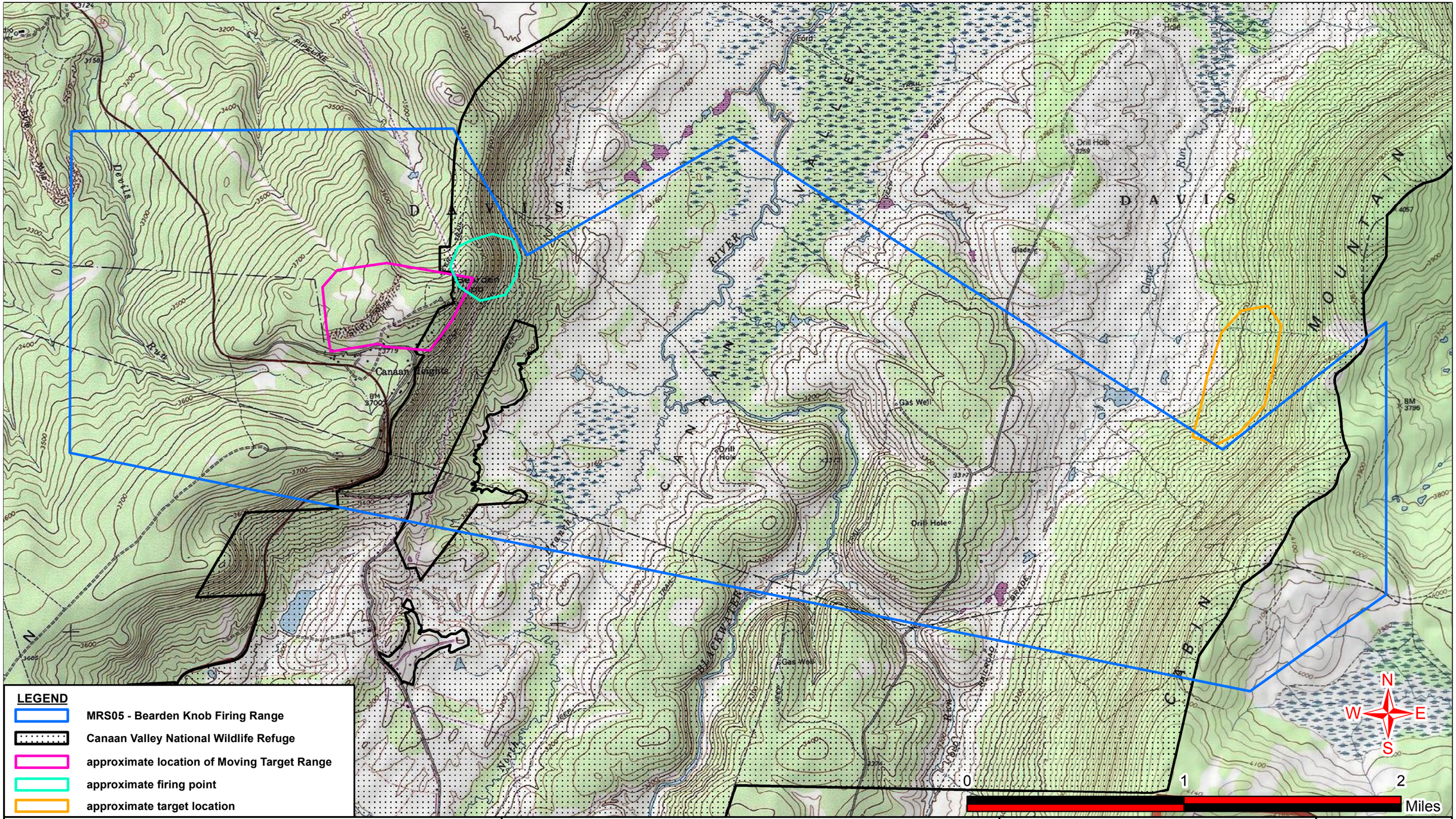
Munitions	Photograph/Diagram
Projectile, 155mm, HE, M102	
Cartridge, 105mm, HE, M1	

TABLE 2.2
Suspected Munitions
Bearden Knob Firing Range MRS

Munitions	Photograph/Diagram
Small arms ammunition, general: Cartridge, .50 caliber, Machine Gun	
Small arms ammunition, general: Cartridge, .30 caliber (includes Carbine)	



Prepared by:

Eco & Associates, Inc.
and
PARSONS

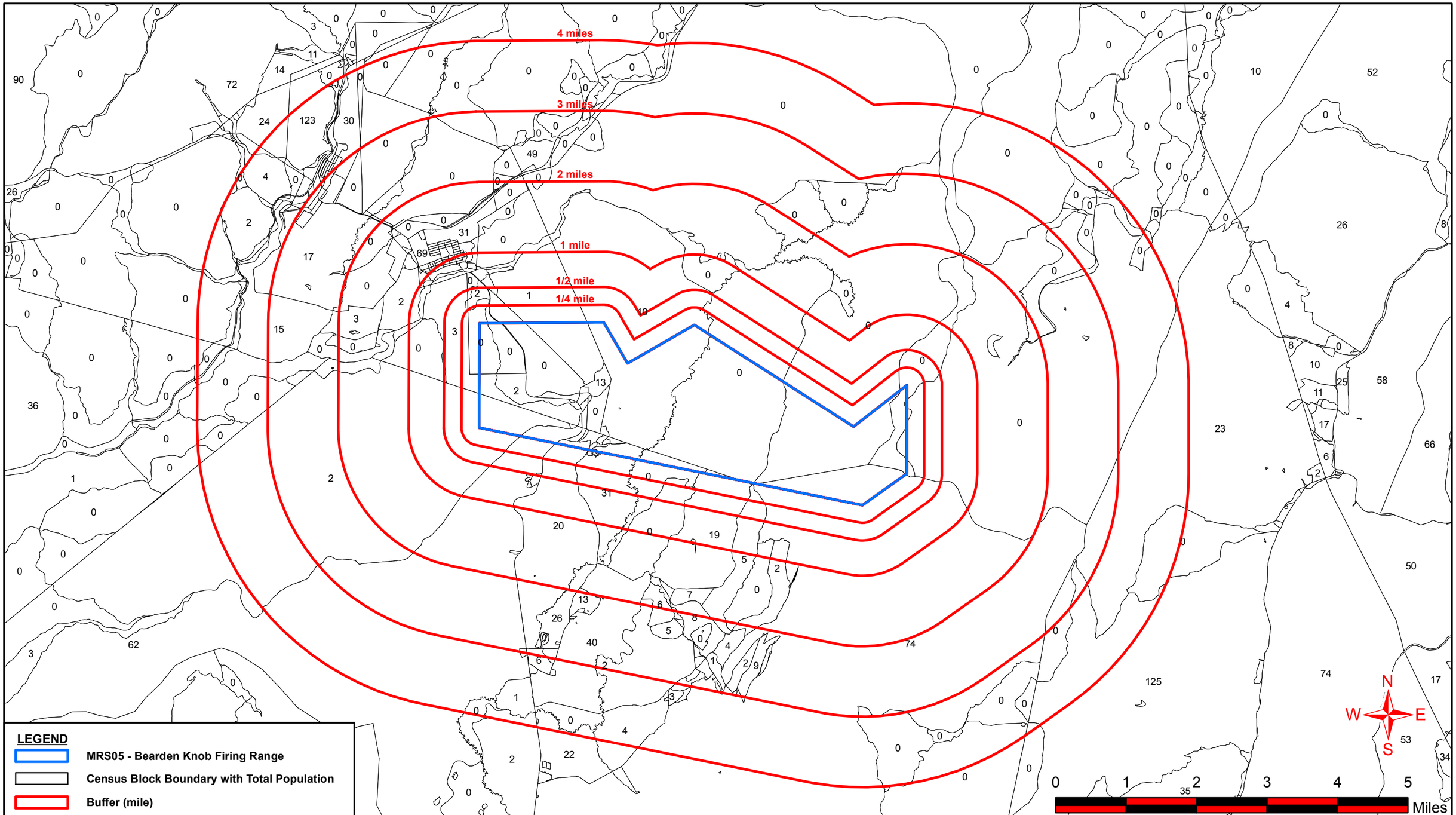
SITE SETTING

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
2.1



Prepared by:

Eco & Associates, Inc.
and
PARSONS

CENSUS DATA

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
2.2

CHAPTER 3
SITE INSPECTION TASKS

3.1 HISTORICAL RECORD REVIEW

A document review of the Bearden Knob Firing Range MRS was conducted in support of this SI. The historic information relevant to the Bearden Knob Firing Range MRS included the INPR and the PA. The findings of the historical review, including site use and potential munitions used, are described in Chapter 2.

3.2 TECHNICAL PROJECT PLANNING

The Bearden Knob Firing Range MRS falls under the purview of the CELRH, which facilitated a TPP meeting on April 7, 2011. Participants included representatives of the CELRH, the CENWW, the WVDEP, the USFS, the USFWS, the CVI, Parsons, and Eco. The TPP Team developed the technical approach presented in the Final TPP Memorandum (Eco 2011a, see Appendix B of this report). Key TPP findings and decisions are summarized below:

- Portions of the MRS are within the CVNWR; therefore, this MRS is considered to be ecologically sensitive. The proposed screening levels to be used for the ecological risk assessment are described as follows.

  Soil: USEPA Ecological Soil Screening Levels (EcoSSLs). In absence of EcoSSLs, values obtained from the Los Alamos National Laboratory (LANL), EcoRisk Database, USEPA Region 3 Ecological Screening Levels (ESLs), and USEPA Region 4 Ecological Screening Values

  Sediment: USEPA Region 3 Ecological Screening Benchmarks, Freshwater Sediment Screening Benchmark, National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables, LANL EcoRisk Database, and USEPA Region 4 Ecological Screening Values

  Surface water: WV Requirements Governing Water Quality Standards (47CSR2) supplemented with USEPA National Recommended Water Quality Criteria, USEPA Region 3 Freshwater Screening Benchmark, LANL EcoRisk Database, and USEPA Region 4 Ecological Screening Values for Fresh Surface Water

- The proposed screening levels to be used for the human health risk assessment are described as follows.

  Soil and Sediment: WV Risk-Based Concentrations used from WVDEP RBCs, Table 60-3B in the Voluntary Remediation and Redevelopment Rule 60CSR3 supplemented with USEPA RSLs

  Surface water: WV Requirements Governing Water Quality Standards (47CSR2) supplemented with USEPA National Recommended Water Quality Criteria and USEPA RSLs for tap water

  Groundwater: WV Requirements Governing Water Quality Standards (47CSR2) then WV RBCs, supplemented with Table 60-3B in the Voluntary Remediation

and Redevelopment Rule (60CSR3), USEPA MCLs, National Primary Drinking Water Standards, and USEPA RSLs for tap water

- It was noted that antitank rounds were not found in this MRS, but were listed in the PA mistakenly. Therefore, antitank rounds were removed from the list of potential munitions for the MRS.
- Because access to the Blackwater River area is very difficult, the TPP Team agreed that field work should be conducted in September/October when the area is relatively dry. The SVT conducted fieldwork in October 2011. One surface water/sediment sample was recollected in May 2012.
- Samples should be taken from the Camp 70 area near the Brown Mountain Firing Range. Samples from the Camp 70 area were collected in September and October 2011 during SI fieldwork conducted for the Brown/Cabin Mountain Firing Ranges MRS.
- Areas of affected soil (circular in shape) can be seen from the air and should be sampled. The circular areas cover approximately 1 acre. The circular areas are located within the wetlands in the center of the valley. Due to hazards associated with wading in the wetlands, these areas were not accessible during the site visit.
- The glade can be accessed from A-Frame Road, a nearby jeep trail. Full waders will be needed due to muddy conditions. This area was accessed during the site visit in October 2011. Although there was abundant water observed in Glade Run at the time of the site investigation, full waders were not deemed necessary to cross Glade Run. As explained in the bulleted item above, no extensive wading was conducted due to safety concerns.
- The TPP Team discussed the soil conditions within the MRS: "Soil conditions are highly variable from the bottom of the valley to the top of the mountain. "O" soil horizons up to 1 foot thick can be encountered in the Red Spruce ecosystem. Huge boulders on top of the mountain will make it difficult to sample. Soil matching between ambient samples and biased samples will need to be done." During the SI visit, no right-of-entry (ROE) could be obtained to collect samples at the top of Cabin Mountain.
- The TPP Team concurred that no known cultural resources exist within MRS. No cultural resources were encountered by the SVT.

3.3 NON-MEASUREMENT DATA COLLECTION

The WVGES and the USGS provided geological and hydrogeological data, including information about wells on and near the MRS. The WVWSC provided well information for West Virginia (WVWSC 2011). The West Virginia Department of Health and Human Resources (WVDHHR) provided information regarding water well permits, wellhead protection areas, and surface water protection zones. Information regarding surface water intakes for drinking water systems in the area, tribal drinking water sources, and public wells in the vicinity of the MRS was provided by the USEPA Region 3.

According to the National Register Information System, National Historic Landmark Program, and National Heritage Area Program websites, no cultural or archaeological resources are known on site. The West Virginia Division of Culture and History (WVDCH) lists no previously recorded archaeological sites within the MRS boundary (WVDCH 2011a). The SVT encountered no cultural resources during the QR.

The following printed and electronic information sources were consulted for the Bearden Knob Firing Range MRS:

- USGS – topographic maps

- USGS – *Ground Water Atlas of the United States*, http://pubs.usgs.gov/ha/ha730/index.html
- USFWS, National Wetlands Inventory – Wetlands Mapper, http://www.fws.gov/wetlands/Data/mapper.html
- USFWS, Endangered Species Program – Threatened and Endangered (T&E) Species System, http://ecos.fws.gov/tess_public/pub/stateListingIndividual.jsp?state=WV&status=listed
- USFWS, National Wildlife Refuge System – Refuge List by State, http://www.fws.gov/refuges/profiles/bystate.cfm
- USFS, http://www.fs.fed.us
- Natural Resources Conservation Service, http://websoilsurvey.nrcs.usda.gov/app/
- National Historic Landmarks Program – Lists of National Historic Landmarks, http://www.nps.gov/nhl/designations/listsofNHLs.htm
- National Heritage Areas Program – Explore Our National Heritage Areas, http://www.nps.gov/history/heritageareas/
- NOAA, http://coastalmanagement.noaa.gov
- National Park Service (NPS), http://www.nps.gov/applications/parksearch/geosearch.cfm
- National Register Information System, http://www.nr.nps.gov/

3.4 SITE-SPECIFIC WORK PLAN

The SS-WP augments the Programmatic Work Plan (PWP) and PSAP, as warranted, to present pertinent site-specific information and procedural adjustments that could not be readily captured in the programmatic documents or that resulted from TPP Team agreements that required modifying the preliminary SI technical approach. The PWP and PSAP are umbrella documents that set overall programmatic objectives and approaches, whereas the SS-WP provides site-specific details and action plans. The PWP, PSAP, and SS-WP accompanied the SVT during SI activities.

The SS-WP includes the project description, the field investigation plan, the sampling and analysis plan, the environmental protection plan, and the accident prevention plan specific to the Bearden Knob Firing Range MRS. The field investigation plan developed a technical approach to guide sample collection and analysis for MEC and metals contamination to ensure that the results were sufficient to determine whether additional investigations or remedies are necessary for the MRS. Key elements of the technical approach include the conceptual site model (CSM) to help determine types of samples and their locations, data quality objectives (DQOs) to ensure that the data acquired are sufficient to characterize MEC and metals contamination at the FUDS, and QR to confirm known target locations and to evaluate the potential presence of MEC or metals contamination in those target locations.

The sampling and analysis plan discusses procedures for soil sample acquisition from locations biased toward the highest potential for MEC contamination; quality control (QC) and quality assurance (QA) for the sampling process; sample shipment to an approved, independent laboratory; and laboratory analysis of the samples. The environmental protection plan presents procedures for avoiding, minimizing, and mitigating potential impacts on environmental and cultural resources during the site visit. The accident prevention plan supplements the programmatic accident prevention plan with site-specific emergency contact information and directions to the nearest hospital.

3.5 DEPARTURES FROM PLANNING DOCUMENTS

The following departures from the approved SS-WP Addendum were based on field conditions and ROE issues. The potential impact to the data quality for each departure from the plan is also discussed below.

- The location of the ambient soil sample (WVMA-MRS05-AMB-SS-02-07) was moved less than ¼-mile east, due to an inability to obtain a ROE. A property owner on a nearby parcel did grant permission to collect a soil sample from their property. The property owner signed a ROE and a sample was collected according to the procedure outlined in the PSAP. No impact to the quality of data is anticipated from this deviation from the SS-WP.
- Sample set WVMA-MRS05-SW-01/SD-01 was moved approximately 1 mile to the south of the planned location, and QR was not conducted due to safety and accessibility concerns associated with the wetlands (see Oct. 5 daily log in Appendix D). No impact to the quality of data is anticipated from this deviation from the SS-WP.
- Upstream sample set WVMA-MRS05-AMB-SW-02/SD-02 was collected before collection of the downstream sample set WVMA-MRS05-SW-01/SD-01 because the SVT was unable to reach the downstream sample location on the planned day due to the wetlands (as discussed in the above bullet). In order to stay on schedule, the samples were collected out of the previously planned order. Since the downstream sample was collected on the next day, no impact on the data quality is anticipated.
- The SVT did not walk those portions of the QR that fell on major roads, but instead drove those areas and did not record the QR with the Geographic Positioning System (GPS). No impact on data quality is anticipated from this departure.
- Because explosive compounds were detected in the original ambient samples, the ambient surface water/sediment sample set WVMA-MRS05-AMB-SW-04/SD-04 was recollected approximately 0.3 miles upstream from the original samples collected in October 2011. Sample set WVMA-MRS05-AMB-SW-04/SD-04 was collected in May 2012 and will be used as the background for comparison to the biased samples. Sample set WVMA-MRS05-AMB-SW-02/SD-02 will not be used as a background sample and will now be considered a biased sample.
- The boundary of the original 8,000-acre MRS05 overlaps with the boundary of the adjacent 16,000-acre Brown/Cabin Mountain Firing Range MRS [MRS06]). In order to accurately count the area of each MRS, the overlapping portion of the ranges must be attributed to only one MRS. Based on the SI findings and historical data, it was determined that the overlapping portion (approximately 1,863 acres) is associated with MRS06. Due to this boundary revision, surface soil sample (WVMA-MRS05-SS-02-06) will be removed from the evaluation of MRS05 and will be included with MRS06. In addition, several observation points (1, 15, 16, 17, 18 and 19) have been included in the evaluation of MRS06 only.

CHAPTER 4
MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS

4.1 GENERAL INFORMATION

4.1.1 QUALITATIVE RECONNAISSANCE AND SAMPLE LOCATIONS

The primary task of the SI is to assess the presence of MEC, MD, and elevated levels of metals. To assess the presence of MEC, the SVT conducted QR by walking 17.5 miles between October 1 and 11, 2011 and an additional 2 miles on May 17, 2012.

The QR consisted of visual reconnaissance of the site surface to identify indicators of suspect areas, including earthen berms, distressed vegetation, stained soil, ground scars or craters, target remnants, and visible metallic debris. QR activities focused on the historic firing and target locations, as well as the reported moving target range at the MRS, which were judged the most likely locations for MEC or metals contamination. Table 4.1 presents the MEC (including potential chemical constituents) potentially present at the site based on the PA and the QR. Appendix J includes the MEC CSM.

The TPP Team agreed to the location and the number of samples prior to the site visit. The SVT moved the location of ambient surface soil sample WVMA-MRS05-SS-02-07 to an area where an ROE could be obtained. The SVT also collected one additional ambient surface water/sediment sample couple (WVMA-MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03) because explosive compounds were detected in the original ambient surface water sample (WVMA-MRS05-AMB-SW-02). The UXO Technician III used a Schonstedt GA-92XT*i* or GA-52Cx magnetometer to screen each location before sampling. Per the PWP, the UXO Technician III performed QC and battery checks prior to use to confirm that the instrument was working properly.

The SVT recorded field observations during the QR at locations where they saw significant site features. Figure 4.1 shows the QR route and observation locations. The observation location numbers correspond to the photo station numbers in the photograph documentation log (Appendix E). The QR route generally followed the proposed paths. However, some portions of the QR could not be conducted due to site conditions and weather during the site visit.

As shown in Appendix E, the SVT noted 35 observations throughout the SI, such as topography, soil color, drainage, and the presence of any barriers. Based on the MRS boundary revisions, six of these observations points will be included within the Brown/Cabin Mountain Firing Range MRS. Table 4.2 summarizes pertinent field observations. Appendix D includes related field forms.

TABLE 4.1:
Chemical Composition of Potential MEC and Potential Munitions Constituents
Bearden Knob Firing Range MRS

Munitions Type / Model	Composition (Case and Filler) [2]	MC Analysis [1]
Projectile, 155mm, HE, M102	**Propellant:** Dibutylphthalate, Dinitrotoluene (DNT), Diphenylamine, Nitrocellulose[5] **Flash Reducer/Ignition Charge:** Potassium Nitrate, Potassium Sulfate, Sodium Nitrate, Sulfur **Primer [7]:** Aluminum, Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Lead Dioxide, Lead Styphnate, Nitrocellulose, PETN, Tetrazene, Zinc, Zirconium **Projectile/Rotating Band:** Steel/Copper Alloy - Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** TNT or Amatol - Ammonium Nitrate, TNT **Fuze, Projectile, PD, M46:** Steel/Brass - Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Carbon, Copper, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Tetryl, Zinc **Fuze Primer [7]:** Antimony Sulfide, Silicon Carbide, Copper, Iron, Lead, Lead Azide, Potassium Chlorate, Sulfur, Zinc **Fuze, Projectile, PD, M47:** Steel - Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Carbon, Copper, Lead Azide, Potassium Nitrate, Sodium Nitrate, Tetryl, Zinc **Fuze Primer [7]:** Antimony Sulfide, Silicon Carbide, Copper, Iron, Lead, Lead Azide, Potassium Chlorate, Sulfur, Zinc **Fuze, Projectile, PD, M51:** Steel - Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl **Fuze Primer [7]:** Antimony Sulfide, Silicon Carbide, Copper, Lead Azide, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Projectile, Time Super Quick, M54:** Aluminum Alloy, Copper Alloy – Aluminum, Bizmuth, Copper, Iron, Lead, Silicon, Sulfur, Zinc **Fuze Filler:** Tetryl **Fuze Primer [7]:** Barium Nitrate, Copper, Lead Azide, Lead Styphnate, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur, Tetrazene **Fuze, Projectile, Mechanical Time (MT), M67:** Aluminum Alloy, Copper Alloy – Aluminum, Bizmuth, Copper, Iron, Lead, Silicon, Sulfur, Zinc **Fuze Filler:** Lead Azide, Tetryl **Fuze Primer [7]:** Barium Nitrate, Copper, Lead Azide, Lead Styphnate, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur, Tetrazene	**Metals** Aluminum, Copper, Lead, Zinc **Explosives** A full explosives panel will be analyzed for from media collected at the MRS.

TABLE 4.1:
Chemical Composition of Potential MEC and Potential Munitions Constituents
Bearden Knob Firing Range MRS

Munitions Type / Model	Composition (Case and Filler) (2)	MC Analysis (1)
Cartridge, 105mm, HE, M1	**Cartridge Case:** Copper Alloy - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene(6), Diphenylamine, Lead Carbonate, Nitrocellulose(5) **Primer (7):** Antimony sulfide, Carbon, Lead Thiocyanate, Potassium Chlorate, TNT **Projectile/Rotating Band:** Steel, Copper Alloy - Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur. Zinc **Projectile Filler:** Amatol or Composition B or TNT - Ammonium Nitrate, Cyclotrimethylenetrinitramine (RDX), TNT **Fuze, Projectile, PD, M51:** Steel - Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl **Fuze Primer (7):** Antimony Sulfide, Silicon Carbide, Copper, Lead Azide, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur	**Metals** Copper, Zinc **Explosives** A full explosives panel will be analyzed for from media collected at the MRS.
Small arms ammunition, general: Cartridge, .50 caliber, Machine Gun	**Cartridge case:** Brass – Copper, Zinc **Propellant:** Calcium Carbonate, Dibutylphthalate, Diphenylamine, Dinitrotoluene(6), Nitrocellulose(5), Nitroglycerin, Potassium Nitrate, Potassium Sulfate, Sodium Sulfate **Primer (7):** Aluminum Powder, Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Iron, Lead, Lead Styphnate, Lead Thiocyanate, Potassium Chlorate, Pentaerythritol Tetranitrate (PETN), Tetrazene, Zinc **Projectile**: Antimony, Carbon, Copper, Iron, Lead, Manganese, Molybdenum, Sodium Carbonate Monohydrate, Silicon, Sulfur, Zinc **Tracer (8):** Barium Peroxide, Calcium Resinate, Magnesium Powder, Polyvinyl Chloride, Potassium Perchlorate, Strontium Nitrate, Strontium Oxalate, Strontium Peroxide, Zinc Stearate	**Metals** Antimony, Copper, Lead **Explosives** A full explosives panel will be analyzed for from media collected at the MRS.
Small arms ammunition, general: Cartridge, .30 caliber (includes carbine)	**Cartridge case:** Copper Alloy – Copper, Iron, Lead, Zinc **Propellant:** Calcium Carbonate, Copper, Dibutylphthalate, Diphenylamine, Dinitrotoluene(6), Ethyl Centralite, Lead, Iron, Nitrocellulose(5), Nitroglycerin, Potassium Nitrate, Sodium Sulfate, Zinc **Primer (7):** Aluminum Powder, Antimony Sulfide, Barium Nitrate, Copper, Iron, Lead, Lead Styphnate, PETN, Tetrazene, Zinc **Projectile**: Antimony, Carbon, Copper, Iron, Lead, Manganese, Silicon, Sulfur, Zinc **Tracer (8):** Barium Peroxide, Calcium Resinate, Magnesium Powder, Polyvinyl Chloride, Strontium Nitrate, Strontium Oxalate, Strontium Peroxide, Zinc Stearate	**Metals (3)** Antimony, Copper, Lead **Explosives (4)** A full explosives panel will be analyzed for from media collected at the MRS.

TABLE 4.1:
Chemical Composition of Potential MEC and Potential Munitions Constituents
Bearden Knob Firing Range MRS

Munitions Type / Model	Composition (Case and Filler) (2)	MC Analysis (1)

(1) MC selected for analysis are typically non-essential nutrient metals and indicative of known or suspected DOD munitions used at this MRS.

(2) MC not selected for analysis are essential nutrient metals, Semi-Volatile Organic Compounds (SVOCs) or materials that represent a very small percentage of the munitions weight.

(3) Lead, antimony, and copper have been selected as programmatic SI "indicator" heavy metals and reflect general former small arms range evaluation strategy and parallels the screening level decision-making objectives of SI. This 3-metals list was developed based on an extensive review of historical SAR studies, fate and transport mechanisms (specifically as they relate to shallow surface soil sampling), compositional prevalence, toxicity, environmental persistence and reactivity, and representativeness. This baseline list may be augmented, as appropriate, following TPP based on justifications of unique site specific considerations such as soils, geology, vegetation, topography, hydrology, land use, or ammunition type.

(4) A full Explosives panel will be analyzed for from media collected at known firing points of small arms ranges and ambient samples. As a conservative measure, all explosives will be included when analyzing for explosive MC.

(5) Nitrocellulose is not considered toxic, has no risk-based screening values and there are no chemical analysis techniques that quantify nitrocellulose separately from the natural common essential nutrient nitrate. Based on this, nitrocellulose analysis will not be conducted during this SI.

(6) Dinitrotoluene products include: 2,4-and 2,6-dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-and 3-nitrotoluene; 4-Amino-2,6-dinitrotoluene; 4-nitrotoluene.

(7) Primer materials represent a very small percentage of the munition's weight. Therefore, analysis of primer constituents will not be conducted. However, if a primer constituent is associated with a larger component of the munition, then analysis of that constituent may be conducted.

(8) Tracer element materials represent a very small percentage of the munitions weight and is consumed while the projectile travels to the target, therefore, tracer element constituents will not be analyzed for at this MRS (if a tracer element constituent is associated with a larger component of the munition it may be analyzed for).

Source: Munitions information was supplied by the 2009 INPR, Munitions Items Disposition Action System (MIDAS) database, and USACE Range Operations Reports RO-01.

TABLE 4.2
SUMMARY OF QUALITATIVE RECONNAISSANCE OBSERVATIONS
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MRS	MEC	MD	OTHER OBSERVATIONS
Bearden Knob Firing Range	None observed	None observed	Three large clearings with multiple subsurface anomalies found on the west side of Middle Ridge, along the Middle Ridge Trail. A third large clearing with subsurface anomalies and an oil and gas well found on the west side of Middle Ridge. Subsurface anomaly found on Cabin Mountain.

4.1.2 DATA QUALITY OBJECTIVES

4.1.2.1 Introduction

DQOs are qualitative and quantitative statements that clarify study objectives and specify the type and quality of the data necessary to support decisions. The development of DQOs for a specific site takes into account factors that determine whether the quality and quantity of data are adequate for project needs, such as data collection, uses, types, and needs. While developing these DQOs in accordance with the process presented in Chapter 3, paragraph 3.1.2 of the PWP, Eco followed the *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA 2006).

The goal of the TPP process is to achieve stakeholder, USACE, and applicable state and federal regulatory concurrence with the DQOs for a given site. Appendix B of this SI Report presents the TPP documentation, including the DQOs discussed at the meeting. The updated DQO worksheets for the MRS are included in this chapter after the appropriate DQO discussions.

As stated in Subchapter 1.2 of this SI Report, data must be sufficient to do the following: 1) determine whether a removal action is necessary; 2) enable HRS scoring by the USEPA; 3) characterize the release for RI/FS initiation; and 4) complete the MRSPP.

DQOs cover four project objectives that SI data must satisfy: 1) evaluate potential presence of MEC; 2) evaluate potential presence of elevated metals concentrations that are consistent with the identified MC contaminants of concern; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring.

4.1.2.2 Munitions and Explosives of Concern Data Quality Objective

The MEC DQO was achieved by evaluating potential presence of MEC within the Bearden Knob Firing Range MRS boundary. The SVT searched for visual evidence of MEC and MD along the QR transects. They identified no MEC and no MD in the Bearden Knob Firing Range MRS. Table 4.3 presents the MEC DQOs.

4.1.2.3 Munitions Constituents Data Quality Objective

The MC DQO was achieved by evaluating the potential presence of metals within the MRS boundary. Table 4.1 summarizes the metals associated with the ordnance potentially used at the Bearden Knob Firing Range MRS. The TPP Team agreed on the list of analytes for sample analysis based on the

munitions potentially used at the site. Chapter 5 presents the metals sampling and analysis results. Appendix G presents the QA and QC reports generated during the data validation process. No concerns regarding data quality were noted. Table 4.4 presents the MC DQOs.

4.1.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective

The MRSPP DQO was achieved by obtaining sufficient information to complete the MRSPP scoring sheets. Specific input data were collected, and the three modules for the MRSPP were populated as part of the SI. Appendix K includes the scoring sheets. Table 4.5 presents the MRSPP DQOs.

4.1.2.5 Hazard Ranking System Data Quality Objective

The HRS DQO was achieved by including information in the SI report necessary for the USEPA to populate the HRS score sheets. Source documents for the HRS information include the INPR, the PA, the metals sampling results reported in Chapter 5 of this SI Report, and information from local and state agencies regarding population, groundwater wells, and drinking water wells. Table 4.6 presents the HRS DQOs.

TABLE 4.3
MEC DATA QUALITY OBJECTIVE WORKSHEET

SITE: **West Virginia Maneuver Area/Dolly Sods FUDS Project No. G03WV0013**
PROJECT: **MMRP Site Inspection/Bearden Knob Firing Range MRS**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? (Y or N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate potential presence of munitions or explosives of concern (MEC)	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, remedy	Y
3	Contaminant or Characteristic of Interest	MEC, MD	Y
4	Media of Interest	N/A	Y
5	Required Locations or Areas	Bearden Knob Firing Range MRS	Y
6	Number of Samples Required	N/A	Y
7	Reference Concentration of Interest or Other Performance Criteria	Visual identification of MEC or MD during QR	Y
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	QR with magnetometer (Schonstedt) for avoidance	Y
9	Analytical Method	N/A	Y

* Refer to EM 200-1-2, Paragraph 4.2.

TABLE 4.4
MC DATA QUALITY OBJECTIVE WORKSHEET

SITE: **West Virginia Maneuver Area/Dolly Sods FUDS Property No. G03WV0013**
PROJECT: **MMRP Site Inspection/Bearden Knob Firing Range MRS**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? (Y or N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate potential release of elevated metals concentrations that are consistent with the identified munitions constituents (MC) contaminants of concern.	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, remedy	Y
3	Contaminant or Characteristic of Interest	See CSM	Y
4	Media of Interest	Surface soil, surface water and sediments	Y
5	Required Sampling Locations or Areas and Depths	Samples were collected as determined by the TPP Team. Soil sample depth is 0-2 inches.	Y
6	Number of Samples Required	6 discretionary biased surface soil samples and 1 ambient surface soil sample. 1 biased sample set of surface water and sediment and 1 ambient sample set. Plus associated QA/QC samples.	Y

TABLE 4.4
MC DATA QUALITY OBJECTIVE WORKSHEET

SITE: **West Virginia Maneuver Area/Dolly Sods FUDS Property No. G03WV0013**
PROJECT: **MMRP Site Inspection/Bearden Knob Firing Range MRS**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? (Y or N)
7	Reference Concentration of Interest or Other Performance Criteria	Human health screening values for soil and sediment are from the USEPA 'protection for groundwater' risk-based screening levels, supplemented with USEPA Region 3 Screening Levels. Human health screening values for surface and ground water are from Requirements Governing Water Quality Standards Rule., supplemented by USEPA Region 3 levels for tap water (or MCLs if no value for tap water was found). Ecological screening values are from USEPA EcoSSLs, supplemented by Los Alamos National Laboratory's EcoRisk Database values and the relevant USEPA Ecological Screening Benchmarks.	Y
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	CRREL Seven-point wheel sampling method in accordance with the SS-WP, PSAP and PSAP Addendum	Y
9	Analytical Method	Explosives: soil samples were dried, sieved, and ground with pestle and mortar according to SW846 8330A and analyzed by HPLC according to SW846-8330B Selected metals: samples were dried and sieved according to SW846-3050B and analyzed by ICP according to SW846-6010B pH: SW846-9045D	Y

* Refer to EM 200-1-2, Paragraph 4.2.1

TABLE 4.5
MRSPP DATA QUALITY OBJECTIVE WORKSHEET

SITE: **West Virginia Maneuver Area/Dolly Sods FUDS Property No. G03WV0013**
PROJECT: **MMRP Site Inspection/Bearden Knob Firing Range MRS**
DQO Statement Number: 3 of 4

Module	Table #	Table Description	Known Data	Current Data Gap	Data Source
Explosive Hazard Evaluation (EHE)	1	Munitions Type	X		Historical records or field findings
	2	Source of Hazard	X		Historical maps
	3	Location of Munitions	X		Historical records or field findings
	4	Ease of Access	X		Field findings
	5	Status of Property	X		Historical records
	6	Population Density	X		U.S. Census Bureau
	7	Population Near Hazard	X		Field findings
	8	Types of Activities/Structures	X		Regional zoning
	9	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	10	Determining the EHE	X		Scores from Tables 1 through 9
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration	X		Historical records or field findings
	12	Sources of CWM	X		Historical records or field findings
	13	Location of CWM	X		Historical records or field findings
	14	Ease of Access	X		Historical records or field findings
	15	Status of Property	X		Historical records
	16	Population Density	X		U.S. Census Bureau
	17	Population Near Hazard	X		Field findings
	18	Types of Activities/Structures	X		Regional zoning
	19	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	20	Determining the CHE	X		Scores from Tables 11 through 19
Health Hazard Evaluation (HHE)	21	Groundwater Data	X		N/A
	22	Surface Water - Human Endpoint	X		Surface water sampling results
	23	Sediment - Human Endpoint	X		Sediment sampling results
	24	Surface Water - Ecological Endpoint	X		Surface water sampling results
	25	Sediment - Ecological Endpoint	X		Sediment sampling results
	26	Surface Soil	X		Surface soil sampling results
	27	Supplemental Contaminant Hazard Factor	X		All MC sampling results
	28	Determining the HHE	X		Scores from Tables 21 through 27
	29	MRS Priority	X		Scores from Tables 10, 20, and 28
	A	MRS Background Information	X		DoD databases

TABLE 4.6
HRS DATA QUALITY OBJECTIVE WORKSHEET

SITE: **West Virginia Maneuver Area/Dolly Sods FUDS Property No. G03WV0013**
PROJECT: **MMRP Site Inspection/Bearden Knob Firing Range MRS**
DQO Statement Number: 4 of 4

Data Description	Known Data	Current Data Gap	Data Source
Source Type	X		Historical records or field findings
Estimated Volume or Area	X		Field findings
Hazardous Substance	X		Constituents of suspected munitions
Groundwater Sample Concentration		X	N/A
Groundwater Use	X		Well records and municipal data
Surface Water Sample Concentration	X		N/A
Surface Water Pathways	X		Field findings
Soil Sample Concentration	X		Sample results
Soil Pathways	X		Field findings
Sensitive Environments	X		State Historic Preservation Office, U.S. Fish and Wildlife Service, various government agencies
Attractiveness/Accessibility	X		Field findings and land use records

4.2 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE

4.2.1 HISTORICAL USE OF MILITARY MUNITIONS

The revised Bearden Knob Firing Range MRS boundary consists of 6,137 acres within a 2,180,367-acre FUDS. Historical records, summarized in the 2009 PA, indicate that the Bearden Knob Firing Range MRS was used from 1943 to 1944 for artillery training and possibly anti-tank training. The PA states that the ordnance most likely used for training were .30 caliber cartridges (includes carbine), .50 caliber machine gun cartridges, 105mm, HE cartridges (M1), and 155mm, HE projectiles (M102) (USACE 2009).

As discussed in Section 2.5.1 above, historical records document a 105mm Howitzer round that was found in April 2007 on the western face of Cabin Mountain (USACE, 2009). Although the PA states that anti-tank rockets have been found in the MRS, these are most likely 3.25-inch rockets that were used as targets for training of anti-aircraft gun crews. It was noted during the initial TPP Meeting that antitank rounds were not found in this MRS, but were listed in the PA mistakenly. Therefore, it is no longer believed that this MRS was used as an anti-tank firing range and all anti-tank munitions have been removed from the list of suspected ordnance. Neither rockets, nor Howitzer rounds are expected to be in use by non-DoD users (hunters).

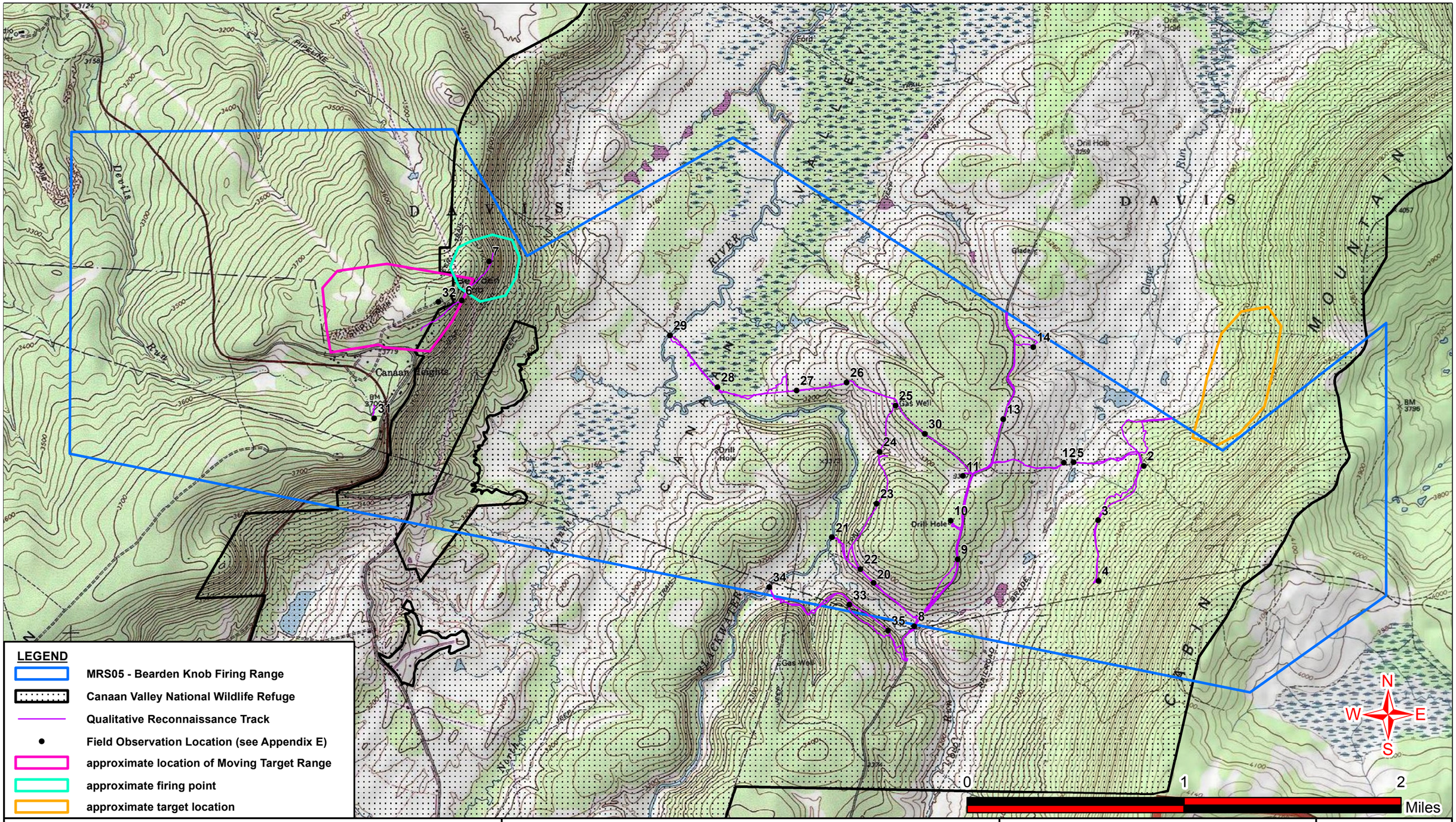
In the months following the site visit for this SI, an 81mm mortar was encountered by a hunter at the end of A Frame Road, in the area near the beaver ponds on the west side. The find was reported to the USFWS. Coordinates of the UXO find were provided as well. Mortars are not expected to be in use by non-DoD users (hunters). As discussed in Section 2.3, these previous findings have been identified within the overlapping area of Bearden Knob and Brown/Cabin Mountain Firing Ranges. Based on the results of the SI and the evidence available from the 2009 PA, these items are most likely associated with MRS06 - Brown/Cabin Mountain Firing Range; therefore, will not be considered in the evaluation for the Bearden Knob Firing Range.

4.2.2 INSPECTION ACTIVITIES

To assess potential MEC and metals contamination within the Bearden Knob Firing Range MRS, the SVT conducted approximately 19.5 miles of QR and collected surface soil, surface water, and sediment samples within the MRS (see Figures 4.1 and 5.2). The SVT collected six biased surface soil samples (WVMA-MRS05-SS-02-01 through WVMA-MRS05-SS-02-06), along with one associated field duplicate sample (WVMA-MRS05-SS-02-08). Samples WVMA-MRS05-SS-02-03 and WVMA-MRS05-SS-02-06 were collected next to detected subsurface anomalies. Surface soil sample (WVMA-MRS05-SS-02-06) was collected within the overlapping area of Bearden Knob and Brown/Cabin Mountain Firing Range and will be used in the evaluation of Brown/Cabin Mountain Firing Range. The remaining biased surface soil samples were collected at or near their proposed locations (see Table 5.2 for description of sample location rationale).

In addition to the surface soil samples, three sets of surface water/sediment samples were collected. One biased sample set (WVMA-MRS05-SW-01/SD01) and one ambient sample set (WVMA-MRS05-AMB-SW-02/SD02) were collected. The biased water/sediment sample set and an associated field duplicate sample were collected from the central portion of the MRS. As noted in Section 3.5 above, this sample set was moved due to accessibility and safety concerns associated with the wetlands. The ambient sample set was collected from an area upstream of any evidence of potential DoD use. However, as described in Section 3.5 above, the ambient sample set for this MRS (WVMA-MRS05-AMB-SW-03/SD03) was recollected approximately 0.3 miles upstream from the original ambient sample because one explosive compound was detected in the original SW sample. Therefore, WVMA-MRS05-AMB-SW-02/SD-02 has been replaced by WVMA-MRS05-AMB-SW-03/SD-03.

The SVT collected 35 observations during the site visit. Based on the MRS boundary revisions, six of these observations points will be included within the Brown/Cabin Mountain Firing Range MRS. No UXO/DMM and no MD was observed during the SI. However, several subsurface anomalies were detected within the MRS (see Appendix E). The SVT also identified several features within the MRS including old fence posts, one abandoned outhouse, and four clearings of note. Two of the clearings had wells, one had the previously mentioned abandoned outhouse, two of them had stockpiled soil and vegetation debris, and all of them contained subsurface anomalies. These clearings were potentially former camp sites used for oil and gas exploration sites, logging camps, and/or military camps. The SVT also encountered several relatively large drainage courses within the MRS including the Blackwater River, Glade Run, and Sand Run. Extensive wetlands and bogs were encountered on the valley floor. In most areas, the wetlands were impassible and the QR track needed to be altered accordingly. The SVT identified abundant inhabited structures (26 or more) within the MRS, and observed many more within two miles of the MRS. The inhabited structures observed within the MRS consisted of residential structures in the community of Canaan Heights. The inhabited structures observed within two miles of the MRS consisted of residential and commercial buildings in and around the town of Davis. The majority of the Bearden Knob Firing Range MRS is owned by the USFWS and is managed as part of the CVNWR. The land is currently used for outdoor recreation and wildlife preservation. The remainder of the former firing range consists of small privately-owned parcels located in the community of Canaan Heights. No archeological or cultural resources were identified during the site visit.



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QUALITATIVE RECONNAISSANCE AND FIELD OBSERVATIONS

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE 4.1

CHAPTER 5
EXPOSURE PATHWAYS AND RECEPTORS

5.1 INTRODUCTION

This chapter evaluates the potential presence of exposure pathways and receptors, based on site-specific conditions. It is necessary to evaluate site-specific conditions and land use to assess risks posed to potential receptors under current and future land use scenarios. Exposure pathways for groundwater, surface water and sediment, soil, and air are evaluated. The conceptual site exposure model (CSEM) for the Bearden Knob Firing Range MRS (Appendix J) summarizes which potential receptor exposure pathways are (or may be) complete and which are (and are likely to remain) incomplete. An exposure pathway for a chemical release is not considered to be complete unless all four of the following factors (in *italics*) are present (USEPA 1989). An example regarding a hypothetical groundwater pathway is included.

1. *A source and mechanism for contaminant release.* For example, a site has known MEC from which MC have leached and contaminated surface soil.
2. *An environmental transport and/or exposure medium.* In the example, MC in soil at the site are mobile and can contaminate groundwater.
3. *A point of exposure at which the contaminant can interact with a receptor.* A well drawing from the contaminated aquifer is located at the site.
4. *A receptor and a likely route of exposure at the exposure point.* A resident uses groundwater from the on-site well as a source of drinking water.

In this hypothetical example, all four factors are present and, therefore, the groundwater exposure pathway is complete. If any single factor was not present (e.g., MC were not present in soil, or the resident obtained drinking water from another source), the pathway would be incomplete.

This chapter presents the information required to evaluate whether exposure pathways at the site are complete. It also addresses those MC that require further consideration in a screening-level risk assessment (SLRA). Chapter 6 assesses the potential significance of complete pathways (i.e., whether there is an unacceptable risk).

5.2 GENERAL INFORMATION

General information regarding the geology, hydrogeology, and hydrology of the WVMA/Dolly Sods FUDS is presented below, followed by a discussion of MRS-specific characteristics and sampling results from the Bearden Knob Firing Range MRS.

5.2.1 REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING

The WVMA/Dolly Sods FUDS is located to the west of the Allegheny Front with approximate centralized coordinates of latitude 39° 07’ 08” N and longitude 79° 27’ 09” W. The Allegheny Front is a complex boundary between two geologic provinces in the Appalachian Highlands. The geology changes abruptly from the folded and faulted surficial strata of the Valley and Ridge province to the east and the gentler faulted strata of the Appalachian Plateaus province to the west. East of the Allegheny Front the strata are found to dip steeply on the limbs of many anticlines, many of which are asymmetrical, with

more steeply dipping to overturned western limbs. West of the Front the strata dip much less steeply, usually less than 30 degrees and surface faulting is rare. This western side of the Front forms a high plateau of essentially horizontal strata and is capped predominantly with resistant sandstones and conglomerates. Spruce Knob, located approximately 15 miles south of the FUDS, is the tallest mountain in the Alleghenies and West Virginia's highest elevation at 4,861 feet (WVGES 2004).

The Bearden Knob Firing Range MRS is situated in the north-central Canaan Valley, which occupies an eroded anticline in the Allegheny Mountain Section of the Appalachian Plateaus physiographic province (USGS 2002). The anticline has a core of Pocono Sandstone and a rim of Greenbrier Limestone, both Mississippian in age. The lower slopes of the surrounding mountains are made up of the Mauch Chunk Formation, consisting of late Mississippian to early Pennsylvanian beds of grayish-red shale, siltstone, sandstone, and conglomerate. The ridges of the Canaan and Cabin Mountain are composed of sandstone, shale, and coal of the Pottsville Group of early Pennsylvanian age. These geologic formations have been extensively fractured by tectonic stress and isostatic rebound from stress relief caused by erosion of the core of the anticline (Kozar 1996).

The Bearden Knob Firing Range MRS overlies a system of Pennsylvanian sandstone aquifers and Mississippian sandstone and carbonate aquifers. The Pocono Sandstone and the Greenbrier Limestone are the principal water-bearing geologic formations within the MRS. Yields of wells completed in sandstone of the Pocono Group range from 5 to 120 gallons per minute, but water in the deeper parts of the Pocono is highly mineralized. Yields from the Greenbrier Limestone range from 5 to 100 gallons per minute in wells, but some springs that issue from the Greenbrier discharge 1,000 gallons per minute or more. The sandstones of the Pottsville and Mauch Chunk Group yield little water (USG 2012). Ground water recharge in Canaan Valley originates from precipitation (rain and snow) in the mountains and in the valley. Recharge is expected to be higher for the carbonate Greenbriar Group than for the noncarbonated Pottsville, Mauch Chunk, and Pocono Groups due to enlarged fractures caused by dissolution (Kozar 1996).

5.2.2 REGIONAL GROUNDWATER USE

The northern half of the Canaan Valley contains large tracts of undeveloped wetlands, and the southern half is devoted largely to recreation and tourism. The area is also a popular site for vacation and retirement homes. Most of the water used in the Canaan Valley is withdrawn from the Blackwater River and its tributaries. Only about 10 percent of the water used is supplied from groundwater sources. Commercial facilities serving skiers, hikers, campers, and other recreationalists withdraw 94 percent of all water used. Approximately 6 percent is being withdrawn by residents of the valley for domestic use (Kozar 1996).

The USEPA indicated that eight surface water intakes are within 15 miles of the MRS, and that there are no tribal drinking water sources within 4 miles of the MRS (EPA 2012). Twenty-three wellhead protection areas and/or Zones of Critical Concern, as defined by the WVDHHR are located within 4 miles of the MRS (WVDHHR 2012).

The Bearden Knob Firing Range MRS overlaps a system of sandstone and carbonate aquifers (USGS 2012). There are 69 water wells within a 4-mile buffer of the MRS boundary including 11 on-site wells within the MRS boundaries (Figure 5.1). Based on the well report, the groundwater depths ranged from 7.65 feet to 176.45 feet below ground surface (bgs) within the 4-mile buffer zone (Environmental Data Resources, Inc. [EDR] 2012).

The SVT observed abundant (26 or more) inhabited structures within the Bearden Knob Firing Range MRS. The structures are concentrated in the southwest portion of the MRS, in a community called Canaan Heights, and consist mainly of residential structures. It is likely that some of these structures receive potable water from public or domestic wells in that area.

5.2.3 REGIONAL HYDROLOGIC SETTING

Because of the size of the WVMA/Dolly Sods FUDS, it spans five watersheds within the larger Monongahela and Potomac groundwater basins: the Tygart Valley watershed, the Cheat watershed, the Youghiogheny watershed, the North Branch Potomac watershed, and the South Branch Potomac watershed (Watershed Atlas [WSA] 2011).

The Bearden Knob Firing Range MRS lies within the Canaan Valley and encompasses portions of the Blackwater River, Sand Run, and Glade Run. The valley is drained by the Blackwater River and its tributaries, and is part of the Cheat River drainage system. Wetlands are present along some reaches of the streams and in scattered areas throughout the valley (Kozar 1996).

The SVT encountered surface water within the Blackwater River, Sand Run, and Glade Run while conducting the SI field activities. The team also observed abundant surface water in the wetlands of the Canaan Valley between Middle Ridge and the Blackwater River. The north branch of the Blackwater River traverses the central portions of the MRS and flows from south to north. Sand Run traverses the south-central MRS boundary until it joins with the Blackwater River to the west. Glade Run traverses the eastern portions of the MRS and flows from south to north along the Cabin Mountain.

5.2.4 REGIONAL SENSITIVE ENVIRONMENTAL RESOURCES

According to the USFWS T&E Species System database, the State of West Virginia supports 17 federally listed T&E species consisting of 11 animals and 6 plants (USFWS 2011b). The USFWS Elkins, WV Office indicates that there are 17 T&E species occurring in the Allegheny Mountains including: running buffalo clover (*Trifolium stoloniferum*), shale barren rock cress (*Arabis serotina*), small whorled pogonia (*Isotria medeoloides*), northeastern bulrush (*Scirpus ancistrochaetus*), Harperella (*Ptilimnium nodosum*), Virginia Spiraea (Spiraea virginiana), Virginia big-eared bat (Corynorhinus townsendii virginianus), Indiana bat (*Myotis sodalis*), Gray bat (*Myotis grisescens*), Clubshell (*Pleurobema clava*), Fanshell (*Cyprogenia stegaria*), Pink mucket (*Lampsilis abrupt*), Northern riffleshell (*Epioblasma torulosa rangiana*), Cheat Mountain salamander (*Plethodon netting*), flat-spired three-toothed snail (*Triodopsis platysayoides*), James spinymussel (*Pleurobema collina*), and West Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*). Federally listed threatened species include the bald eagle (*Haliaeetus leucocephalus*) and the Cheat Mountain salamander (*Plethodon nettingi*). Globally rare and imperiled species include an isopod (*Caecidotea sinuncus*), tall larkspur (*Delphinium exaltatum*), eastern small-footed bat (*Myotis lebii*), Allegheny woodrat (*Neotoma magister*), Timber Ridge cave beetle (*Pseudanophthlmus hadenoecus*), and the South Branch Valley cave millipede (*Pseudotremia princeps*). Two other endangered species, the gray wolf (*Canis lupus*) and the eastern cougar (*Puma concolor couguar*), are believed to have been extirpated from the region during the late 1800's or early 1900's (USDA 2006). In addition to the species identified above, the West Virginia Wildlife Diversity Program lists 477 endangered, threatened, or rare plant species and 536 rare, threatened, or endangered animal species occurring in West Virginia (West Virginia Division of Natural Resources [WVDNR] 2012).

The Bearden Knob Firing Range MRS consists of land within the Canaan Valley National Wildlife Refuge, and private land with residences. There are no federally designated critical habitats located within the MRS (USFWS 2011). The MRS is not within a national park, national forest, state, or county park (USFWS 2011d, NPS 2011a, USFS 2011). Because there are no known caves or karst areas within the MRS, the species of bats and cave inhabiting animals listed above are not likely to be encountered on the site. However, portions of the site are considered suitable habitat for the West Virginia northern flying squirrel and the Cheat Mountain salamander. The Flat-spired three-toothed snail is found only in the Cheat River gorge located approximately 29 miles northwest of the site and is not anticipated to be encountered. The remaining animal species listed are found in larger river systems and are not anticipated to inhabit the area of the Bearden Knob Firing Range MRS.

The USFWS Wetlands Mapper, through the National Wetlands Inventory, was used to identify wetlands within the Bearden Knob Firing Range MRS (USFWS 2011c). Wetlands are land areas that are transitional between terrestrial and deep-water habitats in which the water table usually is at or near the surface or in which the land is covered by shallow water. Several wetlands were identified within the MRS, including freshwater pond, forest/shrub, and freshwater emergent types. During the SI field activities, the SVT observed surface water in streams and wetlands within the MRS.

Based on the above information and a review of the Army Checklist for Important Ecological Places (Department of the Army 2005b), the Bearden Knob Firing Range MRS is classified as an important ecological place because it contains wetlands, and it is within the CVNWR. The determinations regarding important ecological places pertain to whether ecological receptors are present at the site. If a site is determined to be an important ecological place, ecological receptors are present and a Screening Level Ecological Risk Assessment (SLERA) will be conducted if there is an observed release of potential metals contamination. The SVT observed no T&E species during the site visit. Sensitive environments were not impacted by the SI effort and all QR and SI field efforts were performed to minimize any intrusion in sensitive areas.

5.2.5 SAMPLING LOCATIONS AND ANALYTICAL METHODS

Direct release of metals from munitions activities at the Bearden Knob Firing Range MRS would have been to soil, surface water, and sediment, with potential migration to groundwater or air (through re-suspended soil particulates). The TPP Team agreed that surface soil samples would be collected from the MRS using the CRREL "seven-point wheel" composite sampling technique. The TPP Team also agreed that surface water and sediment samples would be collected from the Blackwater River within the MRS. Groundwater sampling would be conducted if drinking water wells were located within the MRS; however, with no confirmed release or a contamination source present, requests for ROE were not made by USACE for the properties containing drinking water wells (Figure 5.1). No air samples were collected as part of this SI, in accordance with TPP Team decisions.

On October 1, 3, 4, 5, 6, and 11, 2011, the SVT conducted QR and surface soil, surface water, and sediment sampling at the Bearden Knob Firing Range MRS. The team collected six biased surface soil samples (WVMA-MRS05-SS-02-01 through WVMA-MRS05-SS-02-06), along with one associated field duplicate sample (WVMA-MRS05-SS-02-08), from within the MRS. Surface soil sample (WVMA-MRS05-SS-02-06) was collected within the overlapping area of Bearden Knob and Brown/Cabin Mountain Firing Range and will be used in the evaluation of Brown/Cabin Mountain Firing Range. The team also collected one biased surface water/sediment coupled sample (WVMA-MRS05-SW-01 and WVMA-MRS05-SD-01), along with one associated field duplicate coupled sample (WVMA-MRS05-SW-03 and WVMA-MRS05-SD-03), from the Blackwater River, within the MRS. These sample locations were identified by the TPP Team prior to conducting the site visit, and were selected to represent areas with the highest likelihood of the presence of MEC or metals contamination (Eco 2011a). Although no MEC, MD, or evidence of metals contamination was observed during the site visit, the SVT did detect subsurface metal anomalies at two locations. Samples WVMA-MRS05-SS-02-03 and WVMA-MRS05-SS-02-06 were moved slightly from the proposed locations to be collected adjacent to these anomalies. Other samples were moved slightly from the proposed locations due to the lack of surface soil or due to access conditions.

One ambient surface soil sample (WVMA-MRS05-AMB-SS-02-07) and one set of ambient surface water/sediment coupled samples (WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02) were collected from areas within the MRS boundary not anticipated to be impacted by DoD activities. No MEC, MD, or evidence of metals contamination was observed during the site visit. However, one explosive compound was detected in the ambient surface water sample during laboratory analysis. Therefore, the SVT collected one additional set of ambient surface water/sediment samples on May 17, 2012, from a location outside of the MRS and further upstream in the Blackwater River (WVMA-

MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03). This resampled ambient sample was used for comparison to biased samples. The original ambient sample was treated as a biased sample and went through the risk evaluation process. Agriculture & Priority Pollutants Laboratories, Inc. (APPL, Inc.) in Clovis, CA analyzed all of the surface water and sediment samples for explosives (Method SW846-8330B), and selected metals (Method SW846-6010B). The soil samples were analyzed for explosives (Method SW846-8330B), selected metals (Method SW846-6010B), and pH (Method SW846-9045D). Selected metals for which sampling was conducted were aluminum, antimony, copper, lead, and zinc.

The UXO Technician III used a Schonstedt GA-92XTi or GA-52Cx magnetometer to screen and approve each potential soil sample location prior to final location selection and sample collection. Per the Final PWP (Parson 2010), the UXO Technician III checked the magnetometer against a known piece of metal and performed battery checks each day to confirm that it was working properly. The surface soil sample collection procedures presented in the Final PWP (Parsons 2010), the Final PSAP (USACE 2005), and the Final PSAP Addendum (Parsons 2006) were followed. The CRREL seven-point wheel composite sampling technique was employed for collecting the soil samples. A 4-foot diameter template was used during sample collection. This method resulted in equidistant spacing of the six locations in a circular pattern, with all six outer locations placed at a distance of two feet from the center location (for a total 4-foot diameter of the sample "wheel"). Therefore, the configuration called for by the CRREL seven-point wheel composite sampling technique was met. The actual GPS coordinates for the center point of each surface soil sample location were recorded and updated in the Geographical Information System (GIS) database (Appendix H).

Surface water samples were collected by submerging the sample containers at each location. The surface water field parameters were gathered prior to sample collection with a Horiba U-22 water quality meter. The following parameters were measured in each water sample:

- Conductivity
- pH
- Temperature
- Turbidity

Sediment grab samples were collected in the same locations as coupled surface water samples using disposable trowels. For each coupled surface water/sediment sample pair, the surface water sample was collected first, followed by the sediment sample, to avoid cross-contamination.

5.2.6 DATA QUALITY ASSESSMENT

The samples were shipped to APPL, Inc. for analysis. APPL. Inc. is certified under the DoD Environmental Laboratories Accreditation Program (ELAP) and the National Environmental Laboratory Accreditation Conference (NELAC). The laboratory submitted the soil, surface water, and sediment chemical data to Eco under Sample Delivery Groups 65891, 65910, 65935, 65942, 65971, and 67821. The data are presented in Appendix F. Parsons validated and assessed the data in accordance with the guidelines outlined in the PSAP (consisting of the field sampling plan and the quality assurance project plan) for the MMRP SI Program (USACE 2005a) and the PSAP Addendum (Parsons 2006). The data validation indicates that the laboratory correctly performed the analyses and that no data were rejected. Appendix G presents the data validation summary reports.

As stated in Section 4.7 of the SS-WP (Eco 2011b), any U-flagged value is treated as "not detected", and is assumed to not be present in the sample. In some cases, the PQL is greater than the screening value. This is common in some analyses due to sample preparation and analytical limitations. This could lead to a situation where the analyte is present at a concentration greater than the screening value, but is reported as "not detected or estimated" leading to an underestimate of risk. However, such occasions are expected

to be rare and are not likely to drive the recommendation for the SI. For this SI, PQLs for six analytes are greater than the selected screening values:

- 1,3-Dinitrobenzene (surface soil): PQL = 0.40 mg/kg; screening value (ecological) = 0.073 mg/kg;
- 2,4-Dinitrotoluene (surface water): PQL = 0.30 µg/L; screening value (human health) = 0.11 µg/L;
- 2-Nitrotoluene (surface water): PQL = 0.30 µg/L; screening value (human health) = 0.27 µg/L;
- 2,4,6-Trinitrotoluene (TNT) (sediment): PQL = 0.30 mg/kg; screening value (ecological) = 0.092 mg/kg;
- 2,4-Dinitrotoluene (sediment): PQL = 0.070 mg/kg; screening value (ecological) = 0.040 mg/kg; and,
- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) (sediment): PQL = 0.50 mg/kg; screening value (ecological) = 0.013 mg/kg.

However, only one trace level explosive was detected in surface water. While this detection was determined not to be associated with DoD-use based on the lack of a munitions source, as a conservative measure, it was run through the risk evaluation. It did not exceed the human health or ecological screening values. No other explosive compounds were detected in the surface soil, surface water, or sediment at MRS05; therefore, it is unlikely these explosive compounds are present at the site.

5.2.7 BACKGROUND/AMBIENT CONCENTRATIONS

Due to the variability of naturally occurring metals in the area and to supplement the single ambient sample (per media) collected during the SI, the TPP Team agreed to the following evaluation criteria:

Soil: To supplement the limited ambient surface soil data collected during the SI, the background values used for comparison include background concentrations obtained from the West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual Version 2.1, Table 2-3: Natural Background Levels of Inorganics in Soil in West Virginia and Surrounding Areas:

(http://www.dep.wv.gov/dlr/oer/voluntarymain/documents/vrra%20guidanceversion2-1.pdf). The applicable data are based on larger sample sizes ($n \geq 10$) leading to a more robust comparison.

The background value used for comparison to the biased surface soil sample results is three times the mean background concentration obtained from West Virginia guidance, per United States Environmental Protection Agency (USEPA) guidance (USEPA, 1992).

Sediment: For sediment, two sources of information were used to determine sediment background metals values at MRS05:

- Three times the average concentrations of elements in Tucker County, West Virginia, identified by the United States Geological Survey (USGS), described in the paragraph below, (USGS, 2012); and
- Analytical results of one ambient sediment sample collected during the 2012 SI field activities in an area not expected to be affected by munitions activities, used in the absence of a Tucker County average concentration. The background value is three times the ambient sample analytical result.

The nationwide Mineral Resources Data System (MRDS) database of concentrations of elements provides county-specific background values for selected metals. The MRDS includes mineral resource occurrence data covering the world, most thoroughly within the United States. This database contains the records previously provided in the MRDS of USGS and the Mineral Availability System/Mineral Industry

Locator System originated by the United States Bureau of Mines, which is now part of the USGS. According to the USGS, the MRDS is a large and complex relational database developed over several decades by hundreds of researchers and reporters (USGS, 2012). This dataset is considered to likely be more representative of conditions within Tucker County; however, the available data are limited to a select group of metals. Data for antimony are not available in this dataset.

Surface Water: For surface water, additional metals background data were not available. Therefore, per USEPA guidance (USEPA, 1992) the surface water background value is established as three times the concentration detected in the ambient surface water sample.

TABLE 5.2:
SAMPLING RATIONALE
Bearden Knob Firing Range MRS

Sample ID	Sample Coordinates (Decimal Degree)		Medium	Analysis[1]	Potential Munitions	Sample Location Rationale
	Longitude	Latitude				
WVMA-MRS05-SS-02-01	-79.426186	39.105111	Soil	Explosives, Selected metals, pH	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample was moved from the proposed location to a Forest Service parcel located at the top of Bearden Knob , in the previous location of a fire tower due to an inability to obtain an ROE for the proposed location. Will assist in supporting an appropriate MRS recommendation.
WVMA-MRS05-SS-02-02	-79.421724	39.10761	Soil	Explosives, Selected metals, pH	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample location was moved to a location approximatly 20 meters north (upslope) of a 4WD road in an area used by the 628th Tank Destroyer Battallion. Will assist in supporting an appropriate MRS recommendation.
WVMA-MRS05-SS-02-03	-79.381479	39.092876	Soil	Explosives, Selected metals, pH	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample location was moved slightly to avoid small boulders and was collected near the proposed location near a farm that local residents said was used by the military nex to subsurface magnetic anomalies. Will assist in supporting an appropriate MRS recommendation.

TABLE 5.2:
SAMPLING RATIONALE
Bearden Knob Firing Range MRS

Sample ID	Sample Coordinates (Decimal Degree)		Medium	Analysis[1]	Potential Munitions	Sample Location Rationale
	Longitude	Latitude				
WVMA-MRS05-SS-02-04	-79.370001	39.085696	Soil	Explosives, Selected metals, pH	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample location was moved slightly to avoid boulders but was collected in the general area of the target area mapped by the Army during operations. Will assist in development of an appropriate MRS recommendation.
WVMA-MRS05-SS-02-05	-79.36594	39.093335	Soil	Explosives, Selected metals, pH	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample location was moved slightly to avoid a buried fenceline but was collected in the general area of the target area mapped by the Army during operations. Will assist in development of an appropriate MRS recommendation.
WVMA-MRS05-AMB-SS-02-07	-79.431873	39.097394	Soil	Explosives, Selected metals, pH	None	Sample location was moved less than 0.25 miles southeast to an area where an ROE could be obtained. Analytical results serves as ambient data for comparison to biased sample(s)

TABLE 5.2:
SAMPLING RATIONALE
Bearden Knob Firing Range MRS

Sample ID	Sample Coordinates (Decimal Degree)		Medium	Analysis[1]	Potential Munitions	Sample Location Rationale
	Longitude	Latitude				
WVMA-MRS05-SW-01	-79.406386	39.102617	Surface Water	Explosives, Selected metals	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample was moved from proposed location due to hazards associated with crossing the wetlands to reach the proposed location. Sample was collected from new location near the center of the MRS. Will assist in supporting an appropriate MRS recommendation.
WVMA-MRS05-AMB-SW-02	-79.392785	39.088923	Surface Water	Explosives, Selected metals	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample was collected from proposed location in October, 2011. However, sample data could not be used for background comparison due to explosive compounds detected in the surface water sample at this location. A new ambient sample was collected in May, 2012 and this sample will now be considered a biased sample used to support an appropriate MRS recommendation.

TABLE 5.2:
SAMPLING RATIONALE
Bearden Knob Firing Range MRS

Sample ID	Sample Coordinates (Decimal Degree)		Medium	Analysis[1]	Potential Munitions	Sample Location Rationale
	Longitude	Latitude				
WVMA-MRS05-SD-01	-79.406386	39.102617	Sediment	Explosives, Selected metals	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample was moved from proposed location due to hazards associated with crossing the wetlands to reach the proposed location. Sample was collected from new location near the center of the MRS. Will assist in supporting an appropriate MRS recommendation.
WVMA-MRS05-AMB-SD-02	-79.392785	39.088923	Sediment	Explosives, Selected metals	Small arms, general: Cartridges: .30 cal (includes carbine), .50 cal, machine gun Cartridge: 81mm, high explosive (HE), M43; 81mm, smoke, White Phosphorus (WP), M57; 81mm, target practice (TP), M43; 105mm, high explosive (HE), M1; Projectile: 155mm, HE, M102	Sample was collected from proposed location in October, 2011. However, sample data could not be used for background comparison due to explosive compounds detected in the surface water sample at this location. A new ambient sample was collected in May, 2012 and this sample will now be considered a biased sample used to support an appropriate MRS recommendation.

TABLE 5.2:
SAMPLING RATIONALE
Bearden Knob Firing Range MRS

Sample ID	Sample Coordinates (Decimal Degree)		Medium	Analysis[1]	Potential Munitions	Sample Location Rationale
	Longitude	Latitude				
WVMA-MRS05-AMB-SW-04	-79.398258	39.085674	Surface Water	Explosives, Selected metals	None	Sample was collected in May, 2012 from revised ambient sample location near the southern edge of the MRS. Analytical results serves as ambient data for comparison to biased sample(s).
WVMA-MRS05-AMB-SD-04	-79.398258	39.085674	Sediment	Explosives, Selected metals, pH	None	Sample was collected in May, 2012 from revised ambient sample location near the southern edge of the MRS. Analytical results serves as ambient data for comparison to biased sample(s).

Notes:

(1) Selected metals include: aluminum, antimony, copper, lead, and zinc
MRS munitions response site
MC munitions constituents
RI/FS Remedial investigation/Feasibility Study
HE high explosive

The ambient surface soil sample (WVMA-MRS05-AMB-SS-02-07) was collected from the southwest corner of the MRS, away from Bearden Knob (the reported firing point for the Bearden Knob Firing Range) and away from and cross-gradient from the reported location of the moving target range. The SVT observed no MD or evidence of DoD use near the ambient sample location. The sample was analyzed for explosives, metals (aluminum, antimony, copper, lead, and zinc), and pH and was used for comparison in the screening level risk assessment (SLRA). The ambient surface water/sediment coupled samples (WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02) were collected during the October 2011 site visit from a location within the Blackwater River, upstream from the majority of the MRS. However, an explosive compound (hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]) was detected in the surface water sample during laboratory analysis. Therefore, the SVT collected additional coupled surface water/sediment samples further upstream from the MRS during the May 2012 site visit. The May 2012 samples were identified as WVMA-MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03 and were used for comparison in the SLRA. The sample IDs for the original ambient surface water/sediment samples were retained; however, the results reported for these samples are considered biased and are not used as ambient criteria.

The ambient sample results were used to represent naturally occurring metals concentrations at the Bearden Knob Firing Range MRS. No explosives were detected in the ambient samples. Tables 5.3, 5.4, and 5.5 summarize the maximum metals concentrations detected in the collected ambient samples. These concentrations were then compared to the maximum detected metals concentrations found in the biased-location samples obtained within the Bearden Knob Firing Range MRS. Since explosives are not naturally occurring, the detected explosive compound was retained for consideration in the SLRA in Chapter 6.

TABLE 5.3
SUMMARY OF BACKGROUND CONCENTRATIONS IN SURFACE WATER
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

ANALYTES	WVMA-MRS05-AMB-SW-04(1)	3X SITE-SPECIFIC AMBIENT SAMPLE(2)
Metals	**µg/L**	
Aluminum	**220**	660
Antimony	3.0U	<3.0*
Copper	2.2U	<2.1*
Lead	2.0U	<2.0*
Zinc	**2.7J**	8.1

Notes:

(1) Ambient sample analytical results. Detections are bolded.

(2) Results from WVMA-MRS05-AMB-SW-04 used

U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)

J Analyte detected, estimated concentration

* - Ambient sample result was not detected above the sample specific PQL. Comparison to detection limit made for SLRA determination

TABLE 5.4
SUMMARY OF BACKGROUND CONCENTRATIONS IN SEDIMENT
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

ANALYTES	WVMA-MRS05-AMB-SD-04[1]	3X USGS BACKGROUND VALUE[2]	3X SITE-SPECIFIC AMBIENT SAMPLE [3]
Metals		**mg/kg**	
Aluminum	**4,800**	85,000	14,000
Antimony	0.034U	NA	<0.034*
Copper	**1.9**	37	5.7
Lead	**5.1**	43	15
Zinc	**32**	170	96

Notes:

(1) Ambient sample analytical results. Detections are bolded.

(2) USGS derived background concentration for Tucker County (http://mrdata.usgs.gov/geochem/county.php?place=f54093&el=Al&rf=east-central). The background values are selected from those available in the column order shown (i.e., the USGS value is used if there is one; if there is no USGS value, then the site-specific value is used).

(3) Results from sample WVMA-MRS05-AMB-SD-04 used

U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

* - Ambient sample result was not detected above the sample specific PQL. Comparison to detection limit made for SLRA determination

TABLE 5.5
SUMMARY OF BACKGROUND CONCENTRATIONS IN SOIL
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

ANALYTES	WVMA-MRS05-AMB-SS-02-07[1]	3X WV VRRP BACKGROUND VALUE[2]
Metals	**mg/kg**	
Aluminum	**11,000**	190,000
Antimony	0.58U	2.3
Copper	**11**	66
Lead	**32**	50
Zinc	**22**	180

Notes:

(1) Ambient sample analytical results. Detections are bolded.

(2) From West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual Version 2.1. Table 2-3: Natural Background Levels of Inorganics in Soil in West Virginia and Surrounding Areas. http://www.dep.wv.gov/dlr/oer/voluntarymain/documents/vrra%20guidanceversion2-1.pdf

U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)

5.2.8 ESTABLISHING AN OBSERVED RELEASE

As explained in Subchapter 5.1.1, an exposure pathway for a chemical release is not considered complete unless metals have been released to environmental media. To make this determination, analytical results for metals in the soil, surface water, and sediment samples, presented in Tables 5.3 through 5.5 above were compared against several criteria. For an analyte to be considered to have been released due to munitions-related activities at the Bearden Knob Firing Range MRS, it is necessary for the following conditions to be true:

- The analyte is detected in the sample medium.
- The analyte is present above the selected background concentration.
- The analyte is a potential constituent of the munitions formerly used at the site (see Table 4.1).

The metals analyzed were evaluated against these criteria to determine whether metals have been released. Only analytes that meet the conditions above are evaluated further in the SLRA in Chapter 6. Any detection of explosives at the site is evidence of a potential release of metals and is evaluated in the SLRA.

The above method is consistent with the process described in Chapter 5, Observed Release, of the *HRS Guidance Manual* (USEPA 1992). The *HRS Guidance Manual* process for establishing an observed release "requires documenting that the concentration of at least one hazardous substance in a release sample is significantly increased above its background level, and that the substance in the release can be attributed to the site" (USEPA 1992). The method described above both confirms whether an analyte is present above background concentrations and whether that analyte is a potential constituent of the munitions formerly used at the site, meeting both criteria defined in the guidance.

5.3 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE

This subchapter of the SI Report evaluates pathways for the Bearden Knob Firing Range MRS. The analysis of each pathway is described in detail. The related CSEM for the MRS is provided in Appendix J.

5.3.1 HISTORICAL MUNITIONS CONSTITUENTS INFORMATION

The revised Bearden Knob Firing Range MRS boundary consists of 6,137 acres. No historical metals-related groundwater, surface water, soil, or air sampling has been documented at this MRS.

5.3.2 GROUNDWATER EXPOSURE PATHWAY

Groundwater can serve as a contaminant transport mechanism that may affect surface water bodies, drinking water supplies, vegetation, and sensitive environments such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of metals in soil at the ground surface that can be transported to the groundwater, site-specific geology, climate, and the expected future land use.

5.3.2.1 Geologic and Hydrogeologic Setting

The geologic and hydrogeologic setting at the Bearden Knob Firing Range MRS is described in Subchapter 5.2.

5.3.2.2 Releases and Potential Releases to Groundwater

There are no known releases or potential releases of metals to groundwater at the Bearden Knob Firing Range MRS. Groundwater would not have been directly affected by activities associated with the MRS.

If there were releases of metals to soil as a result of the munitions-related activities, it is possible that the constituents could leach to groundwater, which ranges from 7.65 feet bgs to 176.45 feet bgs (EDR 2012).

5.3.2.3 Groundwater Exposure Pathway and Receptors

A water well data report included in Appendix L lists 64 groundwater wells within 4 miles of the Bearden Knob Firing Range MRS (EDR 2012), as shown on Figure 5.1 and listed in Table 5.6. The report lists 11 wells within the Bearden Knob Firing Range MRS. These wells were not observed by the SVT during the site visit.

TABLE 5.6

GROUNDWATER WELLS WITHIN 4-MILE BUFFER OF THE BEARDEN KNOB FIRING RANGE MRS

BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

DISTANCE FROM SITE	TOTAL
On site	11
0 to ¼ mile	3
¼ to ½ mile	0
½ to 1 mile	6
1 to 2 miles	12
2 to 3 miles	23
3 to 4 miles	14
Site to 4 miles	64

Detailed well information is included in Appendix L.

As shown in Table 2.1, the 2010 census data indicate that 1,992 people live within a 4-mile radius of the Bearden Knob Firing Range MRS. The census data also indicates that 32 people potentially live within the Bearden Knob Firing Range MRS, as shown in Table 2.1 and on Figure 2.2 (U.S. Census Bureau 2010). The majority of the MRS is open, undeveloped land and wetlands owned by the USFWS and managed as the CVNWR. The wildlife refuge is a popular site for recreation, and tourism. However, the SVT observed abundant (26 or more) inhabited structures concentrated in the southwest portion of the MRS near Highway 32 and Bearden Knob. This area is a community called Canaan Heights. Known site users are USFWS employees, recreational users, residents, construction workers, and site visitors.

Groundwater would not have been directly affected by munitions activities; however, metals in soil could leach to groundwater given the shallow depth to groundwater in some areas of the Bearden Knob Firing Range MRS. Based on the current and future land use of this MRS, potential receptors include current and future residents and construction workers, commercial/industrial workers (e.g., USFWS employees), recreational users (e.g., hikers and hunters), and site visitors. Human receptors in the area could be exposed to groundwater via incidental ingestion, dermal contact, and ingestion of groundwater as drinking water. Although ecological receptors are considered to be present at this site, they are not typically exposed to groundwater; therefore, this exposure pathway is incomplete for ecological receptors.

5.3.2.4 Groundwater Sampling Locations and Methods

As discussed in Subchapter 5.2.5, all drinking water wells were privately-owned and without a confirmed release or a contamination source present, requests for ROE were not made by USACE for parcels with existing wells; therefore, no groundwater samples were collected.

5.3.2.5 Groundwater Sampling Analytical Results

Not applicable; no groundwater samples were collected during the SI at the Bearden Knob Firing Range MRS.

5.3.2.6 Groundwater Exposure Pathway Conclusions

There are 64 groundwater wells within 4 miles of the Bearden Knob Firing Range MRS including 11 wells within the MRS. Groundwater beneath the site would not have been directly affected by activities at the site. Metals were not detected in surface soil at this MRS at concentrations above the background levels. Therefore, the groundwater exposure pathways are incomplete for human receptors at the MRS.

5.3.3 SURFACE WATER AND SEDIMENT EXPOSURE PATHWAYS

Surface water can serve as a contaminant transport mechanism that may affect surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environmental areas such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of metals in soil at the ground surface that can be transported to the surface water and sediment through runoff and erosion.

5.3.4 HYDROLOGIC SETTING

The Bearden Knob Firing Range MRS encompasses portions of the Blackwater River, Sand Run, and Glade Run. Wetlands are present along some reaches of the streams and in scattered areas throughout the Canaan Valley. The SVT encountered surface water within the Blackwater River, Sand Run, and Glade Run while conducting the SI field activities. The team also observed abundant surface water in the wetlands of the Canaan Valley between Middle Ridge and the Blackwater River and between Middle Ridge and the Cabin Mountain. As described in Subchapters 5.2.2 and 5.2.3, the USEPA indicated that no tribal drinking water sources are located within 4 miles of the MRS (USEPA 2012). However, 8 surface water intakes are within 15 miles of the MRS (USEPA 2012) as well as 23 wellhead protection areas and Zones of Critical Concern (WVDHHR 2012). Based on information from the WVDHHR, none of the surface water intakes are located within the MRS.

5.3.4.1 Releases and Potential Releases to Surface Water and Sediment

Based on the 2009 PA (Vol I, pages 72 and 73), ordnance at this MRS was fired from Bearden Knob eastward toward the Cabin Mountain (USACE 2009). However, based on the evaluation of the 2011 sampling results, there is limited evidence of metals in the surface water or wetlands west of the Cabin Mountain.

5.3.4.2 Surface Water and Sediment Exposure Pathway and Receptors

There are perennial surface water bodies present at the Bearden Knob Firing Range MRS in areas directly affected by DoD activities, and surface water was observed in these water bodies by the SVT. While direct release of metals to surface water and sediment may have occurred at this MRS, potential metals present in the soil at the MRS could also migrate to surface water or sediment via runoff and erosion. There are 8 surface water intakes within 15 miles of the MRS. Therefore, human receptors may be exposed to metals by ingestion as drinking water. The surface water and sediment exposure pathways also include incidental ingestion and dermal exposure. Ecological receptors may also be exposed to metals by the ingestion of biota that may have been exposed to metals in surface water or sediment. Current and future residents and construction workers, commercial/industrial workers (e.g., USFWS

employees), recreational users (e.g., hikers and hunters) or site visitors, and ecological receptors at this MRS could be exposed to metals via these pathways.

5.3.4.3 Surface Water and Sediment Sampling Locations and Methods

Two surface water/sediment sample couples, along with one set of associated field duplicate samples were collected from the Blackwater River within the Bearden Knob Firing Range MRS during the October 2011 site inspection. Biased samples WVMA-MRS05-SW-01 and WVMA-MRS05-SD-01 and duplicate samples WVMA-MRS05-SW-03 and WVMA-MRS05-SD-03 were collected from a downstream location at the center of the MRS, in line with the suspected direction of fire from Bearden Knob. These sample locations were selected to represent areas with the highest likelihood of the presence of MEC or metals contamination. However, no MEC, MD or metals contamination was visually observed during the site visits. Samples WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02 were collected from an up-stream location near the southern border of the MRS, and were planned to represent ambient conditions within the MRS. However, due to a low-level detection of an explosive in the surface water sample, the coupled samples cannot be used to represent ambient conditions at the site; therefore, these samples are evaluated as biased samples. In May 2012, the SVT collected a new ambient surface water/sediment sample couple further upstream from the MRS in the Blackwater River. The May 2012 samples were identified as WVMA-MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03. APPL, Inc. in Clovis, California analyzed all of the samples for explosives, using method SW846-8330B, and for selected metals (aluminum, antimony, copper, lead, and zinc), using method SW846-6010B.

5.3.4.4 Surface Water and Sediment Sampling Analytical Results

The analytical results for the surface water and sediment samples collected from the Bearden Knob Firing Range MRS are presented in Tables 5.7 (surface water) and 5.8 (sediment) and are included in Appendix F. These results were evaluated using the criteria described in Subchapter 5.2.8 to determine whether metals contamination is present.

The source evaluations are summarized in Table 5.9 for surface water and Table 5.10 for sediment. One explosive compound (RDX) was detected in one of the surface water samples collected from this MRS. However, explosives were not detected in any of the sediment samples. Explosives are not naturally occurring; therefore, any detection of explosives is retained for further consideration in the SLRA in Chapter 6.

TABLE 5.7:
Summary of Validated Analytical Results for Water Samples Collected in October 2011 and May 2012
Bearden Knob Firing Range MRS

Sample ID: / Sample Date: / Analytes	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SW-02 10/04/11	WVMA-MRS05-AMB-SW-03* 05/17/12	WVMA-MRS05-SW-01 10/05/11	WVMA-MRS05-SW-03** 10/05/11
	µg/L	µg/L	µg/L			
Explosives - SW8330B						
1,3,5-Trinitrobenzene	460 (2)	60000 (5)	0.30 U	0.30 U	0.30 U	0.30 U
1,3-Dinitrobenzene	1.5 (2)	26 (5)	0.30 U	0.30 U	0.30 U	0.30 U
2,4,6-Trinitrotoluene (TNT)	2.2 (2)	100 (6)	0.30 U	0.30 U	0.30 U	0.30 U
2,4-Dinitrotoluene	0.11 (3)	44 (6)	0.30 U	0.30 U	0.30 U	0.30 U
2,6-Dinitrotoluene	15 (2)	81 (6)	0.30 U	0.30 U	0.30 U	0.30 U
2-Amino-4,6-dinitrotoluene	30 (2)	1500 (6)	0.30 U	0.30 U	0.30 U	0.30 U
2-Nitrotoluene	0.27 (2)	39000 (5)	0.30 U	0.30 U	0.30 U	0.30 U
3-Nitrotoluene	1.3 (2)	750 (6)	0.30 U	0.30 U	0.30 U	0.30 U
4-Amino-2,6-dinitrotoluene	30 (2)	43000 (5)	0.30 U	0.30 U	0.30 U	0.30 U
4-Nitrotoluene	3.7 (2)	1900 (6)	0.30 U	0.30 U	0.30 U	0.30 U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.61 (2)	360 (6)	**0.071 J**	0.30 U	0.30 U	0.30 U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	63 (2)	5800 (5)	0.30 U	0.30 U	0.30 U	0.30 U
Nitrobenzene	0.12 (2)	2700 (7)	0.30 U	0.30 U	0.30 U	0.30 U
Nitroglycerin	1.5 (2)	140 (6)	0.30 U	0.30 U	0.30 U	0.30 U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	780 (2)	150 (6)	0.30 U	0.30 U	0.30 U	0.30 U
Pentaerythritol Tetranitrate (PETN)	16 (2)	85000 (6)	1.5 U	1.5 U	1.5 U	1.5 U
Total Metals - SW6010B						
Aluminum	16000 (2)	87 (6)	**260**	**220**	**190**	**230**
Antimony	14 (3)	30 (6)	3.0 U	3.0 U	3.0 U	**1.2 J**

TABLE 5.7:
Summary of Validated Analytical Results for Water Samples Collected in October 2011 and May 2012
Bearden Knob Firing Range MRS

Sample ID: / Sample Date: / Analytes	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SW-02 10/04/11	WVMA-MRS05-AMB-SW-03* 05/17/12	WVMA-MRS05-SW-01 10/05/11	WVMA-MRS05-SW-03** 10/05/11
	µg/L	µg/L	µg/L			
Copper	1000 (3)	9 (6)	2.1 U	2.2 U	2.0 U	2.0 U
Lead	50 (3)	2.5 (6)	2.0 U	2.0 U	2.0 U	2.0 U
Zinc	4700 (2)	120 (6)	**5.4 J**	**2.7 J**	**5.4 J**	**4.9 J**
pH			***s.u.***			
pH	-	-	**5.67**	**4.81**	**5.36**	**5.36**
Turbidity			***NTU***			
Turbidity	-	-	**7.9**	**44.7**	**12.8**	**12.8**

U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise
J - Analyte detected, estimated concentration
* Ambient sample
** Field duplicate of sample on left
s.u. - Standard Unit
NTU - Nephelometric Turbidity Units
Detections are bolded

TABLE 5.7:
Summary of Validated Analytical Results for Water Samples Collected in October 2011 and May 2012
Bearden Knob Firing Range MRS

(1) Human health screening levels for surface water used from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf), supplemented with USEPA National Recommended Water Quality Criteria August 2010 (http://water.epa.gov/scitech/swguidance/standards/current/index.cfm), and USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(2) WV Requirements Governing Water Quality Standard not available. Used USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(3) Human health screening levels for surface water from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf).
(4) Ecological screening values for surface water used from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf) supplemented with USEPA National Recommended Water Quality Criteria August 2010 (http://water.epa.gov/scitech/swguidance/standards/current/index.cfm), and USEPA Region 3 Freshwater Screening Benchmark June 13, 2011 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fw/screenbench.htm), and Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml), and USEPA Region 4 Ecological Screening Values for Fresh Surface Water November 30, 2001 (http://www.epa.gov/region04/waste/ots/ecolbul.html#tbl1), and USEPA Region 5 Ecological Screening Levels August 22, 2003 (http://www.epa.gov/Region5/waste/cars/pdfs/ecological-screening-levels-200308.pdf).
(5) Ecological screening values for surface water used from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf) supplemented with USEPA National Recommended Water Quality Criteria August 2010 (http://water.epa.gov/scitech/swguidance/standards/current/index.cfm), and USEPA Region 3 Freshwater Screening Benchmark June 13, 2011 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fw/screenbench.htm), and Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml), and USEPA Region 4 Ecological Screening Values for Fresh Surface Water November 30, 2001 (http://www.epa.gov/region04/waste/ots/ecolbul.html#tbl1), and USEPA Region 5 Ecological Screening Levels August 22, 2003 (http://www.epa.gov/Region5/waste/cars/pdfs/ecological-screening-levels-200308.pdf).
(6) WV Water Quality Standard not available. Used USEPA Region 3 Freshwater Screening Benchmark June 13, 2011 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fw/screenbench.htm).
(7) WV Requirements Governing Water Quality Standards (47CSR2) no t available. Used USEPA Region 4 Ecological Screening Values for Fresh Surface Water November 30, 2001 (http://www.epa.gov/region04/waste/ots/ecolbul.html#tbl1),

(8) Human health screening levels for surface water from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf).

TABLE 5.8:
Summary of Validated Analytical Results for Sediment Samples Collected in October 2011 and May 2012
Bearden Knob Firing Range MRS

Analytes / Sample ID: / Sample Date:	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SD-02 10/04/11	WVMA-MRS05-AMB-SD-03* 05/17/12	WVMA-MRS05-SD-01 10/05/11	WVMA-MRS05-SD-03** 10/05/11
Explosives - SW8330B	**mg/kg**	**mg/kg**	**mg/kg**			
1,3,5-Trinitrobenzene	2200 (2)	1300 (5)	0.090 U	0.090 U	0.090 U	0.090 U
1,3-Dinitrobenzene	6.1 (2)	1.2 (5)	0.40 U	0.40 U	0.40 U	0.40 U
2,4,6-Trinitrotoluene (TNT)	19 (2)	0.092 (6)	0.30 U	0.30 U	0.30 U	0.30 U
2,4-Dinitrotoluene	1.6 (2)	0.04 (6)	0.070 U	0.070 U	0.070 U	0.070 U
2,6-Dinitrotoluene	61 (2)	9.7 (5)	0.040 U	0.040 U	0.040 U	0.040 U
2-Amino-4,6-dinitrotoluene	150 (3)	34 (5)	0.50 U	0.50 U	0.50 U	0.50 U
2-Nitrotoluene	2.9 (2)	28 (5)	0.50 U	0.50 U	0.50 U	0.50 U
3-Nitrotoluene	6.1 (2)	24 (5)	0.50 U	0.50 U	0.50 U	0.50 U
4-Amino-2,6-dinitrotoluene	150 (2)	9.5 (5)	0.50 U	0.50 U	0.50 U	0.50 U
4-Nitrotoluene	30 (2)	4.1 (6)	0.50 U	0.50 U	0.50 U	0.50 U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	5.5 (2)	0.013 (6)	0.50 U	0.50 U	0.50 U	0.50 U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	240 (2)	100 (5)	0.50 U	0.50 U	0.50 U	0.50 U
Nitrobenzene	4.9 (2)	27 (5)	0.50 U	0.50 U	0.50 U	0.50 U
Nitroglycerin	6.1 (2)	1700 (5)	0.50 U	0.50 U	0.50 U	0.50 U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	3800 (2)	27000 (5)	0.50 U	0.50 U	0.50 U	0.50 U
Pentaerythritol Tetranitrate (PETN)	120 (3)	1400 (5)	2.5 U	2.5 U	2.5 U	2.5 U
Metals - SW6010B			**mg/kg**			
Aluminum	77000 (2)	280 (5)	**2,400**	**4,800**	**7,000 J**	**6,400**
Antimony	31 (2)	2 (6)	0.26 U	0.34 U	0.34 UJ	0.35 U
Copper	3100 (2)	32 (6)	**1.5**	**1.9**	**4.1**	**4.7**
Lead	400 (2)	36 (6)	**3.6**	**5.1**	**7.9 J**	**8**
Zinc	23000 (2)	120 (5)	**33**	**32**	**70**	**68**

TABLE 5.8:
Summary of Validated Analytical Results for Sediment Samples Collected in October 2011 and May 2012
Bearden Knob Firing Range MRS

Analytes / Sample ID: / Sample Date:	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SD-02 10/04/11	WVMA-MRS05-AMB-SD-03* 05/17/12	WVMA-MRS05-SD-01 10/05/11	WVMA-MRS05-SD-03** 10/05/11
Percent Moisture				%		
Moisture, percent			22	41	42	42

QA Notes and Data Qualifiers:

(NO CODE) - Confirmed identification

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)

J - Analyte detected, estimated concentration

* - Ambient sample

** Field duplicate of sample on left

Detections are bolded

(1) Human health screening levels for soil and sediment used from WVDEP Risk-Based Concentrations (RBCs), Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) May 1, 2012 (http://www.dep.wv.gov/dlr/oer/voluntarymain/Documents/60CSR3%20VRRA%20filed%204-11-12.pdf) supplemented with USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil, May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(2) WVDEP Risk-Based Concentrations (RBCs), Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) May 1, 2012 (http://www.dep.wv.gov/dlr/oer/voluntarymain/Documents/60CSR3%20VRRA%20filed%204-11-12.pdf)

(3) WVDEP RBC not available. Used USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil ,May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(4) Ecological screening values for sediment used from USEPA Region 3 Ecological Screening Benchmark June 13, 2011 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm), and National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) (http://archive.orr.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf), and Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml), and USEPA Region 4 Ecological Screening Values for Sediment November 30, 2001 (http://www.epa.gov/region04/superfund/programs/riskasses/ecolbul.html#tbl3), and USEPA Region 5 Ecological Screening Levels August 22, 2003 (http://www.epa.gov/Region5/waste/cars/pdfs/ecological-screening-levels-200308.pdf).

(5) USEPA Region 3 Ecological Screening Benchmark screening value not available. Used Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml).

(6) USEPA Region 3 Ecological Screening Benchmark June 13, 2011 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm).

TABLE 5.9:
SURFACE WATER SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analytes	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Explosives	**µg/L**					
1,3,5-Trinitrobenzene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
1,3-Dinitrobenzene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
2,4,6-Trinitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
2,4-Dinitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
2.6-Dinitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
2-Amino-2,6-dinitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
2-Nitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
3-Nitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
4-Amino-2,6-dinitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
4-Nitrotoluene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine	**0.071J**	N/A	N/A	Yes	**Yes**	--
Methyl-2,4,6-trinitrophenylnitramine	0.30U	N/A	N/A	Yes	No	Not detected at MRS
Nitrobenzene	0.30U	N/A	N/A	Yes	No	Not detected at MRS
Nitroglycerin	0.30U	N/A	N/A	Yes	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	0.30U	N/A	N/A	Yes	No	Not detected at MRS
Pentaerythritol Tetranitrate	1.5U	N/A	N/A	Yes	No	Not detected at

TABLE 5.9:
SURFACE WATER SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analytes	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
						MRS
Metals	**µg/L**					
Aluminum	260	660	No	Yes	No	Not detected above background
Antimony	1.2J	<3.0*	**Yes**	Yes	**Yes**	--
Copper	2.2U	<2.1*	No	Yes	No	Not detected at MRS
Lead	2.0U	<2.0*	No	Yes	No	Not detected at MRS
Zinc	5.4J	8.1	No	Yes	No	Not detected above background

Notes:

(1) 3x Site-specific ambient sample: Results from WVMA-MRS05-AMB-SW-04 used.
(2) Potential MC as listed in Table 4.1.
N/A Not applicable.
J Analyte detected, estimated concentration.
U Analyte was analyzed for but not detected

* - Ambient sample result was not detected above the sample specific PQL. Comparison to detection limit made for SLRA determination, although any detection in biased samples was considered above background as a conservative measure.

TABLE 5.10:
SEDIMENT SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analytes	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Explosives	**mg/kg**					
1,3,5-Trinitrobenzene	0.090U	N/A	N/A	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	0.40U	N/A	N/A	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene	0.30U	N/A	N/A	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	0.070U	N/A	N/A	**Yes**	No	Not detected at MRS
2.6-Dinitrotoluene	0.040U	N/A	N/A	**Yes**	No	Not detected at MRS
2-Amino-2,6-dinitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
2-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
3-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
4-Amino-2,6-dinitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
4-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Nitrobenzene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Nitroglycerin	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS

TABLE 5.10:
SEDIMENT SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analytes	Maximum Detected Site Concentration	Background Concentration (1)	Exceeds Background Concentration?	Potential MC? (2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Pentaerythritol Tetranitrate	2.5U	N/A	N/A	**Yes**	No	Not detected at MRS
Metals	**mg/kg**					
Aluminum	7,000J	85,000	No	**Yes**	No	Not detected above background
Antimony	0.35U	NA	No	**Yes**	No	Not detected at MRS
Copper	4.7	37	No	**Yes**	No	Not detected above background
Lead	8	43	No	**Yes**	No	Not detected above background
Zinc	70	170	No	**Yes**	No	Not detected above background

Notes:

(1) 3x USGS Background Value: USGS derived background concentration for Tucker County (http://mrdata.usgs.gov/geochem/county.php?place=f54093&el=Al&rf=east-central). The background values are selected from those available in the column order shown (i.e., the USGS value is used if there is one; if there is no USGS value, then the site-specific value is used). The selected value is shown in **Bold**.

(2) Potential MC as listed in Table 4.1.

N/A Not applicable.

J Analyte detected, estimated concentration.

U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

As shown in Table 5.7, antimony, aluminum, copper, lead and zinc were detected in the samples collected; however, aluminum, copper, lead and zinc did not exceed the selected background values (Table 5.9). Antimony was detected in a single biased surface water sample exceeding background values and was retained for further evaluation in the SLRA in Chapter 6. RDX (not determined to be related to DoD use) was also detected in one of the surface water samples collected from the MRS, and was retained for further evaluation in the SLRA in Chapter 6 as a conservative measure.

Explosives were not detected in the biased sediment samples. Antimony was not detected in the biased sediment samples. As shown in Table 5.8, four metals (aluminum, copper, lead, and zinc) were detected in the sediment samples collected from the MRS. The maximum detected concentrations of these metals did not exceed the background criteria, as shown in Table 5.10, and were not carried forward in the SLRA.

5.3.4.5 Surface Water and Sediment Exposure Pathway Conclusions

Based on the current and future land use of the Bearden Knob Firing Range MRS, potential receptors include current and future residents and construction workers, commercial/industrial workers (e.g., USFWS employees), recreational users (e.g., hikers and hunters) or site visitors, and ecological receptors. Human receptors may be exposed to metals in surface water or sediment via ingestion as drinking water, incidental ingestion, or dermal exposure. Ecological receptors could be exposed to metals in surface water through incidental ingestion, dermal exposure, and ingestion as a drinking water source. Ecological receptors may also ingest biota that has been exposed to metal contaminants in the surface water. Surface water and sediment samples were collected from the Bearden Knob Firing Range MRS. The maximum detected concentrations of the metals at MRS05 did not exceed the selected background concentrations. Therefore, sediment exposure pathways are incomplete for all receptors. The maximum detected concentrations of aluminum, copper, lead and zinc in the surface water sample did not exceed the selected background values. However, antimony was detected in a single biased surface water sample; antimony was not detected in the ambient surface water sample. Therefore, surface water exposure pathways are complete for all receptors.

5.3.5 SOIL EXPOSURE PATHWAY

Potential soil exposure pathways may include incidental ingestion, dermal contact, and inhalation of re-suspended soil particulates by human and ecological receptors. Contamination in soil can also leach to groundwater and migrate to surface water and sediment via runoff and erosion. Subchapters 5.3.2 and 5.3.3 discuss the groundwater and surface water/sediment exposure pathways, respectively. Ecological receptors may also come into contact with metals in soil by ingesting biota that have been exposed to metals in soil. The likelihood of exposure is influenced by such factors as the mass and concentration of metals in soil exposed at the ground surface; site-specific geology, hydrogeology, climate; and the expected future land use.

5.3.5.1 Physical Source Access Conditions

The SVT encountered some barriers (fences and locked gates) to control access to the Bearden Knob Firing Range MRS. However, these barriers are not monitored, and are not used to prevent pedestrians (e.g., hunters, hikers, tourists) from accessing the wildlife refuge. There are few roads that can be used to access the interior of the MRS by vehicle since it is within a large wetland area and within the CVNWR. Several of the roads have locked gates that are controlled by the USFWS. However, the USFWS employees have keys for the gates, and they use the roads to maintain the refuge. Additionally, these roads and many trails are available and frequently used by pedestrians to access the MRS.

5.3.5.2 Actual or Potential Contamination Areas

Prior to the SI, there were no known metals contamination areas within the Bearden Knob Firing Range MRS. However, military training and munitions-related activities could have directly affected soil, surface water, and sediment at the site. The areas with the highest probabilities for contamination are the firing point and the reported moving target range at the west end of the MRS, and the target areas in the east end of the MRS, which encompass the west-facing slopes of the Cabin Mountain and the wetlands below (Figure 2.1). The location of the MRS is based on reviews of historical documents identified in the INPR and the PA.

5.3.5.3 Soil Exposure Pathways and Receptors

The soil exposure pathway accounts for the potential risk to human and ecological receptors at or near the Bearden Knob Firing Range MRS that may come into contact with potentially contaminated soil. Human and ecological receptors may come into contact with metals in soil via dermal contact, incidental ingestion, or inhalation of re-suspended soil particulates. Ecological receptors are considered to be present at this MRS (Subchapter 5.2.4) and may also come into contact with metals in soil by ingesting biota that have been exposed to metals in soil. Based on the site use, census data, and the SVT observations listed in Subchapter 5.3.2.3, the potential receptors likely present at the Bearden Knob Firing Range MRS are current and future residents and construction workers, commercial/industrial workers (e.g., USFWS employees), recreational users (e.g., hikers and hunters) or site visitors, and ecological receptors.

5.3.5.4 Soil Sampling Locations and Methods

The TPP Team agreed to collect six biased surface soil samples, one ambient surface soil sample, and associated QC samples within the Bearden Knob Firing Range MRS during the SI. All six of the biased samples (WVMA-MRS05-SS-02-01 through WVMA-MRS05-SS-02-06), along with one duplicate (WVMA_MRS05-SS-02-08) and the ambient sample (WVMA-MRS05-AMB-SS-02-07), were collected during the October 2011 site visit using the proposed CRREL "seven-point wheel" composite sampling technique. All of the soil samples were collected from the proposed sample depth of 0 to 2 inches bgs. Surface soil sample (WVMA-MRS05-SS-02-06) was collected within the overlapping area of Bearden Knob and Brown/Cabin Mountain Firing Range and will be used in the evaluation of Brown/Cabin Mountain Firing Range.

No MD and no UXO/DMM were found during the site visit. Samples WVMA-MRS05-SS-02-03 and WVMA-MRS05-SS-02-06 were collected next to detected subsurface anomalies. The remaining biased surface soil samples were collected at or near their proposed locations. The ambient surface soil sample was moved from the proposed location due to lack of ROE. The SVT chose a new location in the southwest corner of the MRS, away from and cross-gradient from Bearden Knob and the reported location of the moving target range. As described in Subchapter 5.2.5 of this report, the UXO Technician III used a Schonstedt GA-92XTi or GA-52Cx magnetometer to screen all soil sample locations before sample collection. Soil sampling was employed, as specified in the final SS-WP. The coordinates for each sample location were recorded and uploaded to the GIS database. Figure 5.2 shows the sample locations and identification numbers. Table 5.2 indicates the rationale behind the sample locations. Appendix D includes the field notes and field forms for the site visit.

All of the surface soil samples were analyzed for explosives, metals (aluminum, antimony, copper, lead, and zinc), and pH. The ambient surface soil sample was analyzed for explosives to verify that the sample location represents background soil conditions at the MRS. The analytical results from the ambient sample are used to estimate background concentrations of naturally occurring metals in the surface soil at the site (Subchapter 5.2.7).

5.3.5.5 Soil Sampling Analytical Results

The results of the soil sample analysis at the Bearden Knob Firing Range MRS are listed in Table 5.11 and are included in Appendix F. These results were evaluated using the criteria described in Subchapter 5.2.8. The source evaluation for the MRS is presented in Table 5.12. There were no detections of explosives in the surface soil samples collected from the MRS. As shown in Table 5.11, four metals (aluminum, copper, lead, and zinc) were detected in the surface soil samples collected from the Bearden Knob Firing Range MRS. None of the metals detected exceeded the background criteria (Table 5.12).

TABLE 5.11:
Summary of Validated Analytical Results for Soil Samples Collected in October 2011
Bearden Knob Firing Range MRS

Analytes / Sample ID: / Sample Date:	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SS-02-07* 10/06/11	WVMA-MRS05-SS-02-01 10/11/11	WVMA-MRS05-SS-02-08** 10/11/11	WVMA-MRS05-SS-02-02 10/03/11	WVMA-MRS05-SS-02-03 10/03/11	WVMA-MRS05-SS-02-04 10/01/11	WVMA-MRS05-SS-02-05 10/01/11
Explosives – SW8330B	***mg/kg***	***mg/kg***				**mg/kg**			
1,3,5-Trinitrobenzene	2200 (2)	6.6 (5)	0.090 U	0.090 U	0.090 U	0.090 U	0.090 U	0.090 U	0.090 U
1,3-Dinitrobenzene	6.1 (2)	0.073 (5)	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
2,4,6-Trinitrotoluene (TNT)	19 (2)	6.4 (5)	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
2,4-Dinitrotoluene	1.6 (2)	2.5 (5)	0.070 U	0.070 U	0.070 U	0.070 U	0.070 U	0.070 U	0.070 U
2,6-Dinitrotoluene	61 (2)	1.8 (5)	0.040 U	0.040 U	0.040 U	0.040 U	0.040 U	0.040 U	0.040 U
2-Amino-4,6-dinitrotoluene	150 (3)	10 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Nitrotoluene	2.9 (2)	9.9 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
3-Nitrotoluene	6.1 (2)	12 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
4-Amino-2,6-dinitrotoluene	150 (2)	3.6 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
4-Nitrotoluene	30 (2)	22 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	5.5 (2)	7.5 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	240 (2)	0.99 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Nitrobenzene	4.9 (2)	40 (6)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Nitroglycerin	6.1 (2)	71 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	3800 (2)	27 (5)	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Pentaerythritol Tetranitrate (PETN)	120 (3)	100 (5)	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Metals – SW6010B						**mg/kg**			
Aluminum	77000 (2)	50 (6)	**11,000**	**2,900 J**	**1,600 J**	**10,000 J**	**17,000**	**7,500**	**9,000**
Antimony	31 (2)	0.27 (7)	0.58 U	0.28 UJ	0.27 U	0.26 U	0.4 U	0.29 U	0.33 U
Copper	3100 (2)	28 (7)	**11**	**3 J**	**2.9**	**16**	**16**	**6.2**	**5**

TABLE 5.11:
Summary of Validated Analytical Results for Soil Samples Collected in October 2011
Bearden Knob Firing Range MRS

Analytes / Sample ID: / Sample Date:	Human Health Screening Values (1)	Ecological Screening Values (4)	WVMA-MRS05-AMB-SS-02-07* 10/06/11	WVMA-MRS05-SS-02-01 10/11/11	WVMA-MRS05-SS-02-08** 10/11/11	WVMA-MRS05-SS-02-02 10/03/11	WVMA-MRS05-SS-02-03 10/03/11	WVMA-MRS05-SS-02-04 10/01/11	WVMA-MRS05-SS-02-05 10/01/11
Lead	400 (2)	11 (7)	**32**	**5.2 J**	**3.7**	**12**	**22**	**20**	**15**
Zinc	23000 (2)	46 (7)	**22**	**8.3 J**	**8.4**	**46**	**32**	**22**	**20**
pH – SW9045D						**s.u.**			
pH			3.9 J	6.3	6.3	4.5	4.8	3.9	4.0
Percent Moisture						**%**			
Moisture, percent			66	28	25	24	50	31	40

QA Notes and Data Qualifiers:

(NO CODE) - Confirmed identification

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)

J - Analyte detected, estimated concentration

s.u. - Standard Unit

* - Ambient sample

** Field duplicate of sample on left

Detections are bolded

(1) Human health screening levels for soil and sediment used from WVDEP Risk-Based Concentrations (RBCs), Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) May 1, 2012 (http://www.dep.wv.gov/dlr/oer/voluntarymain/Documents/60CSR3%20VRRA%20filed%204-11-12.pdf) supplemented with USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil, May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(2) WVDEP Risk-Based Concentrations (RBCs), Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) May 1, 2012 (http://www.dep.wv.gov/dlr/oer/voluntarymain/Documents/60CSR3%20VRRA%20filed%204-11-12.pdf)

(3) WVDEP RBC not available. Used USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil ,May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(4) Ecological screening values for soil used from USEPA EcoSSLs May 2008 (http://www.epa.gov/ecotox/ecossl/), and Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml), and USEPA Region 4 Ecological Screening Values for Soil November 30, 2001 (http://www.epa.gov/region4/superfund/images/allprogrammedia/pdfs/tsstablesoilvalues.pdf), and USEPA Region 5 Ecological Screening Levels August 22, 2003 (http://www.epa.gov/Region5/waste/cars/pdfs/ecological-screening-levels-200308.pdf).

(5) USEPA EcoSSLs not available. Used Los Alamos National Laboratory's EcoRisk Database v3.0 October 2011 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml).

(6) USEPA EcoSSLs not available. Used USEPA Region 4 Ecological Screening Values for Soil November 30, 2001 (http://www.epa.gov/region4/superfund/images/allprogrammedia/pdfs/tsstablesoilvalues.pdf). If pH is less than 5.5, the USEPA Region 4 screening value of 50 mg/kg will be used.

(7) USEPA EcoSSLs May 2008 (http://www.epa.gov/ecotox/ecossl/).

TABLE 5.12:
SOIL SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analyte	Maximum Detected Site Concentration	Background Concentration(1)	Exceeds Background Concentration?	Potential MC?(2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Explosives	**mg/kg**					
1,3,5-Trinitrobenzene	0.090U	N/A	N/A	**Yes**	No	Not detected at MRS
1,3-Dinitrobenzene	0.40U	N/A	N/A	**Yes**	No	Not detected at MRS
2,4,6-Trinitrotoluene	0.30U	N/A	N/A	**Yes**	No	Not detected at MRS
2,4-Dinitrotoluene	0.070U	N/A	N/A	**Yes**	No	Not detected at MRS
2.6-Dinitrotoluene	0.040U	N/A	N/A	**Yes**	No	Not detected at MRS
2-Amino-2,6-dinitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
2-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
3-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
4-Amino-2,6-dinitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
4-Nitrotoluene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Hexahydro-1,3,5-trinitro-1,3,5-triazine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Methyl-2,4,6-trinitrophenylnitramine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Nitrobenzene	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Nitroglycerin	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	0.50U	N/A	N/A	**Yes**	No	Not detected at MRS

TABLE 5.12:
SOIL SOURCE EVALUATION
Bearden Knob Firing Range MRS

Analyte	Maximum Detected Site Concentration	Background Concentration(1)	Exceeds Background Concentration?	Potential MC?(2)	SLRA Required?	Primary Reason for Exclusion from SLRA
Pentaerythritol Tetranitrate	2.5U	N/A	N/A	**Yes**	No	Not detected at MRS
Metals	**mg/kg**					
Aluminum	17,000	190,000	No	**Yes**	No	Not detected above background
Antimony	0.40U	2.3	No	**Yes**	No	Not detected at MRS
Copper	16	66	No	**Yes**	No	Not detected above background
Lead	22	50	No	**Yes**	No	Not detected above background
Zinc	46	180	No	**Yes**	No	Not detected above background

Notes:
(1) 3x WV VRRP Background value: From West Virginia Voluntary Remediation and Redevelopment Act Guidance Manual Version 2.1. Table 2-3: Natural Background Levels of Inorganics in Soil in West Virginia and Surrounding Areas. http://www.dep.wv.gov/dlr/oer/voluntarymain/documents/vrra%20guidanceversion2-1.pdf
(2) Potential MC as listed in Table 4.1.
U Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa)

5.3.6 SOIL EXPOSURE PATHWAY CONCLUSIONS

Potential receptors for soil at the Bearden Knob Firing Range MRS include current and future residents and construction workers, commercial/industrial workers (e.g., USFWS employees), recreational users (e.g., hikers and hunters) or site visitors, and ecological receptors. These receptors may be exposed to surface soil through dermal contact, incidental ingestion, and inhalation of re-suspended particulate matter. Ecological receptors also may be exposed to metals in the soil by ingestion of biota that may have been exposed to metals in the soil. The maximum detected concentrations of aluminum, copper, lead and zinc did not exceed their respective background concentrations, and therefore, the surface soil exposure pathways are incomplete for all potential receptors at the MRS.

5.3.7 AIR EXPOSURE PATHWAY

The air exposure pathway accounts for hazardous substance exposure in gaseous or particulate form through the air. Airborne transport of contaminants can be an exposure pathway for human and ecological receptors. No air sampling has been performed at this site, and none was performed for this SI.

5.3.7.1 Climate

Subchapter 2.2.3 discusses climate.

5.3.7.2 Releases and Potential Releases to Air

There are no known direct releases of metals to air at the Bearden Knob Firing Range MRS. The occurrence of windblown soil particulates may be expected at the site. Releases of metals contamination via this pathway are possible through re-suspension of surface soil particulates.

5.3.7.3 Air Exposure Pathways and Receptors

Because there are no known volatile contaminants associated with the munitions used at the former WVMA/Dolly Sods, the only remaining air exposure pathway would be via the inhalation of re-suspended soil particulates. Based on the known current and future land use, census data, and the SVT observations listed in Subchapter 5.3.2.3, the potential receptors that are likely present at the Bearden Knob Firing Range MRS are current and future residents, construction workers, commercial/industrial workers (e.g., ranchers), recreational users or site visitors, future construction workers, and ecological receptors.

5.3.7.4 Air Sampling and Monitoring Locations and Methods

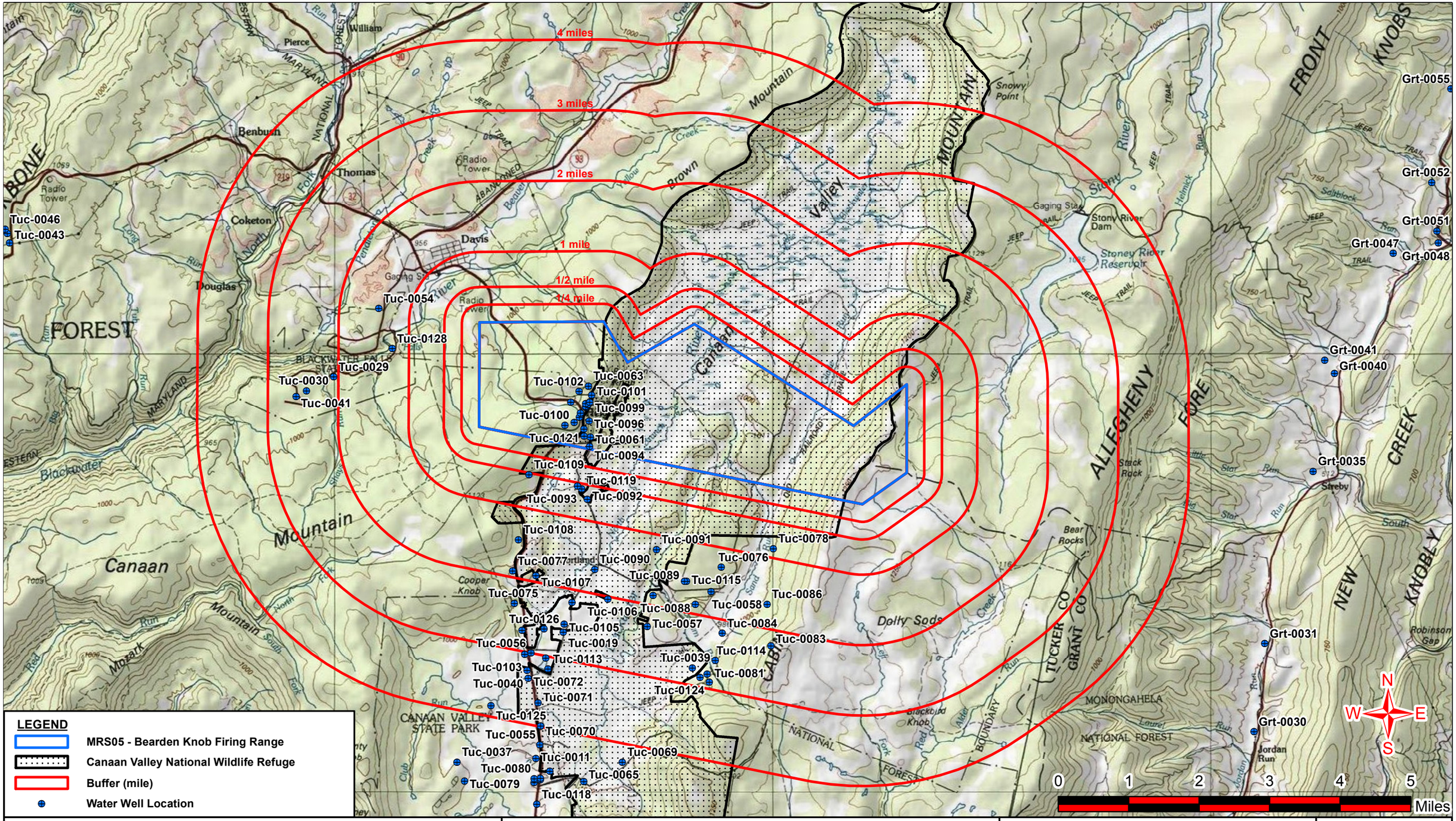
There is no historical record of air sampling at the former WVMA/Dolly Sods. Air sampling was not conducted as part of the SI within the Bearden Knob Firing Range MRS.

5.3.7.5 Air Sampling Analytical Results

Not applicable; no air sampling was conducted as part of the SI at the Bearden Knob Firing Range MRS.

5.3.7.6 Air Exposure Pathway Conclusions

As discussed in Subchapter 5.3.5.5, none of the metals detected within the surface soil samples collected were detected at concentrations exceeding the selected background criteria. Based on these results, the air exposure pathway is incomplete for all receptors present at the Bearden Knob Firing Range MRS. The air exposure pathway for human receptors is assessed through the soil exposure pathway, as the screening values for human receptors include inhalation. While the inhalation exposure pathway is indirectly evaluated through the human health screening values for soil, the ecological screening values for soil do not evaluate this pathway, and the air exposure pathway is considered potentially incomplete but was not quantitatively assessed for ecological receptors at this MRS.



Prepared by:

Eco & Associates, Inc.
and
PARSONS

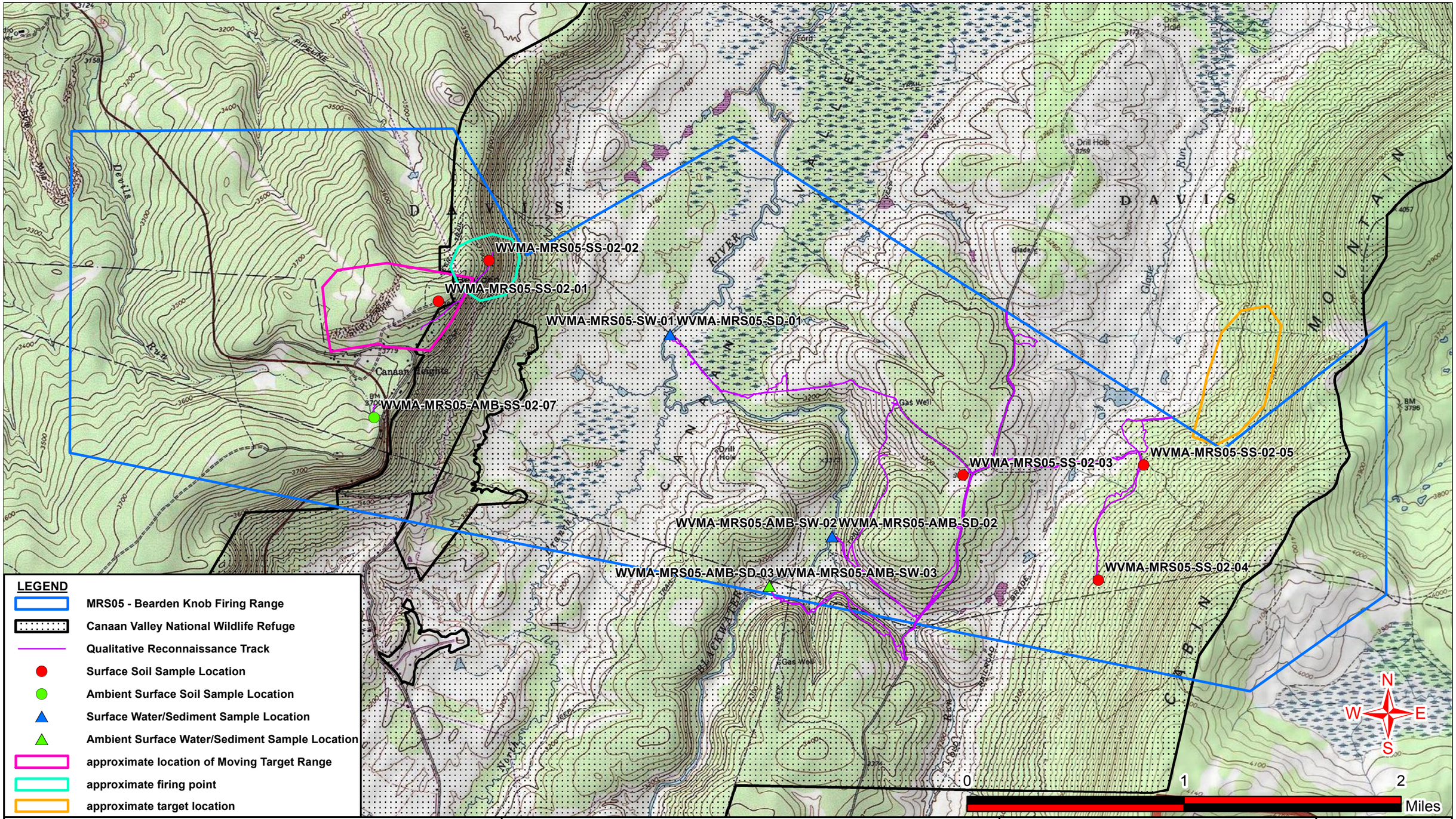
WATER WELLS WITHIN 4-MILE BUFFER

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
5.1



Prepared by:

Eco & Associates, Inc.
and
PARSONS

QUALITATIVE RECONNAISSANCE AND SAMPLE LOCATIONS

MRS05 - Bearden Knob Firing Range
MMRP West Virginia

PROJECT NO. Eco-11-452

DATED August 2013

FIGURE
5.2

CHAPTER 6
SCREENING-LEVEL RISK ASSESSMENT

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT

6.1.1 INTRODUCTION

A qualitative risk assessment evaluates the potential explosive safety risk to the public at the Bearden Knob Firing Range MRS. This risk assessment qualitatively communicates whether a potential risk exists at the MRS and the primary causes of that potential risk. The risk assessment is based on historical information presented in prior studies (e.g., the INPR and the PA) and on observations made during the SI QR.

An explosive safety risk exists if a person can come near or into contact with MEC and interact with the MEC in a manner that results in a detonation. The potential for an explosive safety risk depends on the presence of three critical elements:

1. A source (i.e., presence of MEC)
2. A human receptor (i.e., a person)
3. The potential for interaction between the source and receptor (i.e., the possibility that the person might pick up or disturb the MEC)

All three of these elements must be present for an explosive safety risk to exist. There is no risk if any one element is missing. Each of these three elements provides a basis for implementing effective risk management response actions.

6.1.2 CONCEPTUAL SITE MODEL

The CSM for the Bearden Knob Firing Range MRS, included in Appendix J, summarizes conditions at the FUDS that could result in human exposure to MEC. It describes the types of MEC potentially present in the Bearden Knob Firing Range MRS, past MEC and MD findings, and current and projected future land use and receptors.

6.1.3 QUALITATIVE RISK EVALUATION

For the Bearden Knob Firing Range MRS, the potential risk posed by MEC was characterized qualitatively by evaluating the following three primary risk factors, which are related to the three critical elements listed above:

1. *MEC presence:* whether there is potential for MEC at the MRS
2. *MEC type:* the types of MEC that might be at the MRS and the related potential explosive hazards
3. *Site accessibility:* how potential receptors at the MRS might interact with the MEC

The known or suspected presence of an explosive hazard at a given MRS and any potential human receptors at the MRS will typically be considered sufficient justification for RI/FS implementation at the MRS. The following paragraphs describe each of the primary risk factors.

MEC presence describes whether MEC have been confirmed or are suspected at the MRS, either at the surface or in the subsurface, based on historical information in prior studies (e.g., the INPR and the PA)

and observations made during the QR. If there is historical evidence of potential MEC presence at a site, lack of confirmation of MEC presence during the QR will not be considered as evidence of MEC absence for this qualitative risk evaluation. Table 6.1 describes the three possible categories of MEC presence for this evaluation.

TABLE 6.1
CATEGORIES OF MEC PRESENCE
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MEC PRESENCE	DESCRIPTION
Confirmed or suspected	There is physical or confirmed historical evidence of MEC presence at the MRS, or there is physical or historical evidence indicating that MEC may be present at the MRS.
Small arms only(1)	The presence of small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Evidence of no munitions	Following investigation of the MRS, there is no physical or historical evidence that there are UXO or discarded military munitions present.

Notes:
(1) Small arms ammunition is "ammunition, without projectiles that contain explosives (other than tracers), that is .50-caliber or smaller or for shotguns" (Department of the Army 2005a).

MEC type describes whether the MEC potentially present at the MRS might be detonated, resulting in a minor injury or worse to one or more human receptors. If multiple MEC types are potentially present at the MRS, the type that poses the greatest risk to public health is selected for this qualitative risk evaluation. This determination is based on historical information in prior studies (e.g., the INPR and the PA) as well as observations made during the Si field activities. Table 6.2 describes the three possible categories of MEC type for this evaluation.

TABLE 6.2
CATEGORIES OF MEC TYPE
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MEC TYPE	DESCRIPTION
Potentially hazardous	Fuzed or unfuzed MEC that may result in physical injury to an individual if detonated by an individual's activities.
Small arms only(1)	Small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Inert	MD or other items that will cause no injury (e.g., training ordnance containing no explosives, fuzes, spotting charges, etc.).

Notes:
(1) Small arms ammunition is defined as "ammunition, without projectiles that contain explosives (other than tracers), that is .50-caliber or smaller or for shotguns" (Department of the Army 2005a).

Site accessibility describes whether human receptors have access to the MRS and, therefore, may interact with any MEC at the surface or in the subsurface. For this qualitative risk evaluation, if MEC are confirmed or suspected at the MRS, it is assumed that human receptors might come into contact with the MEC unless there is complete restriction to access. This assessment will also describe the potential receptors. Table 6.3 describes the two possible categories of site accessibility for this evaluation.

TABLE 6.3
CATEGORIES OF SITE ACCESSIBILITY
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

SITE ACCESSIBILITY	DESCRIPTION
Accessible	Access control is not complete: residents, site workers, or visitors can gain access to all or part of the MRS.
Complete restriction to access	Human receptors are completely prevented from gaining access to the MRS.

For this qualitative risk assessment, further evaluation (i.e., RI/FS) for the MRS will typically be justified if the following conditions are all met:

- MEC are confirmed or suspected to be present
- The MEC confirmed or suspected to be present are potentially hazardous
- The MRS is accessible

The primary risk factors identified above were evaluated for the Bearden Knob Firing Range MRS at the former WVMA/Dolly Sods FUDS using the data collected during the 2011 and 2012 site visits and the historical data available from other studies. The following subchapters discuss the qualitative risk evaluation by each primary risk factor to determine whether further evaluation is justified at this MRS.

6.1.4 MUNITIONS AND EXPLOSIVES OF CONCERN RISK ASSESSMENT: BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE

Based on a plate in the 2009 PA showing historical MEC finds, a UXO (105mm howitzer round) was found on Cabin Mountain in the northeast portion of the Bearden Knob Firing Range MRS. The PA report indicates that this item was found in April 2007. No UXO/DMM have been found during previous field visits to the MRS, and no MD or UXO/DMM were observed during the 2011 site visit or the 2012 site visit. In December 2011, a hunter reportedly found a UXO/DMM item. Based on an unconfirmed report from an officer with the West Virginia State Police Department, the item was identified as an 81mm HE mortar and was found in the wetlands at the center of the east end of the MRS. The mortar was reportedly still live with an active point detonator fuze, visibly intact HE filler, and all of its safety features removed. The mortar was removed from the site, taken to a safe location, and destroyed by the West Virginia State Police. As discussed in Section 2.3, these previous findings have been identified within the overlapping area of Bearden Knob and Brown/Cabin Mountain Firing Ranges. Based on the results of the SI and the evidence available from the 2009 PA, these items are associated with the Brown/Cabin Mountain Firing Range; therefore, will not be considered in the evaluation for the Bearden Knob Firing Range. Based on these findings being attributed to the Brown/Cabin Mountain Firing Ranges and no documented UXO/DMM within the Bearden Knob Firing Range, the MEC presence at the Bearden Knob Firing Range MRS is categorized as "Evidence of no munitions."

The revised Bearden Knob Firing Range MRS boundary consists of 6,137 acres approximately 2.5 miles southeast of the town of Davis. The MRS encompasses Bearden Knob and the community of Canaan Heights, a portion of the Cabin Mountain, and a large portion of the Canaan Valley National Wildlife Refuge. The SVT encountered some barriers (fences and locked gates) to control access to the Bearden Knob Firing Range MRS. However, these barriers are not monitored, and are not used to prevent pedestrians (e.g., hunters, hikers, tourists) from accessing the wildlife refuge. Therefore, the site accessibility at the Bearden Knob Firing Range MRS is considered "Accessible."

6.1.5 RISK SUMMARY

Table 6.4 summarizes the qualitative MEC risk evaluation for the Bearden Knob Firing Range MRS. Based on this qualitative evaluation, no known explosive hazards remain at the Bearden Knob Firing Range MRS. Therefore, there is no potential explosive safety risk at this MRS.

TABLE 6.4
MEC RISK EVALUATION
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MRS	MEC PRESENCE	MEC TYPE		SITE ACCESSIBILITY	FURTHER EVALUATION?
Bearden Knob Firing Range	Evidence of no munitions	None	N/A	Accessible	No

6.2 MUNITIONS CONSTITUENTS HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT

6.2.1 CONCEPTUAL SITE MODEL

Based on the current and future land use of the Bearden Knob Firing Range MRS, potential human receptors at the MRS are current and future residents and construction workers, commercial/industrial workers (e.g., USFWS employees), recreational users (e.g., hikers and hunters) or site visitors. Based on the evaluation of exposure pathways in Chapter 5, these receptors may be exposed to metals through direct contact with soil, surface water, sediment, or groundwater. Human receptors may be exposed to metals in the surface soil through incidental ingestion, dermal contact, and inhalation of re-suspended soil particulates. They may also be exposed to metals in surface water or sediment via ingestion as drinking water, incidental ingestion or dermal exposure. There are 11 groundwater wells located within the MRS boundary, therefore human receptors may be exposed to metals in groundwater via ingestion as drinking water, incidental ingestion, and dermal contact. The CSEM identifies source media, transport mechanisms, exposure routes, and potential receptors (Appendix J) for this MRS.

6.2.2 AFFECTED MEDIA

Direct release of metals from munitions activities within the MRS would have been to soil, surface water, and sediment. Metals in the surface soil can become airborne as re-suspended particulate matter, can migrate to shallow groundwater through leaching, and can migrate to surface water and sediment through runoff and erosion. Based on decisions made at the TPP Meeting, biased soil, surface water, and sediment samples and field duplicate samples were collected from this MRS. No other media (groundwater or air) were sampled at this site.

6.2.3 HUMAN HEALTH SCREENING VALUES

Soil and Sediment: WVDEP RBCs, and Table 60-3B in the Voluntary Remediation and Redevelopment Rule (60CSR3) supplemented with USEPA Regional Screening Levels.

Surface water: WV Requirements Governing Water Quality Standards (47CSR2) supplemented with USEPA National Recommended Water Quality Criteria and USEPA RSL for tap water.

6.2.4 RISK CHARACTERIZATION

As discussed in Subchapter 5.2.8, the metals source evaluation is used to determine which analytes are retained for consideration in a SLRA. Only those analytes retained for consideration in the SLRA following the source evaluation are evaluated in this chapter. Groundwater and air samples were not collected during this SI; therefore, these pathways were not directly evaluated in the SLRA.

To complete the human health risk characterization for the Bearden Knob Firing Range MRS, the maximum detected concentrations of each selected metal that exceeded the selected background concentration for surface soil, surface water, and sediment were retained for consideration in the SLRA. These maximum detected concentrations were compared to the screening levels agreed to by the TPP Team and described in Subchapter 6.2.3. For an analyte to be considered a potential human health risk related to a release from munitions activities at the Bearden Knob Firing Range MRS, it is necessary for the metals concentrations to exceed their screening values. The following subchapters evaluate the MRS at the WVMA/Dolly Sods FUDS and any potential effects on human health.

6.2.5 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE

Surface water: Two biased surface water samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.9, RDX was detected, and antimony was detected at a concentration above its background concentration. As shown in Table 6.5 below, the maximum detected concentrations of RDX and the evaluated metal did not exceed the risk-based screening values for surface water at this MRS. Therefore, based on the analytical results presented in this report, no unacceptable human health risk is expected from exposure to metals in surface water due to former munitions-related activities at this MRS.

TABLE 6.5
HUMAN HEALTH SCREENING-LEVEL RISK ASSESSMENT FOR SURFACE WATER WITHIN THE MRS
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

ANALYTE	MAXIMUM DETECTED SITE CONCENTRATION	HUMAN HEALTH SCREENING VALUE	EXCEEDS SCREENING VALUE?
Explosives	**µg/L**		
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.071J	0.61(1)	No
Metals	**µg/L**		
Antimony	1.2J	14(2)	No

Notes:

(1) WV Requirements Governing Water Quality Standard not available. Used USEPA RSLs for Chemical Contaminants at Superfund Sites for Tap Water, May 2012 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf).

(2) Human health screening levels for surface water from WV Requirements Governing Water Quality Standards (47CSR2) June 27, 2011 (http://www.dep.wv.gov/WWE/Programs/wqs/Documents/Rules/WVDEP_47CSR2_WQS_FinalRule%206_27_2011.pdf).

J Analyte detected, estimated concentration

Sediment: Two biased sediment samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.10, none of the metals were detected at concentrations above their respective background concentrations. Therefore, based on the analytical results presented in this report, no unacceptable human health risk is expected from exposure to metals in sediment due to former munitions-related activities at this MRS.

Soil: Six biased surface soil samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.12, none of the metals were detected at concentrations above their respective background concentrations. Therefore, based on the analytical results presented in this report, no unacceptable human health risk is expected from exposure to metals in surface soil due to former munitions-related activities at this MRS.

6.2.6 DISCUSSION

In surface water, the maximum detected concentration of RDX did not exceed the risk-based screening value for surface water at this MRS. Antimony was also not detected above risk-based screening criteria. Therefore, based on the analytical results and the SLRA presented in this report, no unacceptable human health risk is expected from exposure to metals in surface water, due to former munitions-related activities at the Bearden Knob Firing Range MRS.

6.3 MUNITIONS CONSTITUENTS SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

6.3.1 CONCEPTUAL SITE MODEL

As discussed in Subchapter 5.2.4, the Bearden Knob Firing Range MRS is considered an important ecological place because it contains wetlands, and it is within the CVNWR. Therefore, ecological receptors are considered to be present at the Bearden Knob Firing Range MRS. Based on the evaluation of exposure pathways conducted in Chapter 5, ecological receptors may be exposed to metals through incidental ingestion, dermal contact, inhalation of re-suspended soil particulates, and ingestion as a drinking water source. They may also be exposed to metals indirectly through ingesting biota that may have been exposed to metals in soil, surface water, or sediment. Because groundwater is not typically accessible to ecological receptors, the groundwater exposure pathways are incomplete for ecological receptors. Appendix J presents the CSEM developed for this MRS.

6.3.2 AFFECTED MEDIA

Direct release of metals from munitions activities within the MRS would have been to soil, surface water, and sediment. Metals in the surface soil can become airborne as re-suspended particulate matter, can migrate to shallow groundwater through leaching, and can migrate to surface water and sediment through runoff and erosion. Based on decisions made at the TPP Meeting, biased soil, surface water, and sediment samples and field duplicate samples were collected from this MRS. No other media (groundwater or air) were sampled at this site.

6.3.3 ECOLOGICAL SCREENING VALUES

The ecological screening values (ESVs) listed below were used for the screening-level comparison for soil, surface water, and sediment. These ESVs are based on conservative assumptions, including the types of receptors present at a site (e.g., insectivores, terrestrial mammals, etc.) and exposure parameters (such as soil ingestion rate and receptor range). Site-specific information was not used to develop these ESVs. The use of site-specific information typically results in less conservative, and higher, ESVs.

Soil: USEPA EcoSSLs. In absence of EcoSSLs, values obtained from the LANL EcoRisk Database, and USEPA Region 3 Ecological Screening Levels were used.

Sediment: USEPA Region 3 Ecological Benchmarks, Freshwater Sediment Screening Benchmark, National Oceanic and Atmospheric Administration Screening Quick Reference Tables, LANL EcoRisk Database, and USEPA Region 3 ESLs.

Surface water: WV Requirements Governing Water Quality Standards (47CSR2) supplemented with USEPA National Recommended Water Quality Criteria and USEPA Regional Screening Levels for tap water.

6.3.4 ECOLOGICAL RISK CHARACTERIZATION

As discussed in Subchapter 5.2.8, the source evaluation is used to determine which analytes are retained for consideration in the SLERA. Only those analytes retained for consideration in the SLERA following the source evaluation are evaluated in this chapter.

To complete the SLERA at the Bearden Knob Firing Range MRS, the maximum detected concentration of each selected analyte was evaluated using the selected screening values (Subchapter 6.3.3). This comparison resulted in the calculation of hazard quotients (HQs) for each analyte, which were calculated by determining the ratio of the maximum detected site concentration to the screening value (in this case, ecological medium-specific screening value). If the HQ was equal to or less than 1, the potential for ecological risk for that medium was considered to be negligible. If the HQ was greater than 1, then unacceptable ecological risks cannot be ruled out based on the screening comparison alone. HQs greater than 1 should be reviewed to evaluate the significance of the exceedance.

The pH reported for all of the soil samples except one was less than 5.5 (Table 5.11), indicating that the soils at the Bearden Knob Firing Range MRS are generally acidic.

6.3.5 BEARDEN KNOB FIRING RANGE MUNITIONS RESPONSE SITE

Surface water: Two biased surface water samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.9, the explosive compound RDX was detected, and antimony was detected at concentrations above its background concentration. As shown in Table 6.6, the maximum detected concentrations of RDX and antimony, did not exceed the ESVs for surface water at this MRS and have HQs less than 1. Therefore, unacceptable ecological risk due to exposure to RDX and antimony in surface water is not expected.

TABLE 6.6
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT FOR SURFACE WATER WITHIN THE MRS
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

ANALYTE	MAXIMUM DETECTED SITE CONCENTRATION	ECOLOGICAL SCREENING VALUE(1)	EXCEEDS SCREENING VALUE?	HAZARD QUOTIENT
Explosives	**µg/L**			
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.071J	360	No	<1
Metals	**µg/L**			
Antimony	1.2J	30	No	<1

Notes:
(1) WV Water Quality Standard not available. Used USEPA Region 3 Freshwater Screening Benchmark, June 13, 2011, (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fw/screenbench.htm).
J Analyte detected, estimated concentration

Sediment: Two biased sediment samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.10, none of the metals were detected at concentrations above their respective background concentrations. Therefore, unacceptable ecological risk due to exposure to these metals in sediment is not expected.

Soil: Six biased surface soil samples were collected from the Bearden Knob Firing Range MRS. As shown in Table 5.12, none of the metals were detected at concentrations above their respective background concentrations. Therefore, unacceptable ecological risk due to exposure to these metals in surface soil is not expected.

6.3.6 DISCUSSION

The maximum detected concentration of antimony (1.2 µg/L J) did not exceed the ecological screening value (30 µg/L), resulting in a hazard quotient less than 1. Similarly, the detected concentration of RDX (0.071 µg/L J) did not exceed the ecological screening value (360 µg/L), resulting in a hazard quotient

less than 1. Therefore, based on the analytical results presented in this report, no unacceptable ecological risk is expected from exposure to metals or explosives in surface water due to former munitions-related activities at this MRS.

CHAPTER 7
SUMMARY AND CONCLUSIONS

7.1 SUMMARY

The SI performed at the Bearden Knob Firing Range MRS in Grant and Tucker Counties, West Virginia, evaluated site-specific conditions that could affect the potential for complete exposure pathways to human and ecological receptors at the MRS. The project was planned and performed to satisfy the DQOs set for the project: 1) evaluate potential presence of MEC; 2) evaluate potential presence of elevated metals concentrations that are consistent with the identified MC contaminants of concern; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring. Successful completion of the DQOs allowed determination of whether this FUDS project warrants further response action under CERCLA.

The SVT conducted 19.5 miles of QR and the collection of surface soil samples at six locations and surface water and sediment samples at three locations (with associated QC samples) at the Bearden Knob Firing Range MRS. The soil samples were collected at the suspected firing points, suspected target locations, and mid-range locations where observations or magnetic anomalies indicate the potential presence of MEC or metals contamination within the Bearden Knob Firing Range MRS.

APPL, Inc. in Clovis, California, analyzed the soil samples for explosives and selected metals. No explosives were detected in the surface soil or sediment samples but one explosive compound (RDX) was detected in one surface water sample at the MRS. In addition, antimony was detected in the surface water samples at concentrations greater than the background criteria (Tables 5.5, 5.7, 5.8, and 5.9). Therefore, antimony and RDX were retained for further evaluation in the SLERAs. Because the MRS is considered an important ecological place, an ecological screening level risk assessment was conducted in addition to the human health screening level risk assessment.

The SVT did not observe UXO/DMM or MD indicative of MEC during the QR.

7.2 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS

The evaluation of potential MEC exposure (Subchapter 6.1) and the revision of the MRS boundary concluded that the MEC exposure pathway is incomplete for the Bearden Knob Firing Range MRS. Since the only UXO/DMM is associated with MRS06, there is no potential explosive safety risk at the Bearden Knob Firing Range MRS.

7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENTS EXPOSURE PATHWAYS

7.3.1 ELEMENTS CONSTITUTING COMPLETE EXPOSURE PATHWAY

An exposure pathway for a chemical release is not considered complete unless all four of the following elements are present (USEPA 1989):

1. A source and mechanism for chemical release
2. An environmental transport and/or exposure medium

3. A receptor exposure point
4. A receptor and a likely route of exposure at the exposure point

7.3.2 CONCLUSIONS REGARDING EXPOSURE PATHWAYS

Because antimony and one explosive compound (RDX) were detected during the October 2011 site visit, exposure pathways for human and ecological receptors are considered complete. However, neither antimony nor RDX were detected at levels exceeding the screening levels. Therefore, there is no unacceptable human or ecological health risks expected from metals or explosives at the Bearden Knob Firing Ranges MRS.

CHAPTER 8
RECOMMENDATIONS

8.1 RECOMMENDATION

Due to the fact that the Bearden Knob Firing Range MRS and the Brown/Cabin Mountain Firing Ranges MRS overlap, the results of the SI for the overlapping area are considered for only one of the MRSs. Based on the results of the SI and the evidence available from the 2009 PA, the area of overlap is associated with the Brown/Cabin Mountain Firing Range MRS. Therefore, the SI results for the overlapping area will be considered in the Final SI Report for the Brown/Cabin Mountain Firing Range MRS, and did not affect the recommendations in the Final SI Report for the Bearden Knob Firing Range MRS.

No MEC items have been found during previous field visits to the Bearden Knob Firing Range MRS, and no MEC items were observed during the 2011 site visit or the 2012 site visit. In addition, munitions debris has never been reported within the MRS. The 2009 PA reported that members of the public found one MEC item (an unexploded 105mm Howitzer round) within the Bearden Knob Firing Range MRS in April, 2007. However, the item falls within the area of overlap between the Bearden Knob Firing Range MRS and the Brown/Cabin Mountain Firing Ranges MRS and will not affect the recommendation for the Bearden Knob Firing Range MRS. No explosive safety risk has been identified within the modified Bearden Knob Firing Range MRS; therefore, the recommendation is no further action. Since there is no explosive risk, no removal action is necessary.

Based on the analytical results and exposure pathways evaluated during this SI, further sampling of surface soil, sediment, and surface water is not recommended. No explosives were detected in the surface soil or sediment samples. No metals were detected in the surface soil or sediment at concentrations exceeding the selected background concentrations. One explosive compound (RDX) and antimony were detected in one surface water sample, but the concentrations were below the human health and ecological screening values. Therefore, based on the analytical results presented in this report, no unacceptable human health or ecological risk is expected from exposure to MC in surface water due to former munitions-related activities at this MRS and as a result, no further action is necessary.

8.2 REVISION OF MRS BOUNDARY

It is recommended that the boundary for the Bearden Knob Firing Range MRS is officially revised to eliminate the portion of the MRS that overlaps with the Brown/Cabin Mountain MRS. Currently, approximately 1,863 acres are being counted in both MRSs. An assessment of the historical data and SI findings was conducted to determine the appropriate MRS for this overlapping area. Based on the munitions use and observations/findings of both MRSs, the overlap \was determined to be part of the Brown/Cabin Mountain MRS.

TABLE 8.1
RECOMMENDATIONS
BEARDEN KNOB FIRING RANGE MRS, GRANT AND TUCKER COUNTIES, WV

MRS	ACREAGE	MEC ASSESSMENT(1)	METALS ASSESSMENT(2)	RECOMMENDATION
Bearden Knob Firing Range	8000 (revised to 6137 based on removing the portion of the MRS that overlaps with the Brown/Cabin Mountain MRS)	**No** No UXO/DMM have been found during previous field visits, and none were observed during the 2011 site visit and the 2012 site visit	**No** No metals exceeded background concentrations within the surface soil and sediment samples collected. Antimony exceeded background concentrations in a surface water sample collected; however, the maximum detection did not exceed ecological and human health screening criteria. RDX was detected in a surface water sample; however, the detection did not exceed ecological or human health criteria.	No Further Action

Notes:

(1) ”No” in this column indicates no confirmed MD indicative of potential MEC presence, resulting in a no further action recommendation for this MRS.

(2) “No” in this column indicates the absence of metals at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for no further metals sampling for the MRS.

CHAPTER 9
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APPENDIX A

PERFORMANCE WORK STATEMENT

STATEMENT OF WORK

1. PROJECT AND LOCATION. The project sites will be throughout the Range Support Center boundaries and can be found as part of the Former West Virginia Maneuver Area, Grant, Preston, Pendleton, Tucker, and Randolph Counties, West Virginia. Each site identified will require the completion of the Military Munitions Response Program (MMRP) Project Site Inspection phase of work.

2. PURPOSE. The purpose of the project is to complete all planning, field work and reporting for the Site Inspection (SI) phase at each of the projects listed below. The Contractor shall use the existing programmatic documents as developed by Parsons Infrastructure and Technology Group for the 2004 SI initiative. The final SI shall reflect that attempts were made to seek concurrence from state regulators and other potential stake holders related to the decisions made based on the findings of the SI.

3. AUTHORIZATION. This projected is in support of the U.S. Army Corps of Engineers (USACE), Los Angeles District (SPL) Formerly Used Defense Site Program (FUDS). This project will comply with Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Occupational Safety & Health Administration (OSHA), and all other applicable local, city, county, state, or federal requirements.

4. DESCRIPTION OF WORK AND SERVICES REQUIRED. The Contractor shall perform the work and services as follows.

Task 1. **Coordinate Technical Project Planning (TPP) Meetings**: The Contractor shall coordinate, attend, and take meeting minutes for the TPP meeting with the USACE Project Manager, members of the Project Delivery Team (PDT), State Regulators and other stakeholders involved with the execution of the SI phase of work. In preparation for this meeting the Contractor shall research the current property owners associated with the FUDS Project locations and provide this information to USACE to assist in inviting relevant stakeholders to the TPP meetings. The Contractor shall capture decisions made in the TPP meeting in a TPP Memorandum submittal.

Task 2. **Prepare Site Specific Work Plan:** The Contractor shall prepare a Draft Site Specific Work Plan that incorporates all decisions and inputs from the TPP. All work shall be performed in accordance with the programmatic planning documents referenced above.

Task 3. **Field Work and Sampling:** Field work will be scheduled based on the approval of a final Site Specific Work Plan (SSWP) and the execution of an Rights of Entry (ROE) by the Government for all properties to be visited during field activities. Field Work will be conducted in compliance with the SSWP and existing programmatic planning documents.

Task 4. **Reporting:** Reports shall be developed using the established format for the MMRP SI Program. A draft, draft-final and final version shall be prepared. All appendices shall be included with the final deliverable in the electronic version.

Task 5. **Digital Data:** Analytical and Digital Data will be maintained and delivered to the Government at the finalization of each report. Analytical data shall be validated according to the accepted protocols established by the MMRP SI Program. Geographic

Information Systems (GIS) deliverable shall contain a Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE) data structure and Federal Geographic Data Committee (FGDC) metadata.

Sites

Project #	Project Name	FUDS #
05	DAILEY INFILTRATION CAMP	G03WV0013
06	WVMA AMMUNITION DEPOT	G03WV0013
07	MANEUVER AREA	G03WV0013
08	FORE KNOBS-BEAR ROCKS FIRING RANGES	G03WV0013
09	BEARDEN KNOB FIRING RANGE	G03WV0013
10	BROWN/CABIN MOUNTAIN FIRING RANGES	G03WV0013
11	BUENA SMALL ARMS FIRING RANGE	G03WV0013

5. DELIVERABLE REQUIREMENTS. The front cover of all deliverables will state the report version, project name and number, title and date. The deliverables will include a section for responses to USACE and Regulatory comments.

A Compact Disc-Recordable (CD-R) will be included in a three-ring binder (in a plastic insert) along with each three-ring paper version of final reports issued. The CD-R will include the original documents in AutoCAD, MS Office 2007, JPG, PDF formats. The Contractor shall arrange all documents into separate file folders for each chapter. One file titled “Entries” adobe (PDF) file format will be included on the CD-R or FTP site download that contains the entire document, identical to the three-ring paper version.

Distribution List for Submittals:

Submittal	Quantity
Draft TPP Memo	6
Final TPP Memo	6
Draft Site Specific Work Plan	6
Final Site Specific Work Plan	6
Draft Completion Report	6
Draft-Final Completion Report	6
Final Completion Report	6

6. GENERAL REQUIREMENTS.

a. Regulatory Requirements. All activities shall be conducted in compliance with all Federal, State, and Local regulations for the protection of human health and the environment. The Contractor shall comply with all Federal State, and Local environmental laws, statutes, and regulations.

b. Privacy Act and Confidential Information. The Contractor shall comply with the Privacy Act and keep all information private. The Contractor shall keep all data and information obtained confidential prior to the release of data by the USACE.

7. CRITERIA AND STANDARDS. The Contractor shall prepare the final materials in accordance with criteria and applicable publications and manuals listed herein. Materials shall also be prepared in accordance with guidance previously furnished to the Contractor or with supplemental detailed instructions which may be issued by the Contracting Officer or Contracting Officer Representative (COR) before and during the progress of the work. The Contractor is not to undertake action for relocation, enlargement or deletion of any features of this proposed project. The Contractor shall be responsible for notifying the Contracting Officer of any missing criteria needed for their work.

8. PERIOD OF PERFORMANCE. The period of performance shall commence on the date of receipt of the Notice to Proceed (NTP), and shall end 24 months after the NTP. The Contractor shall schedule performance of this statement of work with the COR for this contract to ensure efficiency and cost effectiveness, and shall also schedule the completion and review of interim deliverables as appropriate.

9. QUALITY CONTROL PLAN. The Contractor is responsible for ensuring that product development and independent technical review for this Statement of Work are carried out in accordance with the approved MMRP SI Programmatic Plans.

10. ITEMS AND DATA TO BE FURNISHED BY THE GOVERNMENT. The Government shall make available to the Contractor relevant information from related studies, reports, manuals, and other pertinent available data in its files, which may contribute to this work.

The Contractor shall ensure that all material has been received. This material is, by this reference, hereby incorporated into and made part of this contract, as fully and completely as thought the same were set forth in full.

11. PROJECT MANAGEMENT. The Contractor shall name and assign a responsible Project Manager who shall maintain a project file to contain correspondence and criteria pertinent to this project. The Project Manager shall be knowledgeable about all pertinent work ongoing and shall be available as the Contractor's point of contact to the Government.

During the progress of the work, the Contractor shall confer with the Project's COR, as required, to assure approval of the completed work.

The COR may visit the Contractor's office at any time during the progress of the work for the specific purpose of examining the progress of work and to resolve any questions the Contractor may have concerning the development of the work. The COR shall be supported by a technical specialist as necessary to provide guidance to assure an adequate submittal.

12. VISITS TO SITES, PRIVATE SOURCES, AND GOVERNMENTAL AGENCIES. The Contractor shall advise the COR of each proposed visit to the site, private sources and Governmental agencies prior to each visit. Contacts with Governmental representatives shall be limited to research and coordination of data pertinent to the project.

13. DEVIATION OF THIS STATEMENT OF WORK. The Contractor is advised not perform any extra services under this contract requested by any other person within or external to SPL, orally or in writing, which the Contractor considers to be a change in work or services required which necessitates an

adjustment in the contract fee, until the Contractor has been requested by the Contracting Officer to: (1) review a supplemental Statement of Work; (2) make a written proposal covering such extra services; and/or (3) has negotiated a mutually satisfactory fee and received a notice to proceed in writing from the Contracting Officer.

14. OTHER REQUIREMENTS:

a. Subcontractors: The Contractor shall not enter into any subcontracts without prior written approval of the Contracting Officer.

b. Responsibility for Field Work: The Contractor shall be responsible for all damages to persons and property that all occur as a result of the Contractor fault or negligence in connection with field work, and shall save and hold the Government free from all claims and suits arising from such damages.

15. PAYMENT FOR WORK AND SERVICES. The Government anticipates award of a Firm Fixed Price contract. The agreed upon awarded price shall constitute full compensation by the Government to the Contractor for the work and services performed under this contract. Payments shall be made in accordance with the payment clause included in this contract and period of performance of this contract. The Contractor shall invoice only after the completion of finalized milestones. The milestone structure for this requirement shall be as follows:

Final TPP Memo: 25%
Final SSWP: 25%
Field Work Complete: 25%
Final SI Report: 25%

APPENDIX B

TPP SESSION DOCUMENTATION/ MEETING MINUTES

(ELECTRONIC ONLY)

APPENDIX C

INTERVIEW DOCUMENTATION

NO INTERVIEWS WERE CONDUCTED AT THIS SITE; THEREFORE, NO INTERVIEW DOCUMENTATION IS INCLUDED WITH THIS REPORT

Appendix D

Field Notes and Field Forms

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	1-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	1
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 35°, snow and rain showers	Mobilization included in 9-26-2011 daily report for Brown/Cabin Mountain Firing Ranges MRS	

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
214	***Miles Driven***	**214**
0/0	***Number of Flights/Miles Flown***	**0/0**
4	***Number of Personnel***	**--**

2. Reconnaissance Details

17,424	***Linear Feet: (3.3 miles)***	**17,424**

3. MC Sampling Details

3	***Soil Samples***	**3**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: See Attached DQCR

4. QC Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: See Attached DQCR

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: No QA split samples for this program.

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, severe weather, lightning, cold stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone: (720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone: (850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone: (818) 397-2248	Yes	Yes
Eco Field Team Member	Carlos Hernandez	Cell Phone: (714) 925-5666	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 92-XT*i* , Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, First Aid Kit
Water Sampling Equipment	Horriba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The SVT will conduct QR, 7-point wheel soil sampling, and surface water/sediment sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS. The SVT will also ship samples to the laboratory.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0 **PREPARED BY FTL:**

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912PP-11-C-0007
Delivery Order Number: 0001
Project Name: MMRP FUDS SI
Project Number: 748073-30002
Site Location: WVMA (Bearden Knob Firing Range MRS)
Date: 1-Oct-11

DAILY FIELD SI ACTIVITIES CONDUCTED

The site visit team (SVT) conducted approximately 3.3 miles of qualitative reconnaissance (QR) and completed CRREL 7-point wheel surface soil sampling at the Bearden Knob Firing Range MRS (MRS05) at the Former West Virginia Maneuver Area. QR was conducted on the west facing slope of Cabin Mountain and within the wetlands of the Canaan Valley. No munitions debris or MEC items were found during the QR.

Soil samples WVMA-MRS05-SS-02-04 and WVMA-MRS05-SS-02-05 were moved slightly from the proposed locations in order to avoid boulders and a buried fenceline. Soil sample WVMA-MRS05-SS-02-06 was moved from the proposed location and collected next to a subsurface anomaly. All three samples were collected from the proposed depth of 0 to 2 inches below ground surface (bgs).

TOMORROW'S OPERATION PLAN

The SVT will take the day off on Sunday October 2nd. The team will resume work on Monday, October 3rd.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	N/A	N/A	N/A	N/A	N/A

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
NA	NA	NA	NA	NA

Comments: NA

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-SS-02-04	Soil	1337	Metals*, Explosives, pH	10/3/2011	APPL, Inc.	
WVMA-MRS05-SS-02-05	Soil	1250	Metals*, Explosives, pH	10/3/2011	APPL, Inc.	
WVMA-MRS05-SS-02-06	Soil	1132	Metals*, Explosives, pH	10/3/2011	APPL, Inc.	

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

Soil sample WVMA-MRS05-SS-02-06 was moved from the proposed location and collected next to a subsurface anomaly.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	1-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	3-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS 05)	**REPORT NO:**	2
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 41°, snow/rain showers, winds 5-10 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
103	***Miles Driven***	**317**
1/2,165	***Number of Flights/Miles Flown***	**1/2,165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

21,648	***Linear Feet:(4.1 miles)***	**39,072**

3. MC Sampling Details

2	***Soil Samples***	**5**
	Sampling Notes: See Attached DQCR	

4. QC Activities

0	***Soil Samples***	**0**
	Sampling Notes: See Attached DQCR	

5. QA Activities

0	***Soil Samples***	**0**
	Sampling Notes: No QA split samples for this program.	

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, severe weather, cold stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone: (720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone: (850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone: (818) 397-2248	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 52Cx, Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	Horriba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The SVT will hold the soil samples collected on October 3, 2011, and ship them to the laboratory on October 5, 2011. The SVT will also conduct QR and surface water/sediment sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0

ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Johnson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: W912PP-11-C-0007
Delivery Order Number: 0001
Project Name: MMRP FUDS SI
Project Number: 748073-30002
Site Location: WVMA (Bearden Knob Firing Range MRS)
Date: 3-Oct-11

DAILY FIELD SI ACTIVITIES CONDUCTED

Carlos Hernandez demobilized from the site on the team's day off (October 2, 2011). Today the site visit team (SVT) visited the offices of the Canaan Valley Refuge in the morning. The Manager and the Deputy Manager of the Canaan Valley Wildlife Refuge loaned the SVT a key to the refuge gates, and helped the team gain access to the southern portion of the site through a private housing development. The SVT conducted approximately 4 miles of qualitative reconnaissance (QR) and completed CRREL 7-point wheel surface soil sampling at the Bearden Knob Firing Range MRS (MRS05) at the Former West Virginia Maneuver Area. QR was conducted on the east facing slope of Bearden Knob as well as within the Canaan Valley, along Middle Ridge. No munitions debris or MEC items were found during the QR. The SVT identified a clearing in the trees off to the side of a 4-wheel drive road in the southern portion of the MRS. The ground appeared uneven, and many piles of soil and trees had been pushed to the perimeter of the clearing. A high density of subsurface anomalies were detected throughout the clearing and within the stockpiled soil at the perimeter. The SVT identified additional subsurface anomalies in a second clearing to the north, in the vicinity of surface soil sample WVMA-MRS05-SS-02-03. Soil sample WVMA-MRS05-SS-02-02 was repositioned approximately 20 meters to the north (upslope) of a 4-wheel drive road. Soil sample WVMA-MRS05-SS-02-03 was moved slightly from the proposed location in order to avoid small boulders. Both samples were collected from the proposed depth of 0 to 2 inches below ground surface (bgs).

TOMORROW'S OPERATION PLAN

The SVT will hold the soil samples collected on October 3, 2011, and ship them to the laboratory on October 5, 2011. The SVT will also conduct QR and surface water/sediment sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	N/A	N/A	N/A	N/A	N/A

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
NA	NA	NA	NA	NA

Comments: NA

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-SS-02-02	Soil	1100	Metals*, Explosives, pH	10/5/2011	APPL, Inc.	
WVMA-MRS05-SS-02-03	Soil	1417	Metals*, Explosives, pH	10/5/2011	APPL, Inc.	

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

None

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	3-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	4-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	3
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 45°, rain, winds 5-10 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
98	***Miles Driven***	**415**
0/0	***Number of Flights/Miles Flown***	**1/2,165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

45,408	***Linear Feet:(8.6 miles)***	**84,480**

3. MC Sampling Details

0	***Soil Samples***	**5**
1	***Sediment Samples***	**1**
1	***Water Samples***	**1**

Sampling Notes: See Attached DQCR

4. QC Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: See Attached DQCR

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: No QA split samples for this program.

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, cold stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)				On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone:	(720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone:	(850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone:	(818) 397-2248	Yes	Yes
VISITORS					
None					

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 52Cx, Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	Horriba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The SVT will ship the soil samples collected on 10-3-2011 and the water and sediment samples collected on 10-4-2011 to the laboratory. The SVT will also conduct QR and surface water/sediment sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0

ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Johnson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: **W912PP-11-C-0007**
Delivery Order Number: **0001**
Project Name: **MMRP FUDS SI**
Project Number: **748073-30002**
Site Location: **WVMA (Bearden Knob Firing Range MRS)**
Date: **4-Oct-11**

DAILY FIELD SI ACTIVITIES CONDUCTED

The site visit team (SVT) conducted almost 9 miles of qualitative reconnaissance (QR) and completed surface water and sediment sampling at the Bearden Knob Firing Range MRS (MRS05) at the Former West Virginia Maneuver Area. QR was conducted along Middle Ridge Trail, on the east side of Middle Ridge at the center of the MRS. No munitions debris or MEC items were found during the QR. The SVT identified a clearing in the trees off to the side of a 4-wheel drive road at the northeast end of Middle Ridge. Several large piles of soil and trees were at the center of the clearing. The team also found a wellhead at the center of the clearing that was marked "CACASCO Wellhead 556". A high density of subsurface anomalies was detected between the well and the trail. The SVT completed only half of the QR that traverses the northern end of Middle Ridge from east to west. A large amount of water in the wetlands to the northwest of the ridge prevented the team from continuing. Surface water and sediment samples WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02 were collected in their proposed locations along the southern end of the Blackwater River.

TOMORROW'S OPERATION PLAN

The SVT will ship the soil samples collected on October 3, 2011, and the water and sediment samples collected on October 4, 2011, to the laboratory. Don Martin from the West Virginia Department of Environmental Protection will join the team for the day. The SVT will conduct QR and surface water/sediment sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	3.86	4.58	0	12.72	1341

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
WVMA-MRS05-AMB-SW-02	8.34	0.09	7.9	5.67

Comments: Water in river appeared slightly brown. Heavy snow and rainfall over the last few days could account for more sediment in the river.

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-AMB-SW-02	SW	1354	Metals*, Explosives	10/5/2011	APPL, Inc.	Ambient Sample
WVMA-MRS05-AMB-SD-02	SD	1354	Metals*, Explosives	10/5/2011	APPL, Inc.	Ambient Sample

* aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

The SVT completed only half of the QR that traverses the northern end of Middle Ridge from east to west. A large amount of water in the wetlands to the northwest of the ridge prevented the team from continuing.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
x	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	4-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	5-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	4
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 64°, sunny and clear, winds 0-5 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
81	***Miles Driven***	**496**
0/0	***Number of Flights/Miles Flown***	**1/2,165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

31,152	***Linear Feet:(5.9 miles)***	**115,632**

3. MC Sampling Details

0	***Soil Samples***	**5**
1	***Sediment Samples***	**2**
1	***Water Samples***	**2**

Sampling Notes: See Attached DQCR

4. QC Activities

0	***Soil Samples***	**0**
3	***Sediment Samples***	**3**
3	***Water Samples***	**3**

Sampling Notes: See Attached DQCR

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: No QA split samples for this program.

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, heat stress, cold stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone: (720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone: (850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone: (818) 397-2248	Yes	Yes
VISITORS				
Don Martin	WVDEP	Cell Phone: (304) 545-2132	Yes	Yes

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 52Cx, Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	Horriba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The SVT will ship the water and sediment samples collected on October 5, 2011, to the laboratory. The SVT will then conduct QR and surface soil sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Johnson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: **W912PP-11-C-0007**
Delivery Order Number: **0001**
Project Name: **MMRP FUDS SI**
Project Number: **748073-30002**
Site Location: **WVMA (Bearden Knob Firing Range MRS)**
Date: **5-Oct-11**

DAILY FIELD SI ACTIVITIES CONDUCTED

Don Martin from the West Virginia Department of Environmental Protection (WVDEP) accompanied the site visit team (SVT) during today's field work. The SVT conducted approximately 6 miles of qualitative reconnaissance (QR) and completed surface water and sediment sampling at the Bearden Knob Firing Range MRS (MRS05) at the Former West Virginia Maneuver Area. QR was conducted in the wetlands west of Middle Ridge. There was a large amount of water in the wetlands after the previous snow/rain, making QR extremely slow and hazardous. Therefore, the SVT could not complete the QR in the northwest portion of the wetlands. The team went as far north as they could along the Blackwater River before collecting surface water / sediment sample combination WVMA-MRS05-SW-01 and WVMA-MRS05-SD-01. The samples were collected just upstream (south) from a pipeline that traverses the river and the wetlands. No munitions debris or MEC items were found during the QR.

Surface water and sediment samples WVMA-MRS05-SW-01 and WVMA-MRS05-SD-01 were collected from within the Blackwater River, south of their proposed locations. Matrix spike (MS) and matrix spike duplicate (MSD) samples and field duplicate samples were also collected for SW-01 and SD-01. The duplicate samples were identified as WVMA-MRS05-SW-03 and WVMA-MRS05-SD-03.

TOMORROW'S OPERATION PLAN

The SVT will ship the water and sediment samples collected on October 5, 2011, to the laboratory. The SVT will then conduct QR and surface soil sampling at the Bearden Knob Firing Range (MRS05) at the West Virginia Maneuver Area FUDS.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	4.05	0.0002	0.7	19.58	1209

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
WVMA-MRS05-SW-01	9.85	0.105	12.8	5.36

Comments: Water in river appeared brown. Heavy snow and rainfall over the last few days could account for more sediment in the river.

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-SW-01	SW	1215	Metals*, Explosives	10/6/2011	APPL, Inc.	MS/MSD
WVMA-MRS05-SD-01	SD	1215	Metals*, Explosives	10/6/2011	APPL, Inc.	MS/MSD
WVMA-MRS05-SW-03	SW	1218	Metals*, Explosives	10/6/2011	APPL, Inc.	Field Duplicate of WVMA-MRS05-SW-01
WVMA-MRS05-SD-03	SD	1218	Metals*, Explosives	10/6/2011	APPL, Inc.	Field Duplicate of WVMA-MRS05-SD-01

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

Surface water and sediment samples WVMA-MRS05-SW-01 and WVMA-MRS05-SD-01 were moved south of their proposed locations. A large amount of water in the wetlands after the previous snow/rain, prevented the SVT from completing the QR in the northwest part of the wetlands, which led to the proposed sample location.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	5-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	6-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	5
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 66°, sunny and clear, winds 0-5 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
152	***Miles Driven***	**648**
0/0	***Number of Flights/Miles Flown***	**1/2165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

450	***Linear Feet:(0.09 miles)***	**116,082**

3. MC Sampling Details

1	***Soil Samples***	**6**
0	***Sediment Samples***	**2**
0	***Water Samples***	**2**

Sampling Notes: See Attached DQCR

4. QC Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**3**
0	***Water Samples***	**3**

Sampling Notes: See Attached DQCR

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: No QA split samples for this program.

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, heat stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone: (720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone: (850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone: (818) 397-2248	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 52Cx, Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	Horriba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The site visit team (SVT) will ship the surface soil sample collected on 10-6-2011 to the laboratory. The SVT will then conduct qualitative reconnaissance (QR) and surface soil sampling at the Fore Knobs / Bear Rocks Firing Ranges MRS (MRS04) at the West Virginia Maneuver Area FUDS.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Johnson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: **W912PP-11-C-0007**
Delivery Order Number: **0001**
Project Name: **MMRP FUDS SI**
Project Number: **748073-30002**
Site Location: **WVMA (Bearden Knob Firing Range MRS)**
Date: **6-Oct-11**

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT conducted less than 1.0 mile of QR and completed surface soil sampling at the Bearden Knob Firing Range MRS (MRS05) at the Former West Virginia Maneuver Area. The SVT collected the ambient soil sample, WVMA-MRS05-AMB-SS-02-07 in the southwest corner of the MRS, away from Bearden Knob (the reported firing point for the Bearden Knob Firing Range) and away from and cross-gradient from the reported location of the moving target range. The soil sample was moved from the planned location due to lack of right of entry (ROE). The soil sample was collected from the planned depth of 0 to 2 inches below ground surface (bgs). The majority of planned QR in the area could not be completed due to lack of ROE for the properties in Canaan Heights and on Bearden Knob. Additionally, soil sample WVMA-MRS05-SS-02-01 could not be collected. In preparation for the next day, the SVT spent the remainder of the day driving the roads within the Fore Knobs / Bear Rocks Firing Ranges (MRS04), identifying the location of the nearest hospital and the access points to the site and the sampling locations.

TOMORROW'S OPERATION PLAN

The SVT will ship the surface soil sample collected on 10-6-2011 to the laboratory. The SVT will then conduct QR and surface soil sampling at the Fore Knobs / Bear Rocks Firing Ranges MRS (MRS04) at the West Virginia Maneuver Area FUDS.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	N/A	N/A	N/A	N/A	N/A

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
N/A	N/A	N/A	N/A	N/A

Comments: N/A

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-AMB-SS-02-07	Soil	1017	Metals*, Explosives, pH	10/7/2011	APPL, Inc.	Ambient Sample

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

The ambient soil sample WVMA-MRS05-AMB-SS-02-07 was moved from the planned location due to lack of ROE. The majority of planned QR in the area could not be completed due to lack of ROE for the properties in Canaan Heights and on Bearden Knob. Additionally, soil sample WVMA-MRS05-SS-02-01 could not be collected due to lack of ROE.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	6-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	11-Oct-11
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	6
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 63°, overcast, winds 0-5 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
44	***Miles Driven***	**692**
0/0	***Number of Flights/Miles Flown***	**1/2,165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

0	***Linear Feet:(0.0 miles)***	**116,082**

3. MC Sampling Details

1	***Soil Samples***	**7**
0	***Sediment Samples***	**2**
0	***Water Samples***	**2**

Sampling Notes: See Attached DQCR

4. QC Activities

3	***Soil Samples***	**3**
0	***Sediment Samples***	**3**
0	***Water Samples***	**3**

Sampling Notes: See Attached DQCR

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**

Sampling Notes: No QA split samples for this program.

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, cold stress, hydration, types of dangerous vegetation, dangerous animals, insects, types of munitions, and slips, trips, and falls.

SITE VISIT TEAM (SVT)			On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Johnson	Cell Phone: (720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Jon Bell	Cell Phone: (850) 685-5145	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone: (818) 397-2248	Yes	Yes
VISITORS				
None				

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt 52Cx, Trimble GeoXT, Garmin Rhino 530 HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	NA

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/Logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The site visit team (SVT) will ship the surface soil samples collected on 10-11-2011 to the laboratory. The SVT will then conduct qualitative reconnaissance (QR) and surface soil sampling at the Fore Knobs / Bear Rocks Firing Ranges MRS (MRS04) at the West Virginia Maneuver Area FUDS.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0
ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Johnson

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: **W912PP-11-C-0007**
Delivery Order Number: **0001**
Project Name: **MMRP FUDS SI**
Project Number: **748073-30002**
Site Location: **WVMA (Bearden Knob Firing Range MRS)**
Date: **11-Oct-11**

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT met with several of the landowners for the reported moving target range at the Bearden Knob Firing Range MRS (MRS05). The SVT had hoped to obtain right-of-entry (ROE) for the land in order to conduct the proposed QR and soil sampling. However, ROE was not granted. The SVT moved soil sample WVMA-MRS05-SS-02-01 to the old fire tower property on the easternmost end of the reported moving target range. That portion of the land is owned by the Forest Service, as indicated by signage on the entrance gate. The matrix spike (MS) and matrix spike duplicate (MSD) were collected there. The sample was also collected in duplicate (sample ID WVMA-MRS05-SS-02-08). No munitions debris or MEC were observed in the immediate area. The SVT did not conduct QR on the entire property due to not being able to identify the property boundaries, and because of the watchful private landowner on the adjacent property.

TOMORROW'S OPERATION PLAN

The SVT will ship the surface soil samples collected on 10-11-2011 to the laboratory. The SVT will then conduct QR and surface soil sampling at the Fore Knobs / Bear Rocks Firing Ranges MRS (MRS04) at the West Virginia Maneuver Area FUDS.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	N/A	N/A	N/A	N/A	N/A

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
N/A	N/A	N/A	N/A	N/A

Comments: N/A

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-SS-02-01	Soil	1355	Metals*, Explosives, pH	10/12/2011	APPL, Inc.	MS/MSD
WVMA-MRS05-SS-02-08	Soil	1400	Metals*, Explosives, pH	10/12/2011	APPL, Inc.	Duplicate of SS-02-01

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

The proposed QR on Bearden Knob at the reported moving target range could not be conducted due to lack of ROE. Additionally, soil sample WVMA-MRS05-SS-02-01 was moved east of the proposed sample location due to lack of ROE.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Johnson

Name	Lauren Johnson, Field Team Leader	
Date:	11-Oct-11	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Scott Anderson (Parsons)	Carlos Hernandez (Eco)
	Sandra de las Fuentes (Parsons)	

DAILY FIELD REPORT
MMRP SITE INSPECTION

CONTRACT NO.	**W912PP-11-C-0007**	**DELIVERY ORDER NO.**	**0001**
JOB NO:	**748073-30002**	**DATE/DAY:**	17-May-12
SITE NAME:	WVMA (Bearden Knob Firing Range MRS)	**REPORT NO:**	7
USACE DISTRICT:	**CELRH**	**SHEET:**	1
WEATHER:	High of 77°, sunny, winds 0-5 mph		

WORK IN PROGRESS OR COMPLETED:

1. Mobilization/Demobilization

		CUMULATIVE
119	***Miles Driven***	**811**
0/0	***Number of Flights/Miles Flown***	**1/2,165**
3	***Number of Personnel***	**--**

2. Reconnaissance Details

10,163	***Linear Feet:(1.92 miles)***	**126,245**

3. MC Sampling Details

0	***Soil Samples***	**7**
1	***Sediment Samples***	**3**
1	***Water Samples***	**3**
	Sampling Notes: See Attached DQCR	

4. QC Activities

0	***Soil Samples***	**3**
0	***Sediment Samples***	**3**
0	***Water Samples***	**3**
	Sampling Notes: See Attached DQCR	

5. QA Activities

0	***Soil Samples***	**0**
0	***Sediment Samples***	**0**
0	***Water Samples***	**0**
	Sampling Notes: No QA split samples for this program	

6. Safety Activities

A tailgate safety briefing was conducted on site, prior to the start of field activities. Topics included communication, hospital directions, uneven terrain, heat stress, hydration, types of dangerous vegetation, dangerous animals, types of munitions, and slips trips, and falls.

SITE VISIT TEAM (SVT)				On-site Yes/No	Tailgate Brief Yes/No
Parsons Field Team Leader	Lauren Ranker	Cell Phone:	(720) 988-4413	Yes	Yes
Parsons UXO Technician/SSHO	Rick White	Cell Phone:	(425) 577-8152	Yes	Yes
Eco Sampling Technician	Steven Saunders	Cell Phone:	(818) 397-2248	Yes	Yes
VISITORS					
Don Martin	WVDEP	Cell Phone:	(304) 545-2132	Yes	Yes

EQUIPMENT LIST:

Standard Field Kit Items:	Schonstedt GA-52Cx, Trimble GeoXT, Garmin Rhino 530HCx handheld GPS/radio, Iridium 9555 Satellite Phone, field computer, digital camera, first aid kit
Water Sampling Equipment	Horiba U-22 Water Meter

QC CHECKS (Place ' **X** ' in appropriate box)

QUALITY CONTROL CHECKS	**Analog Instrument**	**YES**	X	**NO**	
	Handheld GPS	**YES**	X	**NO**	
	GIS Data Logger	**YES**	X	**NO**	

ADDITIONAL INFORMATION:

All other site details recorded in PDA/logbook.

ACTIVITIES SCHEDULED FOR NEXT WORK DAY:

The SVT will conduct qualitative reconnaissance (QR) and surface soil sampling in the Buena Small Arms MRS (MRS07) at the West Virginia Maneuver Area / Dolly Sods FUDS. The samples collected on May 17th will be shipped to the laboratory for delivery on Saturday, May 19th.

REQUEST FOR PROJECT ACTION:

None

ACCIDENTS REPORTED TODAY: 0

ACCIDENTS TO DATE: 0 **PREPARED BY FTL:** Lauren Ranker

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: **W912PP-11-C-0007**
Delivery Order Number: **0001**
Project Name: **MMRP FUDS SI**
Project Number: **748073-30002**
Site Location: **WVMA (Bearden Knob Firing Range MRS)**
Date: **17-May-12**

DAILY FIELD SI ACTIVITIES CONDUCTED

The SVT conducted approximately 2 miles of QR and collected one set of coupled surface water and sediment samples at the Bearden Knob Firing Range MRS (MRS05) at the West Virginia Maneuver Area / Dolly Sods FUDS. Don Martin from the West Virginia Department of Environmental Protection (WVDEP) accompanied the team during the QR and the sampling. Previously, ambient surface water and sediment samples WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02 were collected at this MRS. However, due to a detection of explosives in the surface water sample, a new set of ambient surface water and sediment samples was proposed. The new sample location was selected in the Blackwater River, further upstream from the MRS. The samples are identified as WVMA-MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03. The SVT found no munitions debris, MEC items, or subsurface metal anomalies during the QR or the sampling.

TOMORROW'S OPERATION PLAN

The SVT will conduct QR and surface soil sampling in the Buena Small Arms MRS (MRS07) at the West Virginia Maneuver Area / Dolly Sods FUDS. The samples collected on May 17th will be shipped to the laboratory for delivery on Saturday, May 19th.

Water Sample Equipment Calibrations (list or provide attachment)

	pH (s.u.)	Conductivity (µS/cm)	Turbidity (NTU)	Temp. (ºC)	Time
Equip. Reading:	4.01	4.48	0.1	19.87	1000

Field Instrument Measurements (list or provide attachment):

Water Sample ID:	Temp. (ºC)	Cond. (µS/cm)	Turbidity (NTU)	pH (s.u.)
WVMA-MRS05-AMB-SW-03	15.24	0.062	44.7	4.81

Comments: The water in the Blackwater River appeared brown and slightly cloudy.

List all field and quality control samples collected (list or provide attachment):

Sample ID	Media	Time	Analysis	Shipment Date	Lab	Comments
WVMA-MRS05-AMB-SW-03	SW	1117	Metals*, Explosives	5/18/2012	APPL, Inc.	Ambient Sample
WVMA-MRS05-AMB-SD-03	SD	1117	Metals*, Explosives, pH	5/18/2012	APPL, Inc.	Ambient Sample

*aluminum, antimony, copper, lead, and zinc

Departures from approved SAP:

The sediment sample will be analyzed for pH because the site is considered ecologically important and the samples will be analyzed for aluminum. One additional set of coupled surface water and sediment samples were collected (SW/SD-03) due to a detection of explosives in the surface water sample WVMA-MRS05-AMB-SW-02.

Instructions given by government personnel:

None

Check all attachments:

	Field sampling forms (in separate submittal)
	Field-generated analytical results
X	Chain-of-custody forms (in separate submittal)

Signed by: Lauren N. Ranker

Name	Lauren Ranker, Field Team Leader	
Date:	17-May-12	
Phone	Cell: (720) 988-4413	Office: (303) 764-8830
Copies sent to:		
	Richard Meadows (CELRH PM)	Brian Jordan (CESPA)
	Laura Kelley (Parsons PM)	Mohammad Estiri (Eco - PM)
	Brenda Galloway (Parsons)	Opjit Ghuman (Eco)
	Sandra de las Fuentes (Parsons)	Carlos Hernandez (Eco)

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

CHAIN OF CUSTODY RECORD

Client ~~Parsons~~ ECO & Assoc, Inc	~~Parson Geographic Lead~~ Eco Manager Mohammad Estimi	Date 10/3/11	Chain of Custody Number 1754
Address 1855 W. Katella Av. Ste 340	Telephone Number (Area Code)/Fax Number (714) 289-0995	Lab Number 559 275-2175	Page 1 of 1
City Orange, State CA, Zip Code 92867	Site Contact 720-988-4413 Lauren Johnson	Lab Contact: Diane Anderson	
Project Name and Location (State) WVMA MRSO5 MRSO6 (WV)	Carrier/Waybill Number 850447479880		
Contract/Purchase Order/Quote No. ECO-11-452			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: AQ	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: 8330B	6010B	9045D						Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
WVMA-MRSO6-SS-02-05	9/30/11	1341			X		2							X	X	X									Al, Co Pb Zn
WVMA-MRSO6-SS-02-09	9/30/11	1400			X		2							X	X	X									Al, Co Pb Zn
WVMA-MRSO5-SS-02-04	10/1/11	1337			X		2							X	X	X									Al, Co, Sb, Pb, Zn
WVMA-MRSO5-SS-02-05	10/1/11	1250			X		2							X	X	X									" "
WVMA-MRSO5-SS-02-06	10/1/11	1132			X		2							X	X	X									" "

1. Relinquished By	Date 10/3/11	Time 0920	1. Received By	Date 10/4/11	Time 1000
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments **Fed Ex Priority Overnight** 850447479880

# of Coolers this Shipment (1)

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

65910
3.0

INC

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

CHAIN OF CUSTODY RECORD

Client: ~~Parsons~~ Eco & Assoc. Inc.	~~Person Geographic Lead~~ Eco. Proj. Manager Mohammad Estiri	Date: ~~10/4~~ 10/5/11 Hscs	Chain of Custody Number: 1773
Address: 1855 W. Katella Av. Ste 340	Telephone Number (Area Code)/Fax Number: (714) 289-0995	Lab Number: 559 275-2175	Page 1 of 1
City: Orange; State: CA; Zip Code: 92867	Site Contact: 720 988 4913 Lauren Johnson; Lab Contact: Diane Anderson	Analysis (Attach list if more space is needed)	
Project Name and Location (State): WVMA MRSOS (W. Virginia)	Carrier/Waybill Number: 850 4474 7979 8		
Contract/Purchase Order/Quote No.: Eco-11-452			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Wtr	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		8330B	6010B*	9045D							Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
WVMA-MRSOS-SS-02-02	10/3/11	1100			X		2							X	X	X										*Al, Cu, Sb
WVMA-MRSOS-SS-02-03	10/3/11	1417			X		2							X	X	X										Pb, Zn only
WVMA-MRSOS-Amb-SW-02	10/4/11	1354	X				2		1					X	X											↓ ↓
WVMA-MRSOS-Amb-SD-02	10/4/11	1354		X			2							X	X											
~~WVMA-MRSOS-SD-01~~	~~10/4/11~~	~~1550~~		~~X~~			~~6~~							~~X~~	~~X~~											~~MS, MD (Al, Cu, Pb, Zn only)~~
~~WVMA-MRSOS-SD-05~~	~~10/4/11~~	~~1600~~		~~X~~			~~2~~							~~X~~	~~X~~											
Cancel SD-01 SD-05 SZ 10/6/11																										

1. Relinquished By	Date 10/5/11	Time 0745	1. Received By	Date 10/6/11	Time 1000
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments: **Fed Ex Priority Overnight** 850 4474 7979 8

# of Coolers this Shipment: 1

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

65910
3.0

CHAIN OF CUSTODY RECORD

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

Client: ~~Parsons~~ Eco & Assoc., Inc.	~~Parson Geographic Lead~~ Eco. Proj. Manager Mohammad Estiri	Date: ~~10/4/11~~ 10/5/11 SCS	Chain of Custody Number: 1773
Address: 1855 W. Katella Av. ste 340	Telephone Number (Area Code)/Fax Number: (714) 289-0995	Lab Number: 559 275-2175	Page 1 of 1
City: Orange; State: CA; Zip Code: 92867	Site Contact 720 988 4913 Lauren Johnson; Lab Contact: Diane Anderson	Analysis (Attach list if more space is needed)	
Project Name and Location (State): WVMA MRS05 (W. Virginia)	Carrier/Waybill Number: 850 4474 7979 8		
Contract/Purchase Order/Quote No.: Eco - 11 - 452			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: AQ	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	8330B	6010B*	9045D							Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
WVMA-MRS05-SS-02-02	10/3/11	1100			X		2						X	X	X										*Al, Cu, Sb
WVMA-MRS05-SS-02-03	10/3/11	1417			X		2						X	X	X										Pb, Zn only
WVMA-MRS05-Amb-SW-02	10/4/11	1354	X				2		1				X	X											
WVMA-MRS05-Amb-SD-02	10/4/11	1354		X			2						X	X											
~~WVMA-MRS06-SD-01~~	~~10/4/11~~	~~1550~~		~~X~~			~~6~~						~~X~~	~~X~~	~~7~~	delete per Sandra's									~~MS, MD (AT,~~
~~WVMA-MRS06-SD-05~~	~~10/4/11~~	~~1600~~		~~X~~			~~2~~						~~X~~	~~X~~	}	email 10-6-11									~~Cu, Pb, Zn only)~~

1. Relinquished By	Date 10/5/11	Time 0745	1. Received By	Date 10/6/11	Time 1000
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments **Fed Ex Priority Overnight** 850 4474 7979 8

# of Coolers this Shipment: 1

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

10-8-11 dh

65935
25
3.5

CHAIN OF CUSTODY RECORD

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

Client: ~~Parsons~~ Eco & Assoc. Inc.	~~Parsons Geographic Lead~~ Eco Proj. Mngr: Mohammad Estiri	Date: 10/6/11	Chain of Custody Number: 1774
Address: 1855 W. Katella Av. Ste 340	Telephone Number (Area Code)/Fax Number: (714) 289-0995	Lab Number: 559 275-2175	Page of
City: Orange; State: CA; Zip Code: 92867	Site Contact: Lauren Johnson	Lab Contact: Diane Anderson	
Project Name and Location (State): WVMA-MRS05 (WV)	Carrier/Waybill Number: 850 4474 7174 5		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aq	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		8330B	6010B*								Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
WVMA-MRS05-SW-01	10/5/11	1215	X				6		3					X	X											*Al, Cu, Pb,
WVMA-MRS05-SD-01	10/5/11	1215		X			6							X	X											Sb, Zn only
WVMA-MRS05-SW-03	10/5/11	1218	X				2		1					X	X											Run MS/MD
WVMA-MRS05-SD-03	10/5/11	1218		X			2							X	X											on SW-01
																										& SD-01

1. Relinquished By	Date: 10/6/11	Time	1. Received By	Date: 10/7/11	Time: 1000
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments: **Fed Ex Priority Overnight** 850 4474 7974 3

# of Coolers this Shipment: 2

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

65942

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

CHAIN OF CUSTODY RECORD

11°C

Client ~~Parsons~~ Eco & Assoc. Inc.	~~Parson Geographic Lead~~ Eco proj. manager Mohammad Estiri	Date 10/7/11	Chain of Custody Number 1775
Address 1855 W. Katella Av. Ste. 340	Telephone Number (Area Code)/Fax Number (714) 289-0995	Lab Number 559 275-2175	Page 1 of 1
City Orange / State CA / Zip Code 92867	Site Contact Lauren Johnson	Lab Contact: Diane Anderson	
Project Name and Location (State) WVMA - MRSOS (WV)	Carrier/Waybill Number 850 447 479 776		
Contract/Purchase Order/Quote No. Eco-11-452			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: AQ	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		8330B	6010B*	9045D							Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
~~WVMA-MRSOS-Amb-SS-0207~~																										SCS
WVMA-MRSOS-Amb-SS-02-07	10/6/11	1017			X		2							X	X	X										*Al, Cu, Pb Sb, Zn only

1. Relinquished By	Date 10/7/11	Time 0600	1. Received By Alicia Alfaro	Date 10/08/11	Time 10:56
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments **Fed Ex Priority Overnight** 850 447 479 776

# of Coolers this Shipment 1

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

65971(2)
2.5

APPL, Inc. 908 N Temperance Ave, Clovis, CA 93611
Phone: 559-275-2175 Fax: 559-275-4422

CHAIN OF CUSTODY RECORD

Client: ~~Parsons~~ Eco & Assoc. Inc.	~~Parson Geographic Lead~~ Eco Proj. Manager: Mohammad Estiri	Date: 10/12/11	Chain of Custody Number: 1761
Address: 1855 W. Katella Av. #340	Telephone Number (Area Code)/Fax Number: (714) 289-0995	Lab Number: 559 275-2175	Page 1 of 1
City: Orange; State: CA; Zip Code: 92867	Site Contact: Lauren Johnson	Lab Contact: Diane Anderson	
Project Name and Location (State): WVMA (WV)	Carrier/Waybill Number: 85044 7479 802		
Contract/Purchase Order/Quote No.: Eco-11-452			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: AQ	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		Analysis: 8330B	6010B*	9045D							Firing Point	High Lead	HE Site	Special Instructions/ Conditions of Receipt
WVMA-MRS05-SS-02-01	10/11/11	1355			X		6							X	X	X										MS, MD
WVMA-MRS05-SS-02-08	10/11/11	1400			X		2							X	X	X										* Al, Cu, Pb
																										Zn ~~only~~ &
																										Sb only

1. Relinquished By	Date 10/12/11	Time 0700	1. Received By	Date 10/13/11	Time 0955
2. Relinquished By	Date	Time	2. Received By	Date	Time

Comments **Fed Ex Priority Overnight**

# of Coolers this Shipment: 1

DISTRIBUTION: WHITE - Returned to Client with Report Canary - Stays with the Sample Pink - Field Copy

CHAIN OF CUSTODY RECORD

APPL, Inc.
908 N Temperance Ave
Clovis, CA 93611

Phone: (559) 275-2175
Fax: (559) 275-4422

C.O.C. 37928

(1) cooler

Report to: PLEASE PRINT

Company Name: ECO & ASSOC, INC Phone: (714) 289-0995
Address: 1855 W. Katella AV #340
Orange, CA 92867 Fax: (714) 289-0965
Attn: Carlos Hernandez

Invoice to: PLEASE PRINT

Company Name: ECO & ASSOC. INC. Phone: (714) 289-0995
Address: 1855 W. Katella AV. #340
Orange CA 92867 Fax: (714) 289-0965
Attn: Carlos Hernandez

Project Name/Number: Eco-11-452
Purchase Order Number:
Sampler (Print): Steven Saunders
Sampler (Signature):

Date Shipped: 5/18/12
Carrier: Fed Ex
Waybill No.: 8726 2266 2670
Comments: *Metals = Al, Sb, Cu, Pb, Zn

Sample Identification	Location	Date Collected	Time Collected	Time Zone	No. of Containers	Matrix: Aq	Matrix: Sed.	Matrix: Soil		Explos. Des 8330	Metals * 6020	pH									
WVMA-MRSOS-AMB-SW-03	WVMA MRSOS	5/17/12	1117	EDT	3	X				X	X										
WVMA-MRSOS-AMB-SD-03	WVMA MRSOS	5/17/12	1117	EDT	2		X			X	X	X									

Shuttle Temperature:

Turnaround Requested: Check one
☑ Standard 2-3wk ☐ One week ☐ 24/48 Hrs. ☐ Other

Sample Disposal:
☐ Return to client ☐ Disposal by Lab (30-day retention) Refer to Contract

Relinquished by sampler:	Date	Time	Received by:	Relinquished by:	Date	Time	Received by:
	5/18/12	0730					
Relinquished by:	**Date**	**Time**	**Received by:**	**Relinquished by:**	**Date**	**Time**	**Received at lab by:**
					05/19/12	12:50	Alicia Alfaro

White: Return to client with report Yellow: Laboratory Copy Pink: Sampler

See reverse side for Container Preservative and Sampling Information

(1) cooler

APPENDIX E

PHOTOGRAPH DOCUMENTATION LOG

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Saturday, October 01, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 11:32:00 AM **Point_ID:** 1

Team Leader: Lauren Johnson
Sampler: Carlos Hernandez
Sample ID: WVMA-MRS05-SS-02-06

MRSPP Menu: None
MRSPP Note: None

Easting 642205
Northing 4329630

Vegetation: Thin Trees
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

Barrier: None
Topography: Steep Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: Single Item
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Accessed this area from A Frame Road.

Subsurface anomaly detected. Moved sample WVMA-MRS05-SS-02-06 here.

10012011_1122.JPG
Location of subsurface anomaly.

10012011_1123.JPG
Collecting surface soil.

10012011_1127.JPG
Placing soil in sample jars.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Saturday, October 01, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 12:50:00 PM **Point_ID:** 2

Team Leader: Lauren Johnson
Sampler: Carlos Hernandez
Sample ID: WVMA-MRS05-SS-02-05

MRSPP Menu: None
MRSPP Note: None

Easting 641314.12
Northing 4328405.116

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Found no munitions debris in the area.

Vegetation: Thin Trees
Drainage: None
SoilType: Clayey Organic
SoilColor: Brown

Barrier: None
Topography: Steep Slope
Surface Feature: None
Surface Debris: None

10012011_1235.JPG
Placing sample template.

10012011_1241.JPG
Collecting surface soil.

10012011_1244.JPG
Placing soil in sample jars.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Saturday, October 01, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:05:10 PM **Point_ID:** 3

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640975
Northing 4328001

Hiking along Cabin Mountain Trail, which is accessible from A Frame Road. Found nothing of interest.

10012011_1301a.JPG
Facing northeast up the trail. FTL collecting observation point.

10012011_1301b.JPG
Facing southwest down the trail.

10012011_1302.JPG
Facing west into the trees and brush.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Saturday, October 01, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:37:00 PM **Point_ID:** 4

Team Leader: Lauren Johnson
Sampler: Carlos Hernandez
Sample ID: WVMA-MRS05-SS-02-04

MRSPP Menu: None
MRSPP Note: None

Easting 640978
Northing 4327551

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Nothing of interest in area.

Vegetation: Thin Trees
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

Barrier: None
Topography: Steep Slope
Surface Feature: None
Surface Debris: None

10012011_1325.JPG
Collecting surface soil.

10012011_1331a.JPG
Placing soil in sample jars.

10012011_1331b.JPG
View of terrain: steep slope with thin trees.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Saturday, October 01, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 2:16:18 PM **Point_ID:** 5

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
MRSPP Menu: None
MRSPP Note: None
Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A
Easting 640792.115
Northing 4328430.665

Glade Run full of water

Vegetation: Mixed Brush + Grass
Drainage: Creek
SoilType: Sand
SoilColor: Brown
Barrier: None
Topography: Gentle Slope
Surface Feature: Hiking Trail
Surface Debris: None

10012011_1413a.JPG
Facing west toward Glade Run.

10012011_1413b.JPG
Facing northwest. Middle Ridge in the background.

10012011_1413c.JPG
Facing south along Glade Run.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:39:31 AM | **Point_ID:** 6

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: N/A
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 636255.365
Northing 4329631.921

Standing below Bearden Knob. This 4WD road stems off of Canaan Heights Road.

Nothing visible in the distance because of the fog.

10032011_1036a.JPG
Facing northeast down the 4WD road.

10032011_1036b.JPG
Facing east toward the Canaan Valley. FTL collecting observation point.

10032011_1036c.JPG
Facing southwest up the 4WD road.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 11:00:00 AM **Point_ID:** 7

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-SS-02-02

MRSPP Menu: None
MRSPP Note: None

Easting 636455.899975
Northing 4329921.983819

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Steep slope below Bearden Knob.

Collected the soil sample above the road.

Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Clayey Sand
SoilColor: Brown

Barrier: None
Topography: Steep Slope
Surface Feature: None
Surface Debris: None

10032011_1057.JPG
Sample location.

10032011_1108a.JPG
View of sample location above 4WD road.

10032011_1108b.JPG
View down the slope below the road.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:03:28 PM **Point_ID:** 8

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: Creek
SoilType: Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639612
Northing 4327215

With help from the NWR, the team was permitted to access this area through the Mountain Top Realty and Rentals subdivision.

Started the QR at the north end of Sand Run Road, at the southern extent of the wildlife refuge.

10032011_1300a.JPG
Facing northeast, up stream. Footbridge crosses Sand Run.

10032011_1300b.JPG
Facing north. Thick brush along Sand Run.

10032011_1300c.JPG
Facing southwest, downstream.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 1:23:01 PM | **Point_ID:** 9

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639931.749
Northing 4327712.893

Hiking along Middle Ridge Trail.

10032011_1319a.JPG
Facing north along trail. FTL collecting observation point.

10032011_1319b.JPG
Facing south along trail.

10032011_1319c.JPG
Facing southeast into the trees and brush.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:43:39 PM **Point_ID:** 10

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grass + Trees
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Broken Terrain
Surface Feature: None
Surface Debris: None

Subsurface Met: High Density
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639880.98
Northing 4328000.14

Found a clearing in the trees, just off of Middle Ridge Trail.

Lots of mounded areas and many subsurface detections throughout the clearing and on the edges of the clearing.

10032011_1338a.JPG
View of clearing. Facing southwest.

10032011_1338b.JPG
One of several mounds at the north edge of the clearing.

10032011_1338c.JPG
Gully along the west edge of the clearing.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 2:17:00 PM | **Point_ID:** 11

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-SS-02-03

MRSPP Menu: None
MRSPP Note: None

Easting 639971.932
Northing 4328330.414

Vegetation: Mixed Brush + Grass
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: Medium Density
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Large clearing with some subsurface anomalies. Collected surface soil sample SS-02-03 near the anomalies.

10032011_1405.JPG
Clearing vegetation from the sample location.

10032011_1408a.JPG
Collecting surface soil.

10032011_1408b.JPG
View of clearing to the west of the sample location.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Monday, October 03, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 2:38:29 PM | **Point_ID:** 12

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: None
SoilType: Rocky
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640721.093
Northing 4328429.741

Rocky terrain with low grasses and scattered brush on east edge of Middle Ridge, near Glade Run.

10032011_1436a.JPG
Facing northeast toward Glade Run and the Cabin Mountains.

10032011_1436b.JPG
Facing southeast toward the Cabin Mountains.

10032011_1436c.JPG
Facing northwest toward Middle Ridge.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 9:18:07 AM | **Point_ID:** 13

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640271.335
Northing 4328749.913

Clearing along 4WD road. No subsurface anomalies or munitions debris found. Road leads eastward toward Glade Run.

Unusual ridges in ground surface parallel road. Ridges were most likely created when the road was graded.

10042011_0914.JPG
Facing north. Unusual ridges in ground surface parallel road.

10042011_0915a.JPG
Facing northeast. UXO Technician scanning for subsurface anomalies.

10042011_0915b.JPG
Facing southwest.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 9:35:28 AM | **Point_ID:** 14

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640493.597
Northing 4329285.609

Clearing in the trees. Tiny pines, ferns and grass cover the ground here.

Nothing else of interest.

10042011_0931a.JPG
Facing north.

10042011_0931b.JPG
Facing south.

10042011_0931c.JPG
Facing east.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 9:58:28 AM | **Point_ID:** 15

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Thin Trees
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640534.092
Northing 4330101.634

Found a couple car parts on the side of the trail. Otherwise, nothing of interest in area.

10042011_0956a.JPG
Facing northeast along Middle Ridge Trail.

10042011_0956b.JPG
Facing southwest.

10042011_0957.JPG
Fender and miscellaneous car parts on the side of the trail.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 10:16:45 AM **Point_ID:** 16

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: Wetland
SoilType: Clayey Silt
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: Low Density
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640642.495
Northing 4330464.941

Explored a clearing off of the trail. Found a few subsurface anomalies. Ground is saturated and many areas have ponded water.

10042011_1014a.JPG
UXO Technician scanning ground for subsurface anomalies. Facing south.

10042011_1014b.JPG
Facing north.

10042011_1014c.JPG
FTL collecting observation point.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:27:07 AM | **Point_ID:** 17

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: High Density
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640786.224
Northing 4330786.473

Wellhead says "CA CSCO WELLHEAD 556"

The clearing is to the east of Middle Ridge Trail.

10042011_1024.JPG
Facing east toward wellhead.

10042011_1025.JPG
Lettering on wellhead.

10042011_1026a.JPG
Facing west toward clearing.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:50:38 AM | **Point_ID:** 18

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Brush + Grass
Drainage: None
SoilType: Silty Sand
SoilColor: Red

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 640197.764
Northing 4331277.939

Nothing of interest except wild blueberry bushes. Trail is very wet.

10042011_1048a.JPG
Facing west along trail.

10042011_1048b.JPG
Facing south.

10042011_1048c.JPG
Vegetation includes low brush, scattered trees, and grasses.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 11:02:14 AM **Point_ID:** 19

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
MRSPP Menu: None
MRSPP Note: None
Easting 639918.411
Northing 4331248.45
Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Trail has turned into a river that dead ends in a pond. The surrounding areas are too saturated to traverse.

Vegetation: Grasses
Drainage: Wetland
SoilType: Silty Sand
SoilColor: Red
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

10042011_1100a.JPG
Facing north.

10042011_1100b.JPG
Facing west.

10042011_1101.JPG
Facing southwest.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:14:58 PM **Point_ID:** 20

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note: None

Easting 639308.682
Northing 4327535.634

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Overlook of Sand Run.

Vegetation: Grass + Trees
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

Barrier: None
Topography: Steep Slope
Surface Feature: Hiking Trail
Surface Debris: None

10042011_1315a.JPG
Facing south along trail.

10042011_1314b.JPG
Caterpillar of a Hickory Tussock Moth.

10042011_1314a.JPG
Facing west toward Sand Run.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 04, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 1:54:00 PM **Point_ID:** 21

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-AMB-SW-02

MRSPP Menu: None
MRSPP Note: None

Easting 639001.368
Northing 4327874.294

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Collected an ambient surface water and sediment sample on the Blackwater River.

WVMA-MRS05-AMB-SW-02 and WVMA-MRS05-AMB-SD-02

Vegetation: Mixed Brush + Grass
Drainage: River
SoilType: Sand
SoilColor: Brown

Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

10042011_1340a.JPG
Collecting parameters of the river with the water meter.

10042011_1343a.JPG
Sample Tech collecting surface water sample.

10042011_1345.JPG
Collecting sediment sample.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 9:28:07 AM **Point_ID:** 22

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grass + Trees
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: Hiking Trail
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639211.888
Northing 4327638.108

Nothing of interest.

A member of the West Virginia Department of Environmental Protection (WVDEP) has joined the site visit team for the day.

10052011_0925a.JPG
Tree and field team. Facing south.

10052011_0925b.JPG
Facing west. Hilly terrain covered in trees and grass.

10052011_0926.JPG
Facing north along the trail.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 9:45:56 AM **Point_ID:** 23

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
MRSPP Menu: None
MRSPP Note: None
Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A
Easting 639331.794
Northing 4328124.46

Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Organic
SoilColor: Brown
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

10052011_0943.JPG
Facing northeast. FTL collecting observation point.

10052011_0944a.JPG
Facing southwest. Forest floor is covered in leaves and undergrowth.

10052011_0944b.JPG
Facing west into the trees and brush.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 10:01:16 AM **Point_ID:** 24

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
MRSPP Menu: None
MRSPP Note: None
Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A
Easting 639353.368
Northing 4328509.484

Crossed a small unnamed creek.

Vegetation: Thin Trees
Drainage: Creek
SoilType: Silty Organic
SoilColor: Brown
Barrier: None
Topography: Gentle Slope
Surface Feature: Hiking Trail
Surface Debris: None

10052011_0958a.JPG
Facing northwest.

10052011_0958b.JPG
Facing southeast. FTL collecting observation point next to creek.

10052011_0959.JPG
Facing west across creek.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:22:07 AM | **Point_ID:** 25

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Grasses
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: N/A
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639472.4
Northing 4328852.733

Wellhead in the center of a clearing. Three concrete pads next to the well.

Also an old outhouse and a 4WD road nearby.

10052011_1018a.JPG
Wellhead with concrete pads around it.

10052011_1020.JPG
Lettering on the wellhead reads "S CO C&A GAS COMPANY WELL 418."

10052011_1030.JPG
Outhouse in trees.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 10:41:07 AM **Point_ID:** 26

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Trees + Grasses
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: Hiking Trail
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639108.573
Northing 4329024.065

Site visit team is following a 4WD trail toward the wetlands and the Blackwater River on the west side of the MRS.

Trail is very overgrown with grass and hard to follow. Vegetation consists of huckleberry bushes, grass, and thorny trees.

10052011_1039b.JPG
Facing northwest. FTL and a member of the WVDEP.

10052011_1039c.JPG
Facing west. Lots of trees in the area with sharp thorns like this one.

10052011_1039d.JPG
Facing southwest.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:53:33 AM | **Point_ID:** 27

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Trees + Grasses
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 638738.58
Northing 4328964.761

Several mounds of soil in area, but no subsurface anomalies detected in or around them.

10052011_1051a.JPG
Facing north. FTL collecting observation point on top of mound.

10052011_1051b.JPG
Facing east toward more mounded areas.

10052011_1051c.JPG
Facing west.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 11:32:14 AM **Point_ID:** 28

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None
Vegetation: Mixed Brush + Grass
Drainage: Wetland
SoilType: Clayey Silt
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Flat
Surface Feature: Hiking Trail
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 638151.066
Northing 4328988.089

Followed a pipeline westward through the wetlands of the Canaan Valley, toward the Blackwater River.

Ground is extremely saturated and covered in ponded water and thick mats of vegetation.

10052011_1129a.JPG
Facing NW toward the Blackwater River and Bearden Knob.

10052011_1129b.JPG
Facing north across the wetlands toward Brown Mountain and Canaan Mountain.

10052011_1129c.JPG
Facing northeast toward Middle Ridge.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 12:15:00 PM **Point_ID:** 29

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-SW-01
Vegetation: Brush + Grasses
Drainage: River
SoilType: Silt
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 637798.679
Northing 4329373.119

Blackwater River, upstream from a pipeline that is suspended over the river. The water level is high and the water is a brown color.

WVMA-MRS05-SW-01, WVMA-MRS05-SD-01, MS/MSD, and Field Duplicates (WVMA-MRS05-SW-03, WVMA-MRS05-SW-

10052011_1205.JPG
Collecting parameters in river. Banks are heavily vegetated and steep.

10052011_1208b.JPG
Sample Tech collecting surface water samples.

10052011_1218c.JPG
Placing sediment in sample jars.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Wednesday, October 05, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 2:02:49 PM | **Point_ID:** 30

Team Leader: Lauren Johnson
Sampler: None
Sample ID: None

MRSPP Menu: None
MRSPP Note: None

Easting 639689.574
Northing 4328640.679

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

A 2-inch diameter metal pipe follows the edge of the trail (above-ground) for a long way.

The pipe may be related to the oil/gas well at the beginning of the trail to the west.

Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Organic
SoilColor: Brown

Barrier: None
Topography: Gentle Slope
Surface Feature: 4WD road
Surface Debris: None

10052011_1358a.JPG
Facing east along 4WD trail.

10052011_1358b.JPG
Facing west along trail.

10052011_1359.JPG
Facing north into dense trees and brush.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Thursday, October 06, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 10:17:00 AM | **Point_ID:** 31

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-AMB-SS-02-07
Vegetation: Mixed Brush + Grass
Drainage: None
SoilType: Clayey Organic
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 635604.859
Northing 4328755.843

Moved the ambient soil sample to this location due to lack of right-of-entry for the proposed location. Ground is covered in thick ferns.

Collected the sample in the SW corner of the MRS, away from Bearden Knob and the reported location of the moving target range.

10062011_1000c.JPG
Gently sloping terrain covered in thin trees and ferns.

10062011_1001.JPG
Sample Tech collecting surface soil.

10062011_1010.JPG
Sample Tech placing soil in sample jars.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Tuesday, October 11, 2011

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 1:55:00 PM | **Point_ID:** 32

Team Leader: Lauren Johnson
Sampler: Steven Saunders
Sample ID: WVMA-MRS05-SS-02-01

MRSPP Menu: None
MRSPP Note: None

Easting 636081.204
Northing 4329620.187

Vegetation: Grasses
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

Barrier: None
Topography: Gentle Slope
Surface Feature: None
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Collected sample on Bearden Knob, at east extent of reported moving target range.

MS/MSD and Duplicate sample (WVMA-MRS05-SS-02-08)

10112011_1235b.JPG
View of weather station and UXO Tech next to sample location.

10112011_1242.JPG
Sample Tech collecting surface soil.

10112011_1249.JPG
Placing soil in sample jars.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Thursday, May 17, 2012

Property: West Virginia Maneuver Area **Area:** MRS05 **Time** 10:31:26 AM **Point_ID:** 33

Team Leader: Lauren Ranker
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639129.378
Northing 4327375.035

Following upper 4WD road down to the Blackwater River.

05172012_1031a.JPG
Facing north along 4WD road.

05172012_1031b.JPG
Facing northeast downhill.

05172012_1031c.JPG
Facing south along 4WD road.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Thursday, May 17, 2012

Property:	West Virginia Maneuver Area	***Area:***	MRS05	***Time***	11:17:00 AM	***Point_ID:***	34

Team Leader:	Lauren Ranker	***MRSPP Menu:***	None			***Easting***	638534.795
Sampler:	None	***MRSPP Note:***	None	***Subsurface Met:***	No Detect	***Northing***	4327505.926
Sample ID:	WVMA-MRS05-AMB-SW-03			***MEC:***	None		
Vegetation:	Grasses	***Barrier:***	None	***MEC/MOD:***	N/A		
Drainage:	River	***Topography:***	Gentle Slope	***MD:***	None		
SoilType:	Silty Sand	***Surface Feature:***	None				
SoilColor:	Brown	***Surface Debris:***	None	***MD/MOD:***	N/A		

Collected new ambient SW/SD sample in Blackwater River. WVMA-MRS05-AMB-SW-03 and WVMA-MRS05-AMB-SD-03.

The previous ambient samples (SW/SD-02) collected further downstream resulted in a detection of explosives.

05172012_1105a.JPG
Sample Tech collecting surface water sample.

05172012_1117b.JPG
Sample Tech collecting sediment sample.

05172012_1117d.JPG
View upstream along Blackwater River.

Field Team Leader's Site Observations
Bearden Knob Firing Range MRS, Tucker and Grant Counties, West Virginia

Thursday, May 17, 2012

Property: West Virginia Maneuver Area | **Area:** MRS05 | **Time** 11:52:43 AM | **Point_ID:** 35

Team Leader: Lauren Ranker
Sampler: None
Sample ID: None
Vegetation: Mixed Trees + Brush
Drainage: None
SoilType: Silty Sand
SoilColor: Brown

MRSPP Menu: None
MRSPP Note: None
Barrier: None
Topography: Steep Slope
Surface Feature: 4WD road
Surface Debris: None

Subsurface Met: No Detect
MEC: None
MEC/MOD: N/A
MD: None
MD/MOD: N/A

Easting 639415.563
Northing 4327184.902

Following lower 4WD road.

Facing northwest along 4WD road.

Facing northeast down the hill.

Facing southeast along 4WD road.

APPENDIX F

ANALYTICAL DATA

THE ATTACHED CD-ROM INCLUDES THE ENTIRE ANALYTICAL DATA VALIDATION PACKAGE CASE NOS.: 65891, 65910, 65935, 65942, 65971, AND 67821 IN PDF FORMAT

APPENDIX G

ANALYTICAL DATA QA/QC REPORT

DATA VALIDATION SUMMARY REPORT

for samples collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: November 8th, 2011

Parsons - Austin

INTRODUCTION

The following data validation summary report covers three soil samples collected from Bearden Knob Firing Ranges, West Virginia on October 1st, 2011. Samples were logged in under the following Sample Delivery Group (SDG):

65891

All three samples were analyzed for explosives, metals, and pH. Metals included aluminum, antimony, copper, lead and zinc. The following table details the field sample identification and requested parameters.

These samples were collected by Parsons and were shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL). The cooler was received by the laboratory at a temperature of 2.5°C, which was within the 2-6°C range recommended by the PSAP.

All soil samples were prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives, Metals, & pH	Comments
WVMA-MRS05-SS-02-04	S	X	
WVMA-MRS05-SS-02-05	S	X	
WVMA-MRS05-SS-02-06	S	X	

S = Soil

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	S	8330B	8330B	mg/kg	Dry Wt.
Metals	S	3050B	6010B	mg/kg	Dry Wt.
pH	S	NA	9045D	NA	NA

See the end of this report for detailed description of the sample preparation procedures.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria	Maximum RPD (%)
HMX	75-125%	30
RDX	70-135%	30
1,3,5-Trinitrobenzene	75-125%	30
1,3-Dinitrobenzene	80-125%	30
Nitrobenzene	75-125%	30
Tetryl	10-150%	30
Nitroglycerin	68-131%	30
2,4,6-Trinitrotoluene	55-140%	30
4-Amino-2,6-dinitrotoluene	80-125%	30
2-Amino-4,6-dinitrotoluene	80-125%	30
2,4-Dinitrotoluene	80-125%	30
2,6-Dinitrotoluene	80-120%	30
3-Nitrotoluene	75-120%	30
PETN	69-132%	30
2-Nitrotoluene	80-125%	30
4-Nitrotoluene	75-125%	30

1,2-Dinitrobenzene (Surrogate)	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) are 80-120%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of three (3) soil samples. These samples were collected on October 1st, 2011 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. All samples were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. All samples were prepared and analyzed within the holding time required by the method. The screening value for 1,3-dinitrobenzene is below the PQL; however it is above the MDL. Therefore any detection between the MDL and PQL would be identified for decision-making purposes.

The explosives samples were extracted in one batch (#111011A). All samples were analyzed under a single initial calibration (ICAL). Sample analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the LCS and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria except 3-Nitrotoluene was recovered at 121% in the LCS with control limits of 75-120%. Since this compound was not detected in any of the three field samples, no flag was needed.

Precision

Precision could not be evaluated due to the lack of duplicate analysis in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blank for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. These samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.

There was one method blank associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the samples in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The metals portion of this SDG consisted of three (3) soil samples. These samples were collected on October 1st, 2011. Samples were analyzed for a reduced list of metals that included aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. These samples were analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

All samples were digested in one batch (#111019A1). All samples were analyzed under a single ICAL. All analyses were initially performed undiluted. Samples were reanalyzed at a dilution of 10x for aluminum due to high concentrations of aluminum present in the samples.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS.

All LCS recoveries were within acceptance criteria.

Precision

Precision could not be evaluated due to the lack of duplicate analysis in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

These samples were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS05-SD-01 from Bearden Knob Firing Ranges, SDG 65935. The DT was only applicable for aluminum, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Aluminum met criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	4.1	%D ≤ 10

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for antimony, copper, lead, and zinc only since aluminum met criteria in the DT. All four metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	88	75 – 125%
Copper	95	
Lead	81	
Zinc	80	

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action

level as listed in the PSAP for this site.

There was one method blank and several calibration blanks associated with the metals analyses in this SDG. All blanks were compliant.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the samples in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

pH

General

The pH portion of this SDG consisted of three (3) soil samples. These samples were collected on October 1st, 2011 and were tested for pH.

The pH analyses were performed using USEPA SW846 Method 9045D. These samples were analyzed following the procedures outlined in the Work Plan. These samples were tested for pH on the sample delivery day.

Accuracy

The pH meter was calibrated with pH 7.00 buffer standard solution.

Precision

Precision was evaluated based on parent and lab duplicate (LD) pH readings. Lab performed the lab duplicate with sample WVMA-MRS05-SS-02-06. Both parent and LD samples have pH reading of 4.3.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan; and
- Evaluating preservation and holding times.

All samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan.

- All calibration criteria were met.
- All calibration verification criteria were met.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pH result for the samples in this SDG were considered usable. The completeness for the pH portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The laboratory quality control samples and evaluated criteria included analytical duplicate, method blanks, laboratory control samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

DATA VALIDATION SUMMARY REPORT

for samples collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: November 14th, 2011

Parsons - Austin

INTRODUCTION

The following data validation summary report covers two soil samples, one sediment sample, and one surface water sample collected from Bearden Knob Firing Ranges, West Virginia on October 3 & 4, 2011. Samples were logged in under the following Sample Delivery Group (SDG):

65910

The sediment and surface water samples were analyzed for explosives and metals. Metals included aluminum, antimony, copper, lead and zinc. The soil samples were analyzed for pH in addition to the explosives and metals. The following table details the field sample identification and requested parameters.

These samples were collected by Parsons and were shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL). The cooler had temperature reading of 3.0°C, which was within the 2-6°C range recommended by the PSAP.

All samples were prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives & Metals	Comments
WVMA-MRS05-SS-02-02	S	X	
WVMA-MRS05-SS-02-03	S	X	
WVMA-MRS05-AMB-SW-02	SW	X	ambient sample
WVMA-MRS05-AMB-SD-02	SD	X	ambient sample

S = Soil; SW= Surface Water; SD = Sediment

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	S/SD	8330B	8330B	mg/kg	Dry Wt.
Explosives	SW	3535A	8330B	µg/L	NA
Metals	S/SD	3050B	6010B	mg/kg	Dry Wt.
Metals	SW	3010A	6010B	µg/L	NA

See the end of this report for detailed description of the sample preparation procedures for explosive analysis.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria for Soil/Sediment	Accuracy Criteria for Water	Maximum RPD (%)
HMX	75-125%	80-115%	30
RDX	70-135%	50-160%	30
1,3,5-Trinitrobenzene	75-125%	65-140%	30
1,3-Dinitrobenzene	80-125%	45-160%	30
Nitrobenzene	75-125%	50-140%	30
Tetryl	10-150%	20-175%	30
Nitroglycerin	68-131%	71-126%	30
2,4,6-Trinitrotoluene	55-140%	50-145%	30
4-Amino-2,6-dinitrotoluene	80-125%	55-155%	30
2-Amino-4,6-dinitrotoluene	80-125%	50-155%	30

2,4-Dinitrotoluene	80-125%	60-135%	30
2,6-Dinitrotoluene	80-120%	60-135%	30
3-Nitrotoluene	75-120%	50-130%	30
PETN	69-132%	65-115%	30
2-Nitrotoluene	80-125%	45-135%	30
4-Nitrotoluene	75-125%	50-130%	30
1,2-Dinitrobenzene (Surrogate)	70-130%	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) and MS/MSD are 80-120%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of two (2) soil samples, one (1) sediment sample, and one (1) surface water sample. All samples were collected on October 3 and 4, 2011 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. All samples were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. All samples were prepared and analyzed within the holding time required by the method. The screening value for 1,3-dinitrobenzene is below the PQL for soil; however it is above the MDL. Therefore any detection between the MDL and PQL would be identified for decision-making purposes.

The explosives samples were extracted in two batches (#111017A for surface water and #111006A for soil/sediment). Samples were analyzed under two sets of initial calibration (ICAL). All samples were analyzed without any dilution.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the two LCSs and the surrogate spikes for each of the two batches.

All LCS and surrogate spike recoveries were within acceptance criteria for both analytical batches.

Precision

Precision could not be evaluated due to the lack of duplicate analysis.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;

- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.
- There were two method blanks associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the samples in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The explosives portion of this SDG consisted of two (2) soil samples, one (1) sediment sample, and one (1) surface water sample. All samples were analyzed for a reduced list of metals that included aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. The samples were analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

These samples were digested in two batches (#111017A1 for water and #111019A1 for soil and sediment). The sample was analyzed under a single ICAL. The two soil

samples required a 25-fold dilution for aluminum. All other analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the two LCSs.

All LCS recoveries were within acceptance criteria for both batches.

Precision

Precision could not be evaluated due to the lack of duplicate analysis.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS05-SD-01 in SDG 65935. The DT was only applicable for aluminum, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Aluminum met criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	4.1	%D ≤ 10

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for antimony, copper, lead, and zinc only since aluminum met criteria in the DT. All four metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	88	75 – 125%
Copper	95	

Lead	81	
Zinc	80	

- Another set of PDS was performed with sample WVMA-MRS05-SW-01 in SDG #65935 for all target metals since the DT was not applicable to all metals.

Metal	%R	Criteria
Aluminum	99	
Antimony	85	
Copper	91	75 – 125%
Lead	86	
Zinc	89	

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site.

There were two method blanks and several calibration blanks associated with the metals analyses in this SDG. All blanks were compliant.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the samples in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

pH

General

The pH portion of this SDG consisted of two (2) soil samples. Both samples were collected on October 3rd, 2011 and were tested for pH.

The pH analyses were performed using USEPA SW846 Method 9045D. Both samples were analyzed following the procedures outlined in the Work Plan. Both samples were tested for pH on the sample delivery day.

Accuracy

The pH meter was calibrated with pH 7.00 buffer standard solution.

Precision

Precision could not be evaluated due to the lack of duplicate analysis.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan; and
- Evaluating preservation and holding times.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan.

- All calibration criteria were met.
- All calibration verification criteria were met.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pH result for the two soil samples in this SDG were considered usable. The completeness for the pH portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The laboratory quality control samples and evaluated criteria included method blanks, laboratory control samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil/Sediment

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

DATA VALIDATION SUMMARY REPORT

for samples collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: November 14th, 2011

Parsons - Austin

INTRODUCTION

The following data validation summary report covers one sediment sample, one surface water sample and associated field quality control (QC) samples collected from Bearden Knob Firing Ranges, West Virginia on October 5, 2011. Samples were logged in under the following Sample Delivery Group (SDG):

65935

These two samples were analyzed for explosives and metals. Metals included aluminum, antimony, copper, lead and zinc. The following table details the field sample identification and requested parameters. Field QC samples include one field duplicate (FD) and one set of matrix spike/matrix spike duplicate (MS/MSD) for each of the two matrixes.

These samples were collected by Parsons and were shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL). There were two coolers involved in the shipment and cooler temperature readings were both 3.5°C, which was within the 2-6°C range recommended by the PSAP.

All samples were prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives & Metals	Comments
WVMA-MRS05-SW-01	SW	X	MS/MSD
WVMA-MRS05-SD-01	SD	X	MS/MSD
WVMA-MRS05-SW-03	SW	X	FD of SW-01
WVMA-MRS05-SD-03	SD	X	FD of SD-01

SW= Surface Water; SD = Sediment

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	SD	8330B	8330B	mg/kg	Dry Wt.
Explosives	SW	3535A	8330B	µg/L	NA
Metals	SD	3050B	6010B	mg/kg	Dry Wt.
Metals	SW	3010A	6010B	µg/L	NA

See the end of this report for detailed description of the sample preparation procedures.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria for Sediment	Accuracy Criteria for Water	Maximum RPD (%)
HMX	75-125%	80-115%	30
RDX	70-135%	50-160%	30
1,3,5-Trinitrobenzene	75-125%	65-140%	30
1,3-Dinitrobenzene	80-125%	45-160%	30
Nitrobenzene	75-125%	50-140%	30
Tetryl	10-150%	20-175%	30
Nitroglycerin	68-131%	71-126%	30
2,4,6-Trinitrotoluene	55-140%	50-145%	30
4-Amino-2,6-dinitrotoluene	80-125%	55-155%	30
2-Amino-4,6-dinitrotoluene	80-125%	50-155%	30
2,4-Dinitrotoluene	80-125%	60-135%	30

2,6-Dinitrotoluene	80-120%	60-135%	30
3-Nitrotoluene	75-120%	50-130%	30
PETN	69-132%	65-115%	30
2-Nitrotoluene	80-125%	45-135%	30
4-Nitrotoluene	75-125%	50-130%	30
1,2-Dinitrobenzene (Surrogate)	70-130%	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) and MS/MSD are 80-120%.

The precision criteria for MS/MSD is ≤20% relative percent difference (RPD), for sediment parent/FD is ≤70% RPD and for water parent/FD is ≤40% RPD.

EXPLOSIVES

General

The explosives portion of this SDG consisted of two (2) sediment, two (2) surface water samples and a set of MS/MSD for each of the two matrixes. All samples were collected on October 5, 2011 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. All samples were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. All samples were prepared and analyzed within the holding time required by the method.

The explosives samples were extracted in two batches (#111012A for surface water and #111017A for sediment). Samples were analyzed under a single initial calibration (ICAL). All samples were analyzed without any dilution.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the two LCSs, two sets of MS/MSD and the surrogate spikes for each of the two matrixes.

All LCS, MS/MSD, and surrogate spike recoveries were within acceptance criteria for both matrixes.

Precision

Precision was evaluated based on the %RPD of the MS/MSD and parent/FD results of both matrixes.

All %RPDs were compliant for the MS/MSD of both matrixes.

None of the target compounds were detected in both pairs of parent and FD samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.

There were two method blanks associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the ambient sample in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The explosives portion of this SDG consisted of two (2) sediment, two (2) surface water samples and a set of MS/MSD for each of the two matrixes. All samples were analyzed for a reduced list of metals that included aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. The sample was analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

These samples were digested in two batches (#111017A1 for water and #111019A1 for sediment). The sample was analyzed under a single ICAL. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the two LCSs and two pairs of MS and MSD.

All LCS recoveries were within acceptance criteria for both batches.

All MS/MSD recoveries were within acceptance criteria for the water matrix.

All non-compliant %Rs of the sediment pair of MS/MSD are listed below:

WVMA-MRS05-SD-01

Metals	MS, %R	MSD, %R	Criteria, %R
Aluminum	190	120	
Antimony	70	73	80 - 120
Lead	74	74	
Zinc	78	(81)	

( ) indicates the %R was compliant.

"J" flags were applied to the aluminum, antimony and lead results of the parent sediment sample. The "J" flag applied to the zinc result was removed by Parsons data validator due to minor exceedance.

Precision

Precision was evaluated based on the %RPD of MS/MSD and parent/FD sample results.

All %RPDs of the MS/MSD results were compliant for both matrixes.

The %RPD calculation is only applicable when both parent and FD results are greater than the practical quantitation limit:

WVMA-MRS05-SW-01

Metal	Parent, µg/L	FD, µg/L	%RPD	Criteria, %RPD
Aluminum	190	230	19	≤40

WVMA-MRS05-SD-01

Metal	Parent, mg/kg	FD, mg/kg	%RPD	Criteria, %RPD
Aluminum	7000	6400	9.0	
Copper	4.1	4.7	14	≤70

Lead	7.9	8.0	1.3	
Zinc	70	68	2.9	

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS05-SD-01. The DT was only applicable for aluminum, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Aluminum met criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	4.1	%D ≤ 10

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for antimony, copper, lead, and zinc only since aluminum met criteria in the DT. All four metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	88	75 – 125%
Copper	95	
Lead	81	
Zinc	80	

- Another set of PDS was performed with sample WVMA-MRS05-SW-01 for all target metals since the DT was not applicable to all metals.

Metal	%R	Criteria

Aluminum	99	
Antimony	85	
Copper	91	75 – 125%
Lead	86	
Zinc	89	

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site.

There were two method blanks and several calibration blanks associated with the metals analyses in this SDG. All blanks were compliant.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the samples in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The field and laboratory quality control samples and evaluated criteria included field duplicates, analytical duplicates, method blanks, MS/MSD samples, laboratory control samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil/Sediment

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

DATA VALIDATION SUMMARY REPORT

for sample collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: November 8th, 2011

Parsons - Austin

INTRODUCTION

The following data validation summary report covers one ambient soil sample collected from Bearden Knob Firing Ranges, West Virginia on October 6, 2011. This sample was logged in under the following Sample Delivery Group (SDG):

65942

This sample was analyzed for explosives, metals, and pH. Metals included aluminum, antimony, copper, lead and zinc. The following table details the field sample identification and requested parameters.

This sample was collected by Parsons and was shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL). The cooler was received by the laboratory at a temperature of 11°C, which was above the 2-6°C range recommended by the PSAP. Since this is an ambient sample and explosives and metals data should not be affected by the cooler temperature, Parsons instructed lab to proceed with the analysis. The pH data is qualified with "J" as an estimated value.

This soil sample was prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives, Metals, & pH	Comments
WVMA-MRS05-AMB-SS-02-07	S	X	Ambient sample

S = Soil

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	S	8330B	8330B	mg/kg	Dry Wt.
Metals	S	3050B	6010B	mg/kg	Dry Wt.
pH	S	NA	9045D	NA	NA

See the end of this report for detailed description of the sample preparation procedures.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged “U” for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria	Maximum RPD (%)
HMX	75-125%	30
RDX	70-135%	30
1,3,5-Trinitrobenzene	75-125%	30
1,3-Dinitrobenzene	80-125%	30
Nitrobenzene	75-125%	30
Tetryl	10-150%	30
Nitroglycerin	68-131%	30
2,4,6-Trinitrotoluene	55-140%	30
4-Amino-2,6-dinitrotoluene	80-125%	30
2-Amino-4,6-dinitrotoluene	80-125%	30
2,4-Dinitrotoluene	80-125%	30

2,6-Dinitrotoluene	80-120%	30
3-Nitrotoluene	75-120%	30
PETN	69-132%	30
2-Nitrotoluene	80-125%	30
4-Nitrotoluene	75-125%	30
1,2-Dinitrobenzene (Surrogate)	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) are 80-120%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of one (1) soil sample. The sample was collected on October 6, 2011 and was analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. This sample was analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. This sample was prepared and analyzed within the holding time required by the method. Since soil was dried at room temperature, the cooler temperature of 11°C has not impact to the data quality. The screening value for 1,3-dinitrobenzene is below the PQL for soil; however it is above the MDL. Therefore any detection between the MDL and PQL would be identified for decision-making purposes.

The explosives sample was extracted in batch #111017A. The sample was analyzed under a single initial calibration (ICAL) without any dilution.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the LCS and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria.

Precision

Precision could not be evaluated due to the lack of duplicate analysis in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and

- Examining laboratory blank for cross contamination of samples during analysis.

The sample in this SDG was analyzed following the COC and the analytical procedures described in the Work Plan. This sample was prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.

There was one method blank associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the ambient sample in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The metals portion of this SDG consisted of one (1) ambient soil sample. The sample was collected on October 6, 2011. Sample was analyzed for a reduced list of metals that included aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. The sample was analyzed following the procedures outlined in the Work Plan. This sample was prepared and analyzed within the holding time required by the method and the Work Plan. Since an acid digestion procedure is involved in the sample preparation, all organic and inorganic metal were digested into the digestate. The non-compliant cooler temperature had no impact to the metal results. Also EPA SW846 does not have a temperature requirement for soils by SW846 Method 6010B.

This sample was digested in batch #111019A1. The sample was analyzed under a single ICAL without any dilution.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS.

All LCS recoveries were within acceptance criteria.

Precision

Precision could not be evaluated due to the lack of duplicate analysis in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

This sample was analyzed following the COC and the analytical procedures described in the Work Plan. This sample was prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV sample was prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS05-SD-01 from Bearden Knob Firing Ranges, SDG 65935. The DT was only applicable for aluminum, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Aluminum met criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	4.1	%D ≤ 10

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for antimony, copper, lead, and zinc only since aluminum met criteria in the DT. All four metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	88	75 – 125%
Copper	95	
Lead	81	

Zinc	80	

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site.

There was one method blank and several calibration blanks associated with the metals analyses in this SDG. All blanks were compliant.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the sample in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

pH

General

The pH portion of this SDG consisted of one (1) ambient soil sample. This sample was collected on October 6, 2011 and was tested for pH.

The pH analyses were performed using USEPA SW846 Method 9045D. This sample was analyzed following the procedures outlined in the Work Plan. This sample was tested for pH two days after sample was delivered to the lab.

Accuracy

The pH meter was calibrated with pH 7.00 buffer standard solution.

Precision

Precision was evaluated based on parent and lab duplicate (LD) pH readings. Lab performed the lab duplicate with the ambient soil sample in this SDG. The parent sample has pH reading of 3.9 and the LD has the pH reading of 4.0.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan; and
- Evaluating preservation and holding times.

The sample in this SDG was analyzed following the COC and the analytical procedures described in the Work Plan. Due to the temperature of the cooler, the pH value was flagged with “J”.

- All calibration criteria were met.
- All calibration verification criteria were met.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pH result for the sample in this SDG was considered usable. The completeness for the pH portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The laboratory quality control samples and evaluated criteria included method blanks, laboratory control samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

DATA VALIDATION SUMMARY REPORT

for samples collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: November 19, 2011

Parsons - Austin

INTRODUCTION

The following data validation summary report covers one soil sample and one field quality control (QC) sample collected from Bearden Knob Firing Ranges, West Virginia on October 11, 2011. Samples were logged in under the following Sample Delivery Group (SDG):

65971

These two samples were analyzed for explosives, metals, and pH. Metals included aluminum, antimony, copper, lead and zinc. There was one field duplicate (FD) sample collected as field QC sample. Sample WVMA-MRS05-SS-02-01 was designated for matrix spike and matrix spike duplicate (MS/MSD) analyses. The following table details the field sample identifications and requested parameters.

These two samples were collected by Parsons and were shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL). The cooler was received by the laboratory at a temperature of 2.5°C which was within the 2-6°C range recommended by the PSAP.

These two soil samples were prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives, Metals, & pH	Comments
WVMA-MRS05-SS-02-01	S	X	MS/MSD
WVMA-MRS05-SS-02-08	S	X	FD of WVMA-MRS05-SS-02-01

S = Soil

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	S	8330B	8330B	mg/kg	Dry Wt.
Metals	S	3050B	6010B	mg/kg	Dry Wt.
pH	S	NA	9045D	NA	NA

See the end of this report for detailed description of the sample preparation procedures.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged “U” for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria	Maximum RPD (%)
HMX	75-125%	30
RDX	70-135%	30
1,3,5-Trinitrobenzene	75-125%	30
1,3-Dinitrobenzene	80-125%	30
Nitrobenzene	75-125%	30
Tetryl	10-150%	30
Nitroglycerin	68-131%	30
2,4,6-Trinitrotoluene	55-140%	30
4-Amino-2,6-dinitrotoluene	80-125%	30
2-Amino-4,6-dinitrotoluene	80-125%	30
2,4-Dinitrotoluene	80-125%	30

2,6-Dinitrotoluene	80-120%	30
3-Nitrotoluene	75-120%	30
PETN	69-132%	30
2-Nitrotoluene	80-125%	30
4-Nitrotoluene	75-125%	30
1,2-Dinitrobenzene (Surrogate)	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) and MS/MSD are 80-120%, and the precision criteria for MS/MSD is ≤20% relative percent difference (RPD).

The precision requirement for parent and FD is relative percent difference (%RPD) ≤70%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of two (2) soil samples. These two samples were collected on October 11, 2011 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. Both samples were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. These two samples were prepared and analyzed within the holding time required by the method. The screening value for 1,3-dinitrobenzene is below the PQL for soil; however it is above the MDL. Therefore any detection between the MDL and PQL would be identified for decision-making purposes.

The explosives samples were extracted in one batch (#111024A). Both samples were analyzed under a single initial calibration (ICAL). Both samples were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the LCS, MS, MSD and the surrogate spikes.

All LCS, MS, MSD, and surrogate spike recoveries were within acceptance criteria.

Precision

Precision was evaluated based on the %RPD of the MS/MSD and parent/FD sample results.

All %RPDs of the MS/MSD were compliant.

None of the target compounds were detected in the parent and FD samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating holding times; and
- Examining laboratory blank for cross contamination of samples during analysis.

Both samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. Both sample were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.

There was one method blank associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the two samples in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The metals portion of this SDG consisted of two (2) soil samples. These samples were collected on October 11, 2011. Samples were analyzed for aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. The sample was analyzed following the procedures outlined in the Work Plan. These two

samples were prepared and analyzed within the holding time required by the method and the Work Plan.

These two samples were digested in one batch (#111019A1). The sample was analyzed under a single ICAL. All analyses were performed undiluted except aluminum analyses were performed with 10 fold dilution.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS, MS and MSD samples.

All LCS recoveries were within acceptance criteria.

All MS/MSD %Rs were non-compliant:

WVMA-MRS05-SS-02-01

Metals	MS, %R	MSD, %R	Criteria, %R
Aluminum	250	0	
Antimony	50	55	
Copper	76	67	80-120
Lead	64	55	
Zinc	66	66	

"J" flags were applied to all metal results of the parent sample. The aluminum concentration of the parent sample was significantly greater than the spiked amount, >2 times, which caused the abnormal %Rs.

Precision

Precision was evaluated based on the %RPD of MS/MSD and parent/FD sample results.

All %RPDs of MS and MSD results were compliant.

WVMA-MRS05-SS-02-01

Metals	Parent, mg/kg	FD, mg/kg	%RPD	Criteria, %RPD
Aluminum	2,900	1,600	58	
Copper	3.0	2.9	3.4	≤70
Lead	5.2	3.7	34	
Zinc	8.3	8.4	1.2	

%RPD calculation is only applicable when both concentrations are greater than reporting limit.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;

- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

These two samples were analyzed following the COC and the analytical procedures described in the Work Plan. These two samples were prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS05-SS-02-01. The DT was only applicable for aluminum, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Aluminum did not meet criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	13	%D ≤ 10

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for all target metals. All metals except aluminum met criteria in the PDS, as follows:

Metal	%R	Criteria
Aluminum	**70**	75 – 125%
Antimony	91	
Copper	93	
Lead	80	
Zinc	81	

  "J" flags were applied to all aluminum results in this SDG.

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site.

There was one method blank and several calibration blanks associated with the metals analyses in this SDG. Antimony was detected greater than ½ of reporting limit in the method blank, however, none of the associated samples had antimony detected at method detection limit. Therefore, no corrective action was needed.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the two samples in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

pH

General

The pH portion of this SDG consisted of two (2) soil samples. These two samples were collected on October 11, 2011 and were tested for pH.

The pH analyses were performed using USEPA SW846 Method 9045D. These two samples were analyzed following the procedures outlined in the Work Plan. These two samples were tested for pH on the same day when samples were delivered to the lab.

Accuracy

The pH meter was calibrated with pH 7.00 buffer standard solution.

Precision

Precision was evaluated based on parent and FD pH readings. Lab performed the lab duplicate (LD) with sample WVMA-MRS05-SS-02-01. All pH readings are listed below:

Parent Sample	FD	LD
6.3	6.3	6.4

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan; and
- Evaluating preservation and holding times.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All calibration criteria were met.

- All calibration verification criteria were met.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pH results for the two samples in this SDG were considered usable. The completeness for the pH portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

COMPARABILITY

All data was generated using contract-specific standard methods and reported with known data quality, type of analysis, units, etc.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The field and laboratory quality control samples and evaluated criteria included field duplicates, analytical duplicates, method blanks, MS/MSD samples, laboratory control spike samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

DATA VALIDATION SUMMARY REPORT

for samples collected from the

BEARDEN KNOB FIRING RANGES

West Virginia

Data Validation by: Tammy Chang

Date: June 21, 2012

Parsons - Austin

INTRODUCTION

The following data validation summary report covers one sediment sample, one surface water sample collected from Bearden Knob Firing Ranges, West Virginia on May 17, 2012. Samples were logged in under the following Sample Delivery Group (SDG):

67821

These two samples were analyzed for explosives and metals. Metals included aluminum, antimony, copper, lead and zinc. pH was also determined for the sediment sample. The following table details the field sample identification and requested parameters.

These two samples were collected by Parsons and Eco & Associates and were shipped to Agriculture and Priority Pollutants Laboratories, Inc. (APPL) in one cooler. The cooler temperature reading was 2.0°C, which was within the 2-6°C range recommended by the PSAP.

All samples were prepared and analyzed following the procedures outlined in the Project Sampling and Analysis Plan and Addendum (PSAP) for the Southeast Region and the site specific Sampling and Analysis Plan.

All APPL method detection limits (MDLs) and practical quantitation limits (PQLs) were below the lowest associated action level for all target analytes, except as noted in this report.

SAMPLE IDs AND REQUESTED PARAMETERS

Sample ID	Matrix	Explosives & Metals	pH	Comments
WVMA-MRS05-AMB-SW-04	SW	X		ambient sample
WVMA-MRS05-AMB-SD-04	SD	X	X	ambient sample

SW= Surface Water; SD = Sediment

EXTRACTION, ANALYTICAL, AND REPORTING DETAILS

PARAMETER	MATRIX	EXTRACTION METHOD	ANALYTICAL METHOD	UNITS	DRY WT. VS. WET WT
Explosives	SD	8330B	8330B	mg/kg	Dry Wt.
Explosives	SW	3535A	8330B	µg/L	NA
Metals	SD	3050B	6010B	mg/kg	Dry Wt.
Metals	SW	3010A	6010B	µg/L	NA
pH	SD	NA	9045D	NA	NA

See the end of this report for detailed description of the sample preparation procedures.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the Project Work Plan, site specific Sampling and Analysis Plan, and PSAP. Information reviewed in the data packages included sample results; field and laboratory quality control results; calibrations; case narratives; raw data; cooler receipt forms, and chain-of-custody (COC) forms. The analyses and findings presented in this report are based on the reviewed information, and whether guidelines in the Work Plan were met.

Due to the flagging requirements of the electronic data deliverable (EDD) software, Automatic Data Review (ADR), the following rules were applied for flagging the data:

If an analyte was detected in the method blank, the associated sample concentrations were examined. If the analyte was detected in a sample at a concentration similar to that found in the blank (five times the blank concentration for most analytes, or ten times the blank concentration for common laboratory contaminants), the PQL for that analyte was raised to the detected level and the result was flagged "U" for that particular sample.

Approval was also received from a USACE chemist for laboratory to use the historically developed control limits to evaluate accuracy for explosives. The approved accuracy and precision criteria for explosives are as follows:

Analyte	Accuracy Criteria for Sediment	Accuracy Criteria for Water	Maximum RPD (%)
HMX	75-125%	80-115%	30
RDX	70-135%	50-160%	30
1,3,5-Trinitrobenzene	75-125%	65-140%	30
1,3-Dinitrobenzene	80-125%	45-160%	30
Nitrobenzene	75-125%	50-140%	30
Tetryl	10-150%	20-175%	30
Nitroglycerin	68-131%	71-126%	30
2,4,6-Trinitrotoluene	55-140%	50-145%	30
4-Amino-2,6-dinitrotoluene	80-125%	55-155%	30
2-Amino-4,6-dinitrotoluene	80-125%	50-155%	30

2,4-Dinitrotoluene	80-125%	60-135%	30
2,6-Dinitrotoluene	80-120%	60-135%	30
3-Nitrotoluene	75-120%	50-130%	30
PETN	69-132%	65-115%	30
2-Nitrotoluene	80-125%	45-135%	30
4-Nitrotoluene	75-125%	50-130%	30
1,2-Dinitrobenzene (Surrogate)	70-130%	70-130%	NA

For metals, the accuracy criteria for the laboratory control sample (LCS) and MS/MSD are 80-120%.

EXPLOSIVES

General

The explosives portion of this SDG consisted of one (1) sediment sample and one (1) surface water samples. Both samples were collected on May 17, 2012 and were analyzed for the full list of explosives as specified in the Work Plan.

The explosives analyses were performed according to the United States Environmental Protection Agency (USEPA) SW846 Method 8330B. All samples were analyzed following the procedures outlined in the laboratory Standard Operation Procedure (SOP) which was approved by USACE. All samples were prepared and analyzed within the holding time required by the method.

The explosives samples were extracted in two batches (#120522A for surface water and #120525A for sediment). Samples were analyzed under a single initial calibration (ICAL). All samples were analyzed without any dilution.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the two LCSs and the surrogate spikes for each of the two matrixes.

All LCS and surrogate spike recoveries were within acceptance criteria for both matrixes.

Precision

Precision could not be evaluated due to lack of duplicate analysis involved in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;

- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

The samples in this SDG were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

- All initial calibration criteria were met.
- All secondary source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- The limits of detection (LODs) were verified quarterly according to the DoD Quality System Manual (QSM) version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site with one exception. The PQL for 1,3-dinitrobenzene exceeded the lowest action level of 0.073 mg/kg at 0.40 mg/kg. However, the MDL for this compound was well below the action level at 0.003 mg/kg.

There were two method blanks associated with the explosives analyses in this SDG. All target explosives were non-detect in the method blank.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All explosives results for the two ambient samples in this SDG were considered usable. The completeness for the explosives portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

METALS

General

The explosives portion of this SDG consisted of one (1) sediment sample and one (1) surface water sample. All samples were analyzed for a reduced list of metals that included aluminum, antimony, copper, lead, and zinc.

The metals analyses were performed using USEPA SW846 Method 6010B. The sample was analyzed following the procedures outlined in the Work Plan. All samples were prepared and analyzed within the holding time required by the method and the Work Plan.

These samples were digested in two batches (#120529A2 for water and #120607A1 for sediment). The sample was analyzed under a single ICAL. All analyses were performed undiluted except aluminum and lead were analyzed with five fold dilution for the sediment sample.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the two LCSs.

All LCS recoveries were within acceptance criteria for both batches.

Precision

Precision could not be measured due to the lack of duplicate analyses in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan;
- Evaluating preservation and holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the Work Plan. All samples were prepared and analyzed within the holding times required by the method.

- All instrument initial calibration criteria were met.
- All metals met criteria in the low-level check standards.
- All second source criteria were met. The ICV samples were prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- The dilution test (DT) was performed on sample WVMA-MRS07-SS-02-02 which was in SDG 67839. The DT was only applicable for aluminum and lead, since no other metals were detected in the parent sample at a concentration of 50 times the MDL or greater. Both metals met criteria in the DT, as follow:

Metal	%D	Criteria
Aluminum	0.93	%D ≤ 10
Lead	1.7	

- The post digestion spike (PDS) was performed on the same sample as the DT. The PDS was applicable for antimony, copper, and zinc only since aluminum and lead met criteria in the DT. All three metals met criteria in the PDS, as follows:

Metal	%R	Criteria
Antimony	98	75 – 125%
Copper	104	
Zinc	83	

- Another set of PDS was performed with sample WVMA-MRS01-SW-01 which was in SDG 67746 for all target metals since the DT was not applicable to all metals.

Metal	%R	Criteria
Aluminum	90	75 – 125%
Antimony	98	
Copper	99	
Lead	99	
Zinc	85	

- The LODs were verified quarterly according to the DoD QSM version 4.2 requirements.
- All sample-specific MDL and PQL values were below the lowest associated action level as listed in the PSAP for this site.

There were two method blanks and several calibration blanks associated with the metals analyses in this SDG. All blanks were compliant.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All metal results for the samples in this SDG were considered usable. Therefore, the completeness for the metal portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

pH

General

The pH portion of this SDG consisted of one (1) sediment sample which was collected on May 17, 2012.

The pH analysis was performed using USEPA SW846 Method 9045D. This sample was analyzed following the procedures outlined in the Work Plan. This sample was delivered to the lab on Saturday and lab tested for pH on the following Monday.

Accuracy

The pH meter was calibrated with pH 7.00 buffer standard solution.

Precision

Precision was evaluated based on parent lab duplicate (LD) with sample WVMA-MRS05-AMB-SD-04. All pH readings are listed below:

Parent Sample	LD
6.2	6.3

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the Work Plan;
- Comparing actual analytical procedures to those described in the Work Plan; and
- Evaluating preservation and holding times.

This sample was analyzed following the COC and the analytical procedures described in the Work Plan. All calibration criteria were met.

- All calibration verification criteria were met.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All pH result for the sediment sample in this SDG was considered usable. The completeness for the pH portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

DATA USABILITY

The purpose of this data validation report is to ensure the integrity and reliability of analytical laboratory data. The data quality is evaluated based on precision, accuracy, representativeness, comparability, and completeness (PARCC) characteristics of the data. The field and laboratory quality control samples and evaluated criteria included analytical duplicates, method blanks, laboratory control samples, and surrogates. The validated data indicated that the laboratory correctly performed the analyses. Based on the data quality assessment, none of the data were qualified as rejected.

All calculations were spot checked and verified. All data in this SDG are considered usable for the purposes of this project. All sample MDLs and PQLs met the requirements listed in the approved site specific Sampling and Analysis Plan except as previously noted in this report.

APPL Inc Non- Incremental Sampling Procedures for Soil/Sediment

Sample Drying to a Constant Weight:

Place approximately 20-30 grams of the sample into a labeled plastic weigh boat (or tray). Dry the samples at room temperature (or LESS) to a “constant weight” as described below:

Record the date / time and the weight of the tray plus sample in a laboratory log book. Leave the samples overnight to dry on shelves in a dark room.

The following morning weigh the tray containing the sample and record the weight, date and time, and place the trays back in the rack. After one hour record the weight, date and time again.

If the weight is consistent with the previous weighing (within +/- 3%), then this step is complete. If the weight is still not constant, continue drying and subsequent weighing until a constant weight is achieved before proceeding to the next step.

SAMPLE SIEVING AND GRINDING

Crush the dried soil in the weigh boat using a mortar and pestle. Pass the sample through a #30 mesh screen sieve and into a clean, labeled weigh boat in order to eliminate rocks and sticks. Wash the sieve in between each sample with soap and water and rinse with acetone.

SAMPLE WEIGHING

Weigh 10 grams of sample from the weigh boat into a labeled and tared 4oz. glass jar. Record the weight to the nearest 0.01 grams on the extraction sheet.

One method blank and one LCS are prepared with every analytical batch of 20 samples, using clean commercial sand. The LCS is spiked after sieving and grinding. The blank and LCS are taken through the exact same procedures as the samples.

Matrix Spike / Matrix Spike Duplicates are included for every analytical batch of 20 samples, based on the client's project requirements.

SAMPLE EXTRACTION

Add the appropriate amount of the 8330 Soil Surrogate (See SOP HPL002 Standard and Spike Prep) for the Blank, the LCS, MSD/MSD and field samples.

Add the appropriate amount of the 8330 Spike Mix (See SOP HPL002 Standard and Spike Prep) for the LCS and MSD/MSD.

Add 20mL Acetonitrile to each jar containing the spiked /surrogated soil. Place jars on a mechanical shaker for at least 18 hours.

Allow the extracts to settle for 30 minutes and remove approximately 8mL of the extract and place in a labeled 8mL amber screw-cap vial. Centrifuge the vials for approximately 10 minutes. Store the samples in a refrigerator between 2°C and 6°C.

Using a digital auto pipettor, remove 0.4mL of the final extract and combine with 0.4mL of DI water in an injection vial. Store under refrigeration until analysis.

APPENDIX H

GEOGRAPHIC INFORMATION SYSTEMS DATA

THE ATTACHED CD ROM INCLUDES THE ENTIRE GEOGRAPHICAL INFORMATION SYSTEMS LAYER

APPENDIX I

GEOPHYSICAL DATA

THERE WAS NO GEOPHYSICAL INVESTIGATION FOR THIS SI EVALUATION

APPENDIX J

CONCEPTUAL SITE MODEL

CONCEPTUAL SITE MODEL – MUNITIONS AND EXPLOSIVES OF CONCERN

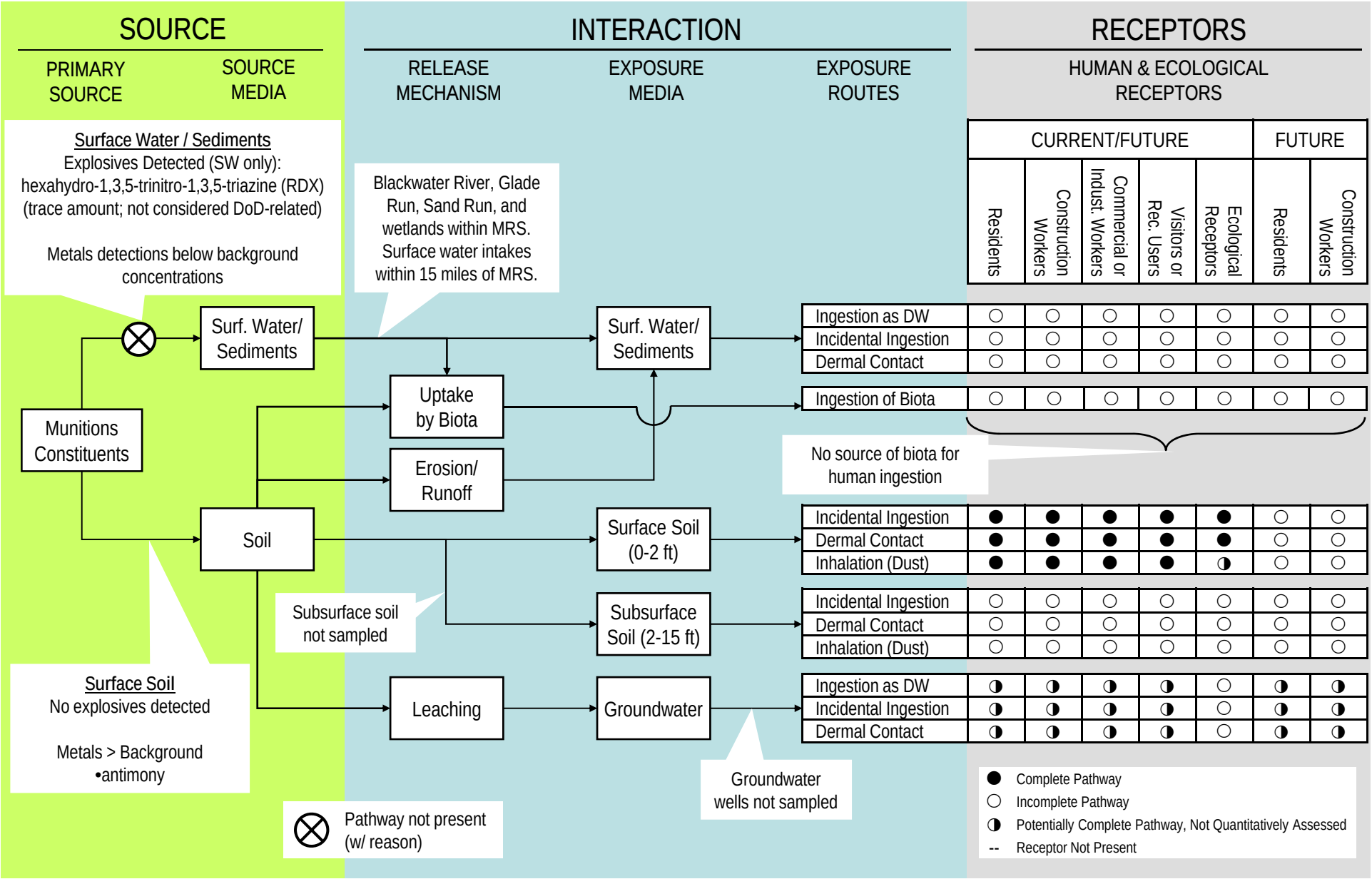
BEARDEN KNOB FIRING RANGE MRS, TUCKER COUNTY, WEST VIRGINIA

Subsite / Range	Acreage	Suspect Past DoD Activities	Potential MEC / Munitions Debris Present	MEC / Munitions Debris Found Since Closure	Previous Investigation / Clearance Actions	Post-DoD Land Use and Current Land Use	Potential Receptors	Potential Source and Receptor Interaction	SI Field Sampling / Qualitative Reconnaissance
BEARDEN KNOB FIRING RANGE	8,000 (revised to 6,137 based on SI field observations and subsequent conclusion that the overlapping portion of the adjacent MRS (MRS06 - Brown/Cabin Mountain) should be included with MRS06. This determination was made due to the historical findings in the overlap and known training activities at MRS06.	Firing points and target locations for 105mm and 155mm howitzer rounds.	Evidence of no munitions present.	No MEC or munitions debris was found during the 2011 or 2012 SI site visits. Note: The Bearden Knob Firing Range MRS (MRS05) was first identified as part of the FUDS by the 2009 PA. A field visit was not conducted at the MRS until the 2011 site visit in support of the 2012 SI. The 2009 PA reports that historical records document a 105mm Howitzer round that was found in the Cabin Mountains (date of find unknown), in the northeast portion of the MRS. Based on MRS boundary revisions, this historical finding is attributed to the Brown/Cabin Mountain MRS. In December 2011, a hunter found an unexpended 81mm HE mortar in the wetlands in the central east end of the MRS. Based on MRS boundary revisions, this historical finding is attributed to the Brown/Cabin Mountain MRS.	2009 PA 2010 INPR 2012 SI No documentation of site clearance was found for this site.	Most of the MRS is owned by the U.S. Fish and Wildlife Service and managed as part of the Canaan Valley National Wildlife Refuge. The remainder consists of small privately-owned parcels located in the community of Canaan Heights.	Current and future residents and construction workers, commercial/industrial workers (U.S. Fish and Wildlife Service employees), recreational users (e.g., hikers and hunters), and site visitors.	NO: Presence of potentially hazardous MEC is not expected.	Approximately 17.5 miles of QR CRREL 7-point wheel soil sampling: 7 surface soil samples: WVMA-MRS05-SS-02-01 WVMA-MRS05-SS-02-02 WVMA-MRS05-SS-02-03 WVMA-MRS05-SS-02-04 WVMA-MRS05-SS-02-05 WVMA-MRS05-AMB-SS-02-07 Grab Samples: 3 surface water samples: WVMA-MRS05-SW-01 WVMA-MRS05-AMB-SW-02 WVMA-MRS05-AMB-SW-04 3 sediment samples: WVMA-MRS05-SD-01 WVMA-MRS05-AMB-SD-02 WVMA-MRS05-AMB-SD-04 Associated QC samples: WVMA-MRS05-SS-02-08 WVMA-MRS05-SW-03 WVMA-MRS05-SD-03
				Source: PA (2009) INPR (2010) SI (2012)	DoD = Department of Defense MEC = munitions and explosives of concern PA = Preliminary Assessment QR = qualitative reconnaissance SI = Site Inspection				

CONCEPTUAL SITE EXPOSURE MODEL

MRS Name: WEST VIRGINIA MANEUVER AREA: Bearden Knob Firing Range MRS

Created/Revised By: Emily Baxter, PARSONS ***Last Revision Date:*** August 26, 2013



APPENDIX K

MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL EVALUATION

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

Munitions Response Site Name: Bearden Knob Firing Range

Component: U.S. Army Corps of Engineers (FUDS)

Installation/Property Name: WV Maneuver Area/Dolly Sods

Location (City, County, State): Davis, Grant and Tucker Counties, West Virginia

Site Name (RMIS ID)/Project Name (Project No.): Proj. No. G03WV0013/FFID WV39799F346000

Date Information Entered/Updated: 27 August 2013

Point of Contact (Name/Phone): Mr. Richard Meadows (304) 543-2755

Project Phase (check only one):

❑ PA	☑ SI	❑ RI	❑ FS	❑ RD
❑ RA-C	❑ RIP	❑ RA-O	❑ RC	❑ LTM

Media Evaluated (check all that apply):

❑ Groundwater	☑ Sediment (human receptor)
☑ Surface soil	☑ Surface Water (ecological receptor)
☑ Sediment (ecological receptor)	☑ Surface Water (human receptor)

MRS Summary:

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from DoD databases, such as RMIS. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental non-munitions related contaminants found at the MRS (e.g., benzene, trichloroethylene), and any potentially exposed human and ecological receptors. Include a map of the MRS, if one is available.

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM (by type of munition, if known) or munitions constituents (by type, if known) known or suspected to be present):

The Bearden Knob Firing Range MRS is located in Grant and Tucker Counties, West Virginia. The site is located approximately 2.5 miles southeast of the town of Davis, in the northeast portion of the WVMA/Dolly Sods FUDS The total FUDS acreage is 2,180,367 acres, including the Bearden Knob Firing Range MRS (2013 SI Report, Section 2.1). The boundary of the 8,000-acre Bearden Knob Firing Range MRS (MRS05) overlaps with the adjacent MRS to the north (the 16,000-acre Brown / Cabin Mountain Firing Ranges MRS [MRS06]). The overlap consists of approximately 1,863 acres and includes portions of the Canaan Valley, Middle Ridge, and Cabin Mountain. Two items identified as unexploded ordnance (UXO)/ Discarded Military Munitions (DMM) have historically been identified within this area of overlap: a 105mm Howitzer round found along the base of Cabin Mountain in 2007, and an 81mm mortar found by hunters in 2011, also along the base of Cabin Mountain. Both the Bearden Knob Firing Range and the Cabin Mountain Firing Range reportedly served as firing points and target locations for 105mm Howitzer rounds. However, only the Brown / Cabin Mountain Firing Range served as firing points and target locations for 81mm mortars. During the 2011 site visit, the site visit team identified more than 10 craters at the northern extent of Middle Ridge, further supporting the use of mortars at the Brown / Cabin Mountain Firing Ranges MRS. Additionally, ground scarring that is suspected to be craters can be seen in historical aerial photographs within the wetland areas at the base of Cabin Mountain. The majority of the craters are within the Brown / Cabin Mountain Firing Range MRS. In order to accurately account for the area of each MRS, the overlapping portion of the ranges must be attributed to only one of the MRSs. Based on the results of the SI and the evidence available from the 2009 Preliminary Assessment (PA), the MEC items found within the area of overlap are attributed with the Brown / Cabin Mountain Firing Ranges MRS; therefore, the overlapping portion is included with the Brown / Cabin Mountain Firing Ranges MRS (2013 SI Report, Section ES).The munitions potentially present at the MRS include: .30 caliber cartridges (includes carbine), .50 caliber cartridges, machine gun, 105mm, high explosive (HE) cartridges (M1), 155mm, and HE projectiles (M102) (2013 SI Report, Section 2.3 and Table 2.2). No MEC items have been found during previous field visits to the Bearden Knob Firing Range MRS, and no MEC items were observed during the 2011 site visit or the 2012 site visit. In addition, munitions debris has never been reported within the MRS (2013 SI Report Section 8.1).

Description of Pathways for Human and Ecological Receptors:

Human and ecological receptors may be exposed to metals in the surface soil through incidental ingestion, dermal contact, and inhalation of re-suspended soil particulates; therefore human receptors may be exposed to metals in groundwater via ingestion as drinking water, incidental ingestions, and dermal contact (2013 SI Report Subsection 6.2.1). Ecological receptors may also be exposed to metals indirectly through ingesting biota that may have been exposed to metals in soil, surface water, or sediment. Because groundwater is not typically accessible to ecological receptors, the groundwater exposure pathways are incomplete for ecological receptors (2013 SI Report, Subsection 6.3.1). Surface soil and sediment exposure pathways for human and ecological receptors are considered incomplete. Surface water however, is considered complete due to elevated antimony levels.

Description of Receptors (Human and Ecological):

Human receptors include current and future residents and construction workers, commercial/industrial workers (e.g., U.S. Fish and Wildlife Service [USFWS] employees), recreational users (e.g., hikers and hunters) or site visitors (2013 SI Report Subsection 6.2.1). The MRS is located within the Canaan Valley National Wildlife Refuge (CVNWR).

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ All UXO that are considered likely to function upon any interaction with exposed persons [e.g., submunitions, 40mm high-explosive (HE) grenades, white phosphorus (WP) munitions, high-explosive antitank (HEAT) munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions]. ◆ All hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	◆ All UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ All DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ All UXO containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). ◆ All DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ All DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ All UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	◆ All DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor), that are deteriorated. ◆ Bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ All DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ All UXO that are practice munitions that are not associated with a sensitive fuze. ◆ All DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ All UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ All used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	0

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the score(s) that correspond with **all** munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

No MEC items have been found during previous field visits to the Bearden Knob Firing Range MRS, and no MEC items were observed during the 2011 site visit or the 2012 site visit. In addition, munitions debris has never been reported within the MRS (2013 SI Report Section 8.1). As a result, Tables 2-9 have been omitted and the EHE module will receive an alternative rating of No Known or Suspected Explosive Hazard.

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	0	0
Source of Hazard	Table 2		
Accessibility Factor Data Elements			
Location of Munitions	Table 3		
Ease of Access	Table 4		
Status of Property	Table 5		
Receptor Factor Data Elements			
Population Density	Table 6		
Population Near Hazard	Table 7		
Types of Activities/ Structures	Table 8		
Ecological and /or Cultural Resources	Table 9		
EHE MODULE TOTAL			**0**

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	***No Known or Suspected Explosive Hazard***

No explosive safety risk has been identified within the modified Bearden Knob Firing Range MRS (2013 SI Report Section 8.1). Based on SI report recommendation for no further action, the alternate rating of No Known or Suspected Explosive Hazard has been applied to the EHE module.

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the score(s) that correspond to **all** CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, explosive configuration either UXO or damaged DMM	The CWM known or suspected of being present at the MRS is: ◆ Explosively configured CWM that are UXO (i.e., CWM/UXO). ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: ◆ Nonexplosively configured CWM/DMM. ◆ Bulk CWM/DMM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ Only CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	0

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

Research conducted for the preparation of the PA showed that this MRS is not suspected to contain any CWM; therefore, Tables 12-19 are omitted.

Table 20
Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			0

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	**No Known or Suspected CWM Hazard**

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
CHF Scale	**CHF Value**	**Sum The Ratios**	
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ☐

Table 21 Comments: Groundwater wells are located within the Bearden Knob Firing Range MRS. Therefore, the groundwater exposure pathway is considered potentially complete but has not been quantitatively assessed for human receptors at the MRS (2013 SI Report, Subchapter 5.3.2.6).

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
Antimony	1.2	15	0.08
Hexahydro-1,3,5-trinitro-1,3,5-triazine	0.071	61.0	0.001
CHF Scale	**CHF Value**	**Sum The Ratios**	**0.081**
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ☐

Table 22 Comments: The surface water exposure pathways are complete for human receptors. Antimony and RDX were detected in surface water above background levels (2013 SI Report, Subchapter 5.3.4.5).

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the site's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum The Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Human Endpoint) MC Hazard ☑

Table 23 Comments: The sediment exposure pathways are incomplete for human receptors. None of the metals analyzed for were detected above their respective background concentrations (2013 SI Report, Subchapter 5.3.4.5).

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
Antimony	1.2	30	0.04
CHF Scale	**CHF Value**	**Sum the Ratios**	**0.04**
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ☐

Table 24 Comments: The surface water exposure pathways are complete for ecological receptors. Antimony was detected in surface water above the background level (2013 SI Report, Subchapter 5.3.4.4).

Table 25

HHE Module: Sediment– Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard for ecological endpoints present in the sediment, select the box at the bottom of the table.

.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ☑

Table 25 Comments: The sediment exposure pathways are incomplete for ecological receptors. None of the metals analyzed for were detected above their respective background concentrations (2013 SI Report, Subchapter 5.3.4.4)

Table 26

HHE Module: Surface Soil – Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the **ratios** for each medium together, including additional contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Soil MC Hazard ☑

Table 26 Comments: The surface soil exposure pathways are incomplete for all receptors at the MRS. None of the metals analyzed for were detected about their respective background concentrations (2013 SI Report, Subchapter 5.3.5.5)

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Remember not to add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28

Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard, Migration Pathway, and Receptor Factors** for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the reference provided below, determine each media's rating (A–G) and record the letter in the corresponding **Media Rating** box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)					
Surface Water/Human Endpoint (Table 22)	L	M	M	MML	E
Sediment/Human Endpoint (Table 23)					
Surface Water/Ecological Endpoint (Table 24)	L	M	M	MML	E
Sediment/Ecological Endpoint (Table 25)					
Surface Soil (Table 26)					

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the **HHE Module Rating** box below.

Note:

An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE MODULE RATING	No Longer Required

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 28 comments: Based on the SI and historical information, no munitions are suspected at the MRS; therefore, the HHE module is given the alternative rating of No Longer Required. The low level of RDX and antimony are not attributed to DoD use based on the lack of munitions in the MRS.

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS priority is the single highest priority; record this number in the **MRS or Alternative Priority** box at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		*No Longer Required*	
No Known or Suspected Explosive Hazard		*No Known or Suspected CWM Hazard*		No Known or Suspected MC Hazard	
MRS or ALTERNATIVE PRIORITY				*No Longer Required*	

APPENDIX L

REFERENCE COPIES

NOTE:

Selected pages from reference documents have been included in the hard copy of the Site Inspection Report. An electronic version containing full documents is on the CD-ROM included with this report.

FORMER WV MANEUVER AREA/DOLLY SODS
GRANT, PRESTON, PENDLETON, TUCKER AND RANDOLPH COUNTIES, WEST VIRGINIA
FUDS Property Number G03WV0013

PRELIMINARY ASSESSMENT

VOLUME I
REPORT AND APPENDICES A - K

Final Version

Prepared by
U.S. Army Corps of Engineers
Huntington, WV District
502 8th Street
Huntington, WV 25701-2070

February 2009

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KY 40201-0059

http://www.lrl.usace.army.mil/

CELRL-ED-E DEC 1 2010

MEMORANDUM FOR Commander, Great Lakes and Ohio River Division, ATTN: CELRD-PDM/Patty Bertsch, 550 Main Street, Rm. 10032, Cincinnati, Ohio 45202-3222

SUBJECT: Defense Environmental Restoration Program – Formerly Used Defense Sites (DERP-FUDS) Inventory Project Report (INPR) for Property No. G03WV0013, WV Maneuver Area/Dolly Sods, Davis, West Virginia

1. Reference ER 200-3-1, Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy, Department of the Army, U.S. Army Corps of Engineers, Washington, D.C., 20314, 10 May 2004.

2. This memorandum transmits the INPR for the subject DERP-FUDS property. This INPR requests after-the-fact approval for one existing Military Munitions Response Program (MMRP) project and proposes seven new MMRP projects.

3. Office of Counsel, Real Estate, and the Environmental and Munitions Center of Expertise (EM CX) have reviewed this INPR and concur that the property was formerly used by the Department of Defense (DoD) and that the projects described in paragraph 5 below are appropriate.

4. A Property Survey Summary Sheet including property maps and photographs is included at Enclosure 1. The revised FDE, dated 7 January 1992, is included at Enclosure 2. The property had an original FDE, dated 21 May 1990, but was subsequently revised to clarify the eligibility of Blackbird Knob. The revised FDE indicates a Property Number of G03WV0065 which is a duplicate of G03WV0013. The INPR checklist is included at Enclosure 3. The Executive Summary of the WV Maneuver Area/Dolly Sods Preliminary Assessment is included at Enclosure 4.

5. The following is a summary of the existing and proposed projects at the subject property:

a. **G03WV001304 (MMRP)** – *Dolly Sods Removal.* This existing MMRP project was approved on 25 May 1990 to address munitions-related contamination at an area of the property known as the Dolly Sods Region. While it was approved as MMRP project G03WV006500, all funding has been recorded under MMRP project G03WV001304. Consequently, this INPR seeks after-the-fact approval of this on-going MMRP project. The Dolly Sods Region consists of approximately 18,000 acres located in the northwest portion of the WV Maneuver Area/Dolly Sods property. Project 04 has transitioned to the Long-Term Management (LTM) phase. An Archives Search Report (ASR), Engineering Evaluation and Cost Analysis (EE/CA), Remedial Investigation/Feasibility Study (RI/FS), and a Munitions and Explosives of Concern (MEC)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

February 8, 2012

Carlos Hernandez
Eco & Associates, Inc.
1855 West Katella Avenue, Suite 340
Orange, California 92867

SUBJECT: United States Army Corps of Engineers
West Virginia Maneuver Area
Town of Davis, Tucker County, West Virginia

Dear Mr. Hernandez:

The United States Environmental Protection Agency (EPA) Region III Drinking Water Branch is in receipt of your emails dated January 10 and 18, 2012, regarding the above referenced project. Eco & Associates, Inc., on behalf of the United States Army Corps of Engineers, is conducting an environmental study of the former West Virginia Maneuver Area to assess potential impacts to surface and ground waters in the vicinity of the defunct training area. You requested the location of wellhead protection areas, tribal drinking water sources, and public and private water supply wells within four miles of the MRS05 and MRS06 sites as outlined in the GIS shapefile you conveyed on January 19, 2012. You also requested the location of surface water intakes within fifteen miles of these sites.

This office neither maintains a database of delineated state or local source water protection areas nor a database of private water supply wells; you are encouraged to contact the West Virginia Department of Health and Human Resources for assistance in obtaining these areas, if available. Also, please be advised that at present there are no federally recognized tribal areas within EPA Region III.

Furthermore, the specific locations of public water supply wells and intakes are treated as sensitive information and, as such, we are disinclined to release the exact locations of these sources. However, based upon the GIS layer of the MRS05 and MRS06 sites you submitted, we have determined that the following public water systems and/or sources may fall within the aforementioned radii:

State	County	Public Water System	PWSID	Source Type	Buffer
WV	Grant	Town of Petersburg	WV3301204	Intake	15 miles of MRS05 and MRS06
WV	Tucker	Canaan Valley State Park	WV9947044	Intake	15 miles of MRS05 and MRS06
WV	Tucker	Hamrick PSD	WV3304704	Intake	15 miles of MRS05 and MRS06
WV	Tucker	City of Parsons	WV3304707	Intake	15 miles of MRS05 and MRS06
WV	Tucker	Davis Water Works	WV3304701	2 Intakes	15 miles of MRS05 and MRS06

Printed on 100% recycled/recyclable paper with 100% post-consumer fiber and process chlorine free.
Customer Service Hotline: 1-800-438-2474

State	County	Public Water System	PWSID	Source Type	Buffer
WV	Tucker	City of Thomas	WV3304709	Intake	15 miles of MRS05 and MRS06
WV	Grant	Mountain Top PSD	WV3301205	Intake	15 miles of MRS05 and MRS06
WV	Tucker	Timberline Four Season Resort Management	WV3304711	Well	4 miles of MRS05 and MRS06
WV	Tucker	Canaan Valley National Wildlife Reserve	WV9947006	Well	4 miles of MRS05 and MRS06
WV	Tucker	Canaan Village Inn	WV9947029	Well	4 miles of MRS05 and MRS06
WV	Tucker	Canaan Valley Stores	WV9947036	Well	4 miles of MRS05 and MRS06
WV	Tucker	Deerfield Village	WV9947039	3 Wells	4 miles of MRS05 and MRS06
WV	Tucker	WV Resorts	WV9947002	2 Wells	4 miles of MRS05 and MRS06
WV	Tucker	Beaver Ridge Resort	WV9947032	2 Wells	4 miles of MRS05 and MRS06
WV	Tucker	North Point Subdivision	WV9947042	Well	4 miles of MRS05 and MRS06
WV	Tucker	Black Bear Woods	WV9947031	4 Wells	4 miles of MRS05 and MRS06
WV	Tucker	Mettiki Coal LLC-Mtn View Mine	WV9947047	Well	4 miles of MRS05 and MRS06

If you would like to discuss this further, please contact me at (215) 814-5733.

Sincerely,

Alysa Suero

Alysa Suero, P.G.
Lead, Drinking Water Sensitive Data Security
Drinking Water Branch

Received
Sep 2, 2011
sc

WEST VIRGINIA
Division of Culture and History

The Culture Center
1900 Kanawha Blvd., E.
Charleston, WV 25305-0300
Randall Reid-Smith, Commissioner
Phone 304.558.0220 • www.wvculture.org
Fax 304.558.2779 • TDD 304.558.3562
EEO/AA Employer

August 29, 2011

Mr. Gabriel Cosyleon
Senior Scientist
Parsons
1700 Broadway
Suite 900
Denver, CO 80290

RE: Army National Guard Munitions Response Sites – Proposed Site Inspections
FR#: 11-990-Multi

Dear Mr. Cosyleon:

We have reviewed the information submitted for the above referenced project. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

According to the submitted information, Parsons is performing site inspections (SI) for the Department of Defense (DoD) under the US Army Corps of Engineers (COE) for the Formerly Used Defense Sites (FUDS) Military Munitions Response Program (MMRP). The sites are part of the former West Virginia Maneuver Area/Dolly Sods FUDS. The Munitions Response Sites (MRS) include: MRS01 – Dailey Infiltration Camp; MRS02 – WV Maneuver Area Ammunition Depot; MRS03 – Jenningston Training Area; MRS04 - Fore Knobs/Bear Rocks Firing Range; MRS05 – Beardon Know Firing Range; MRS06 – Brown/Cabin Mountain Firing Ranges; and MRS07 – Buena Small Arms Firing Ranges.

A search of our records indicates that archaeological resources have been recorded across the landscape within the general vicinity of the proposed project areas. However, it is our understanding that the project consists of taking samples from the ground that are a half-inch in diameter and zero to two inches in depth. It is also our understanding that no construction, auguring or trenching is proposed for this project, which will result in minimal or no new disturbance. As a result, we are of the opinion that the proposed project will have no adverse effect to any archaeological resources that are eligible for or listed in the National Register of Historic Places. No further consultation is necessary.

We appreciate the opportunity to be of service. *If you have any questions regarding our comments or the Section 106 Process, please contact Lora A. Lamarre-DeMott, Senior Archaeologist, at 304-558-0220*

Sincerely,

Susan M. Pierce

Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/LAL

WVMA MRS05 and MRS06
Davis, WV 26260

Inquiry Number: 3246606.1w
January 27, 2012

EDR DataMap™ Well Search Report

Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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GEOCHECK VERSION 2.1
SUMMARY

FEDERAL DATABASE WELL INFORMATION

MAP ID	WELL ID
2	USGS2249085
3	USGS2249084
5	USGS2249080
8	USGS2249077
10	USGS2249076
13	USGS2249074
14	USGS2249275
16	USGS2249226
19	USGS2249216
19	USGS2249215
20	USGS2249200
21	USGS2249201
22	USGS2249202
23	USGS2249198
23	USGS2249196
24	USGS2249197
25	USGS2249195
26	USGS2249193
27	USGS2249192
27	USGS2249190
27	USGS2249189
27	USGS2249188
27	USGS2249186
29	USGS2249185
29	USGS2249184
30	USGS2249183
31	USGS2249182
32	USGS2249181
33	USGS2249180
34	USGS2249175
35	USGS2249174
36	USGS2249169
37	USGS2249167
39	USGS2249371
40	USGS2249370
39	USGS2249369
41	USGS2249368
42	USGS2249367
43	USGS2249361
44	USGS2249358
45	USGS2249357
46	USGS2249356
47	USGS2249353
46	USGS2249354
48	USGS2249355

GEOCHECK VERSION 2.1
SUMMARY

FEDERAL DATABASE WELL INFORMATION

MAP ID	WELL ID
49	USGS2249350
50	USGS2249348
50	USGS2249347
51	USGS2249343
52	USGS2249342
53	USGS2249340
54	USGS2249338
55	USGS2249339
56	USGS2249336
57	USGS2249335
59	USGS2249334
60	USGS2249331
61	USGS2249329
63	USGS2249328
64	USGS2249327
65	USGS2249325
68	USGS2249321
69	USGS2249320
69	USGS2249319
70	USGS2249316
71	USGS2249312
72	USGS2249311
74	USGS2249308
73	USGS2249309
76	USGS2249305
77	USGS2249304
78	USGS2249303
79	USGS2249301
82	USGS2249297
83	USGS2249293

STATE WATER WELL INFORMATION

MAP ID	WELL ID
1	Not Reported
1	Not Reported
4	GA
6	GA
7	GA
7	GA
7	GA
7	GA
7	GA
7	GA
7	GA
7	GA
7	GA
7	GA
9	GA
11	Not Reported
11	Not Reported
11	Not Reported
12	GA

GEOCHECK VERSION 2.1
SUMMARY

STATE WATER WELL INFORMATION

MAP ID	WELL ID
12	Not Reported
28	2590
36	2593
36	2591
36	2592
37	1395
38	2595
38	2594
54	2589
58	2588
58	2587
62	2620
66	2621
67	1392
69	2586
69	1391
69	2603
73	1377
75	2315
76	2318
78	2317
80	2316
79	344
81	1390
84	1383

STATE OIL/GAS WELL INFORMATION

MAP ID	WELL ID
1	WVOG70000079401
2	WVOG70000077975
3	WVOG70000077755
4	WVOG70000075693
5	WVOG70000075350
6	WVOG70000074830
7	WVOG70000074769
8	WVOG70000074334
9	WVOG70000074000
10	WVOG70000073583
11	WVOG70000073458
12	WVOG70000073457
13	WVOG70000073435
14	WVOG70000073286
15	WVOG70000072805
16	WVOG70000072766
17	WVOG70000072066
18	WVOG70000071941
19	WVOG70000071441
20	WVOG70000071144
21	WVOG70000070653
22	WVOG70000070532
23	WVOG70000069915
24	WVOG70000069852

GEOCHECK VERSION 2.1
SUMMARY

STATE OIL/GAS WELL INFORMATION

MAP ID	WELL ID
25	WVOG70000069513
26	WVOG70000068798
27	WVOG70000068675
28	WVOG70000068466
29	WVOG70000068075

PUBLIC WATER SUPPLY SYSTEM INFORMATION

Map ID: 15
PWS ID: WV3304709
PWS Name: THOMAS WATER
BOX 248
THOMAS, WV 26292
PWS currently has or had major violation(s) or enforcement:

Map ID: 17
PWS ID: WV9947044
PWS Name: CANAAN VALLEY STATE PARK
RT 1 BOX 320
DAVIS, WV 26260
PWS currently has or had major violation(s) or enforcement:

Map ID: 18
PWS ID: WV3304701
PWS Name: DAVIS WATER WORKS
BOX 207
BOX 207
DAVIS, WV 26260
PWS currently has or had major violation(s) or enforcement:

Map ID: 74
PWS ID: WV3304711
PWS Name: TIMBERLINE FOUR SEASON RESORT MANAGEMENT
K TETER
HC 70 BOX 488
DAVIS, WV 26260
PWS currently has or had major violation(s) or enforcement:

USGS TOPOGRAPHIC MAP(S)

39079-A2 MAYSVILLE, WV
39079-A3 BLACKBIRD KNOB, WV
39079-A4 BLACKWATER FALLS, WV
39079-A5 MOZARK MOUNTAIN, WV
39079-B2 GREENLAND GAP, WV
39079-B3 MOUNT STORM LAKE, WV
39079-B4 DAVIS, WV MD
39079-B5 LEAD MINE, WV

AREA RADON INFORMATION

GEOCHECK VERSION 2.1
SUMMARY

AREA RADON INFORMATION

EPA Region 3 Statistical Summary Readings for Zip Code: 26739

Number of sites tested: 16.

Maximum Radon Level: 32.7 pCi/L.
Minimum Radon Level: 0.2 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
11 (68.75%)	4 (25.00%)	0 (0.00%)	1 (6.25%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 26720

Number of sites tested: 1.

Maximum Radon Level: 1.3 pCi/L.
Minimum Radon Level: 1.3 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
1 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 26716

Number of sites tested: 2.

Maximum Radon Level: 0.1 pCi/L.
Minimum Radon Level: 0.1 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
2 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 26292

Number of sites tested: 14.

Maximum Radon Level: 26.0 pCi/L.
Minimum Radon Level: 0.4 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
10 (71.43%)	0 (0.00%)	3 (21.43%)	1 (7.14%)	0 (0.00%)	0 (0.00%)

GEOCHECK VERSION 2.1
SUMMARY

AREA RADON INFORMATION

EPA Region 3 Statistical Summary Readings for Zip Code: 26260

Number of sites tested: 12.

Maximum Radon Level: 2.3 pCi/L.
Minimum Radon Level: 0.6 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
12 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 26833

Number of sites tested: 24.

Maximum Radon Level: 9.3 pCi/L.
Minimum Radon Level: 0.8 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
17 (70.83%)	7 (29.17%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 26269

Number of sites tested: 7.

Maximum Radon Level: 4.8 pCi/L.
Minimum Radon Level: 1.1 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
4 (57.14%)	3 (42.86%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

EPA Region 3 Statistical Summary Readings for Zip Code: 21550

Number of sites tested: 391.

Maximum Radon Level: 77.7 pCi/L.
Minimum Radon Level: -0.2 pCi/L.

pCi/L <4	pCi/L 4-10	pCi/L 10-20	pCi/L 20-50	pCi/L 50-100	pCi/L >100
274 (70.08%)	65 (16.62%)	31 (7.93%)	17 (4.35%)	4 (1.02%)	0 (0.00%)

Federal EPA Radon Zone for GARRETT County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

GEOCHECK VERSION 2.1
SUMMARY

AREA RADON INFORMATION

Federal Area Radon Information for GARRETT COUNTY, MD

Number of sites tested: 20

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.567 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	5.090 pCi/L	70%	25%	5%

Federal Area Radon Information for PRESTON COUNTY, WV

Number of sites tested: 18

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	3.264 pCi/L	82%	18%	0%
Living Area - 2nd Floor	0.450 pCi/L	100%	0%	0%
Basement	3.256 pCi/L	83%	17%	0%

Federal Area Radon Information for GRANT COUNTY, WV

Number of sites tested: 8

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	1.250 pCi/L	100%	0%	0%
Living Area - 2nd Floor	0.450 pCi/L	100%	0%	0%
Basement	7.650 pCi/L	0%	100%	0%

Federal Area Radon Information for TUCKER COUNTY, WV

Number of sites tested: 6

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	4.800 pCi/L	83%	17%	0%
Living Area - 2nd Floor	0.450 pCi/L	100%	0%	0%
Basement	7.650 pCi/L	0%	100%	0%

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 05/24/86 County Tucker Permit #: DW-47-85-07-41

Town: Area Name/Location Canaan Heights, Lots 10 & 11, Subdivision 2.

Well Owner: Charles Douglas Henderson Address: P.O. Box 305

Telephone Number: 259-5157 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
3.0	Soil horizons.
21.0	Ss., weathered.
31.0	Ss. w/ Sh. interbeds and coal spars.
40.0	Sh., gray. 15 GPM @ upper contact.
51.0	Ss., med.-grnd., gray.
108.0	Sh. & Ss., gray.
196.0	Sh., red w/occ. thin St., gray.
263.0	Ss., med.-grnd., gray.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 263.0' Date Completed: 05/24/86

CASING: Length 58.5 Feet Height above ground 1.5 Feet

☐ Steel ☒ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST DRILL STEM TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	1		
Pumping Level (Ft Below Grade)	261		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. NA

Well Cap: Type, Make, Etc. Royer, cast aluminum/

Well Seal: Type, Make, Etc. NA

Well Platform: To be installed by owner.

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Charles Douglas Henderson — Name
016 — Certification No.
Henderson Well Drilling — Registered Business Name
Charles Douglas Henderson — Signed
06/18/86 — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 06/13 - 26/87 County Tucker Permit #: DW-47-87-15

Town: Area Name/Location Route 32/14 - Canaan Heights

Well Owner: William M. Peterson, Sr. Address: Canaan Heights

Telephone Number: 259-5192 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
3.0	Soil horizons.
71.0	Ss., buff-brown w/ccc.
	weathered zones.
83.0	Ss., silty, gray.
198.0	St. & Sh., red & gray.
205.0	Ls.
238.0	Ss., med. grained, gray.
	60.0 GPM @ 225.0'
251.0	St., red.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 251.0' Date Completed: 06/26/87

CASING: Length 84 Feet Height above ground 1.3 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST Drill Stem Test

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	60		
Pumping Level (Ft Below Grade)	250		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. NA

Well Cap: Type, Make, Etc. Royer, cast aluminum

Well Seal: Type, Make, Etc. NA

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Charles Douglas Henderson — 016
Name — Certification No.

Henderson Well Drilling
Registered Business Name

Charles Douglas Henderson — 07/22/87
Signed — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 09/24&25/87 County Tucker Permit #: DW-47-87-42

Town: Area Name/Location Canaan Heights

Well Owner: M. Leyden Willingham Address: 2908 Coleman Road

Telephone Number: 205 237-4429 Anniston, AL 36201

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
4.0	Soil horizons.
10.0	St., soft.
110.0	Sh. & St., red
115.0	St., red & gray.
138.0	Sh., red.
158.0	Sh., gray.
185.0	Sh., red.
188.0	Ls.
219.0	St., gray.
227.0	Sh., red.
	3 GPM @ 86.0'
	5 GPM @ 207.0'

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 227.0' Date Completed: 09/25/87

CASING: Length 74 Feet Height above ground 2 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST Drill Stem Test

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	8		
Pumping Level (Ft Below Grade)	225		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. NA

Well Cap: Type, Make, Etc. Royer, cast aluminum

Well Seal: Type, Make, Etc. NA

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Charles D. Henderson — Name
252 — Certification No.
Henderson Well Drilling — Registered Business Name
Charles D. Henderson — Signed
10/21/87 — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 11/01/88 County Tucker Permit #: OW-47-88-61

Town: Area Name/Location Canaan Heights

Well Owner: Harold Dial Address: Rt. 1. Box 41
Davis, WV 26260

Telephone Number:

Well Driller: Henderson Well Drilling Address: P.O. Box 66
Harman, WV 26270

Telephone Number: 304-227-4365

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
5	Soil horizons
57	Ss. weathered
135	Ss & Sh red & gray
	20 GPM @ 101.0'

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 135.0' Date Completed: 11/01/88

CASING: Length 64 Feet Height above ground 1.25 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	20		
Pumping Level (Ft Below Grade)	134		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Royse Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Randell D. Henderson — Name
401 — Certification No.
Henderson Well Drilling — Registered Business Name
Signed
11/30/88 — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s): 12/07-15/88 County: Tucker Permit #: DW-47-88-60

Town: Area Name/Location: 1st. property on Canaan Loop Road N. to right.

Well Owner: M. Leyden Willingham Address: Canaan Heights

Telephone Number: 205 237-4429 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
2	Soil horizons.
21	Ss., weathered.
66	Sh., gray.
96	Sh., weathered.
198	Sh., red.
547	Ss. & Sh., red & gray.
	1 GPM. source undetected.

REMARKS:

Type of Well: Domestic Drilling Method: DHM

Well Diameter: 8" Casing O.D.: 6 5/8"

Well Depth: 547.0' Date Completed: 12/15/88

CASING: Length 105 Feet Height above ground 1 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	1		
Pumping Level (Ft Below Grade)	546		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Copper Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Randal D. Henderson — Name
421 — Certification No.
Henderson Well Drilling — Registered Business Name
Randal D. Henderson — Signed
01/02/89 — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 09/01-05/89 County Tucker Permit #: DW-47-89-41

Town: _____ Area Name/Location Canaan Heights.

Well Owner: Henry Carter Address: P.O. Box 239

Telephone Number: 259-5547 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING	REMARKS:
18	Ss., weathered, brown.	Type of Well: Domestic Drilling Method: DHH
20	Ss. w/occ. weathered zones,	Well Diameter: 6" Casing O.D.: 6 5/8"
	gray & brown.	Well Depth: 145.0' Date Completed: 09/05/89
22	Ss. w/coal spars.	**CASING:** Length 106 Feet Height above ground 1.2 Feet
67	Ss., gy. w/occ/. thin Sh.	☑ Steel ☐ Plastic ☐ Cast Iron
86	Sh., gy. w/sparse thin Ss.	Other _____ Type
120	St., gray-green w/occ.	
	thin Sh., red.	**SCREEN**
	10 GPM @ 118-120'.	☒ None Installed
145	Sh., red w/occ. thin Ss.,	Type _____ Diameter _____
	gray.	Slot/Gauge _____ Length _____
		Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	10		
Pumping Level (Ft Below Grade)	144		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Royer Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Charles Douglas Henderson 016
Name Certification No.

Henderson Well Drilling
Registered Business Name

Charles Douglas Henderson 09/25/89
Signed Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s): 07/26/91 County: Tucker Permit #: DW-47-91-20

Town: Area Name/Location: Canaan Heights.

Well Owner: Harold Dial Address: Rt. 1, Box 41

Telephone Number: 259-5139 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
10	Sand.
35	Ss., brown & white.
50	Ss., gray.
60	Sh., gray.
80	Ss, gray.
125	Ss., gray w/Sh., red &
	gray.
	6 GPM @ 85'. Additional
	54 GPM continuously
	between 95' and 125'.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 125.0' Date Completed: 07/26/91

CASING: Length 67 Feet Height above ground 2 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	60		
Pumping Level (Ft Below Grade)	124		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Royer Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Charles D. Henderson 252
Name Certification No.

Henderson Well Drilling
Registered Business Name

Charles D. Henderson 08/09/91
Signed Date

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 07/10-11/95 County Tucker Permit #: DW-47-95-21

Town: Area Name/Location Canaan Heights.

Well Owner: Kevin L. Smith Address: Rt. 1, Box 33

Telephone Number: 304 259-5694 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
003	Soil horizons.
024	Shale & sandstone, weathered.
230	Shale & sandstone with streaks of coal.
250	Shale & sandstone, red.
260	Shale & sandstone, gray. .25 GPM est. @ 175'. Owner did not wish to drill deeper at this time.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 260.0' Date Completed: 07/11/95

CASING: Length 32 Feet Height above ground 1 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	.25		
Pumping Level (Ft Below Grade)	259		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Royer Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Randal D. Henderson 421
Name Certification No.

Henderson Well Drilling
Registered Business Name

Signed 08/01/95
Date

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s): 07/11-12/95 County: Tucker Permit #: DW-47-95-22

Town: Area Name/Location: Off of Bearden Knob Rd. in Canaan Heights.

Well Owner: Harry T. Reed Address: Rt. 1, Box 36A

Telephone Number: 304 259-5195 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
002	Soil horizons.
033	Sandstone, weathered.
140	Sandstone & shale, gray,
	with streaks of coal.
141	Fracture w/2.5 GPM.
220	Sandstone & shale, gray,
	with streaks of coal.
	2.5 GPM @ 141', .5 GPM @
	190'.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 220.0' Date Completed: 07/12/95

CASING: Length 39 Feet Height above ground 1 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	3		
Pumping Level (Ft Below Grade)	219		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. ~~Royer Cast Aluminum~~

Well Seal: Type, Make, Etc. ~~None~~

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Randal D. Henderson 421
Name Certification No.

Henderson Well Drilling
Registered Business Name

Signed 08/01/95
Date

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s): 10/17&18/95 County: Tucker Permit #: DW-47-95-36

Town: Area Name/Location: Canaan Heights

Well Owner: Edith Phelps Address: Rt. 1, Box 27

Telephone Number: 463-4579 Davis, WV 26260

Well Driller: Henderson Well Drilling Address: P.O. Box 66

Telephone Number: 304-227-4365 Harman, WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
001	Soil horizons.
013	Sandstone, weathered.
042	Sandstone, grey.
043	Slightly weathered zone.
207	Sandstone & shale, grey
	with streaks of coal.
	1/2 GPM @ 60'.
	Owner did not wish to
	drill deeper.

REMARKS:

Type of Well: Domestic Drilling Method: DHH

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 207.0' Date Completed: 10/18/95

CASING: Length 21 Feet Height above ground 1 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☒ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	NA		
Pumping Rate (GPM)	1/2		
Pumping Level (Ft Below Grade)	206		
Duration of Test (In Hours)	1/2		
Recovery Time to Static Level (In Hours)	NA		

WELL HEAD

Pitless Adapter: Type, Make, Etc. None installed

Well Cap: Type, Make, Etc. Royer Cast Aluminum

Well Seal: Type, Make, Etc. None

Well Platform: To be installed by owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☒ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Randal D. Henderson — Name
421 — Certification No.
Henderson Well Drilling — Registered Business Name
Signed
11/02/95 — Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 10/5/01 County Tucker Permit #: OW-47-01-17

Town: Davis Area Name/Location Canaan Heights Road

Well Owner: Bill Easter Address:

Telephone Number:

Well Driller: Blackwater Const. Comp. Address: P.O. BOX 106

Telephone Number: 304-227-4460 Harman WV. 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
2	Soil Horizon
24	Weathered SS
35	White & Brown SS
130	Gray SS w/Lyrs, Brown SS
130	Fracture 1/2 Gpm
190	Gray Shale
235	Gray SS

REMARKS:

Type of Well: Domestic Drilling Method: D.H.H.

Well Diameter: 6 1/8" Casing O.D.: 6 5/8"

Well Depth: 235 Date Completed: 11/5/01

CASING: Length 21 Feet Height above ground 1 Feet

☑ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☑ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	N/A		
Pumping Rate (GPM)	1/2		
Pumping Level (Ft Below Grade)	N/A		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	N/A		

WELL HEAD

Pitless Adapter: Type, Make, Etc.

Well Cap: Type, Make, Etc. Royer Alum.

Well Seal: Type, Make, Etc. Bentonite

Well Platform: To be Installed By Owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☑ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Delmer Fields Jr. 583
Name Certification No.

Blackwater Const. Comp.
Registered Business Name

Delmer Fields Jr. 11/27/01
Signed Date

SW258

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT

Date(s) 7-12-02 County Tucker Permit #: DW-47-02-21
Town: Davis Area Name/Location Canaan Heights Davis
Well Owner: C. Harold Dial Address: Rt 1 Box 41
Telephone Number: 304-259-5139 Davis W.V. 26260
Well Driller: Wolford's Well & Pump Service Inc Address: HC 33 Box 3005 Spring Run Rd
Telephone Number: 304-257-9717 Dorcas W.V. 26847

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
0-7	Dirt Rocks
7-18	Sandstone
18-30	Sandy Soil
30-49	Gray Sandy Shale
49-50	Water
50-89	Gray Shale
89-90	Water
90-97	Red Shale
97-125	Gray Shale

REMARKS:

Type of Well: Orchid Drilling Method: air Rotary
Well Diameter: 6 1/2 Casing O.D.: 6 5/8
Well Depth: 125 ft Date Completed: 7-12-02
CASING: Length 40 Feet Height above ground 1 1/2 Feet
☑ Steel ☐ Plastic ☐ Cast Iron
Other _____ Type

SCREEN
☑ None Installed
Type _____ Diameter _____
Slot/Gauge _____ Length _____
Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	40 ft		
Pumping Rate (GPM)	40 GPM		
Pumping Level (Ft Below Grade)	100 ft		
Duration of Test (In Hours)	1 hr		
Recovery Time to Static Level (In Hours)	1 hr		

WELL HEAD
Pitless Adapter: Type, Make, Etc. to be installed w/ Pump system
Well Cap: Type, Make, Etc. LRG-1
Well Seal: Type, Make, Etc. _____
Well Platform:
Length _____ Width _____ Thickness _____
Grouting: ☐ Yes ☑ No
All Public Water Supplies must be grouted.

hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record s true to the best of my knowledge and belief.

Denton J. Wolford 543
Name Certification No.
Wolford's Well & Pump Service Inc
Registered Business Name
Denton J. Wolford 7/19/02
Signed Date

WV Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

SW258

WELL COMPLETION REPORT

Date(s) 11/21/02 / 11/21/03 County Tucker Permit #: DW-47-02-49

Town: Davis Area Name/Location Canaan Heights

Well Owner: Sammy Huffman Address:

Telephone Number:

Well Driller: Blackwater Const. Co. Delmer Fields Jr. Address: P.O. BOX 106

Telephone Number: 304-227-4460 Harman, WV. 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
1	Soil Horizon
30	Weathered SS
195	Gray SS
195	Fracture 1 Gpm
270	Gray Shale w/Lyrs. Gray SS
300	Gray Shale w/Lyrs. Red Shale

REMARKS:

Type of Well: Domestic Drilling Method: D.H.H.

Well Diameter: 6 1/8" Casing O.D.: 6 5/8"

Well Depth: 300' Date Completed: 6/12/03

CASING: Length 42 Feet Height above ground 1 Feet

☑ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☑ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	N/A		
Pumping Rate (GPM)	1		
Pumping Level (Ft Below Grade)	N/A		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	N/A		

WELL HEAD

Pitless Adapter: Type, Make, Etc.

Well Cap: Type, Make, Etc. Royer Alum.

Well Seal: Type, Make, Etc. Bentonite

Well Platform: To be Installed By Owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☑ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Delmer Fields Jr — 583
Name — Certification No.

Blackwater Const. Co
Registered Business Name

Delmer Fields Jr — 7/5/03
Signed — Date

WV Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

SW258

WELL COMPLETION REPORT

Date(s) 9/29/04 9/29/05 County Tucker Permit #: DW-47-04-25

Town: Davis Area Name/Location Canaan Heights

Well Owner: John W Fitzwater Address:

Telephone Number:

Well Driller: Blackwater Const. Co. Address: P.O. Box 106

Telephone Number: 227-4460 Harman WV 26270

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
2	Soil Horizon
18	Weathered Shale
29	Gray SS w/Lyrs. Brown SS
31	Coal
73	Gray SS w Thin Lyrs. Brown SS
232	Gray SS
293	Gray Shale w/Lyrs. Gray SS
300	Red Shale

REMARKS:

Type of Well: Domestic Drilling Method: D.H.H.

Well Diameter: 6 1/8" Casing O.D.: 6 5/8"

Well Depth: 300' Date Completed: 10/04

CASING: Length 42 Feet Height above ground 1 Feet

☑ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☑ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	N/A		
Pumping Rate (GPM)	2		
Pumping Level (Ft Below Grade)	N/A		
Duration of Test (In Hours)	1/4		
Recovery Time to Static Level (In Hours)	N/A		

WELL HEAD

Pitless Adapter: Type, Make, Etc. N/A

Well Cap: Type, Make, Etc. Royer Alum.

Well Seal: Type, Make, Etc. Bentonite

Well Platform: To be Installed By Owner

Length _____ Width _____ Thickness _____

Grouting: ☐ Yes ☑ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Delmer Fields Jr. 583
Name Certification No.

Blackwater Const. Co.
Registered Business Name

Signed [signature] 10/15/04
Date

WV Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

SW258

WELL COMPLETION REPORT

Date(s) 9-9-05 County Tucker Permit #: DW 470521

Town: Davis Area Name/Location Canaan Heights

Well Owner: Cristal Moore Address: HC 70 Box 370

Telephone Number: Davis WV

Well Driller: Wayne's Water 'n' Wells Address: 19139 Garrett Highway

Telephone Number: 301-387-7181 Oakland MD 21550

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
0 - 8	Yellow Clay
8 - 31	Brown Sandstone
31 - 82	Gray Sandstone
82 - 84	COal
84 - 125	Dk Gray Sandy Shale
125 - 147	Gray Sandstone
147 - 165	Black Shale
165 - 191	Gray SShale
191 - 208	Red * Gray Shale
208 - 257	Gray Sandstone
257 - 282	Red Shale

REMARKS:

Type of Well: Domestic Drilling Method: Air Percussion

Well Diameter: 6 Casing O.D.: 6

Well Depth: 282 Date Completed: 9-6-05

CASING: Length 212 Feet Height above ground 1.5 Feet

☒ Steel ☐ Plastic ☐ Cast Iron

Other _____ Type

SCREEN

☐ None Installed

Type _____ Diameter _____

Slot/Gauge _____ Length _____

Set Between _____ Ft. and _____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	35		
Pumping Rate (GPM)	12		
Pumping Level (Ft Below Grade)			
Duration of Test (In Hours)	2		
Recovery Time to Static Level (In Hours)			

WELL HEAD

Pitless Adapter: Type, Make, Etc. Diekones S10

Well Cap: Type, Make, Etc. Varmet Proof

Well Seal: Type, Make, Etc. _____

Well Platform:

Length _____ Width _____ Thickness _____

Grouting: ☒ Yes ☐ No (Press Pumped)

All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

Wayne T. Belden — Name
391 — Certification No.
Wayne's Water n' Wells Ltd — Registered Business Name
Wayne T. Belden — Signed
9/9/05 — Date

WV STATE DEPARTMENT OF HEALTH
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

WELL COMPLETION REPORT "Abandonment"

Date(s) 9/13/05 County Tucker Permit #: DW-47-05-24
Town: Davis Area Name/Location Canaan Heights
Well Owner: Moore, Cristal Address: HC 70 Box 370
Telephone Number: 304-259-4823 Davis, WV 26260
Well Driller: Wayne's Water 'n' Wells Address: 19139 Garrett Hwy
Telephone Number: 301-387-7181 Oakland, MD 21550

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
ABANDON WELL	
142-0	Grout Seal
	8 Bags
	(Press Pumped)

REMARKS:

Type of Well: Drilling Method:
Well Diameter: Casing O.D.:
Well Depth: Date Completed:
CASING: Length ____ Feet Height above ground ____ Feet
☐ Steel ☐ Plastic ☐ Cast iron
Other ____ Type

SCREEN
☐ None Installed
Type ____ Diameter ____
Slot/Gauge ____ Length ____
Set Between ____ Ft. and ____

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)			
Pumping Rate (GPM)			
Pumping Level (Ft Below Grade)			
Duration of Test (In Hours)			
Recovery Time to Static Level (In Hours)			

WELL HEAD
Pitless Adapter: Type, Make, Etc.
Well Cap: Type, Make, Etc.
Well Seal: Type, Make, Etc.
Well Platform:
Length ____ Width ____ Thickness ____
Grouting: ☐ Yes ☐ No
All Public Water Supplies must be grouted.

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this re is true to the best of my knowledge and belief.

Wayne Bolden 391
Name Certification No.
Wayne's Water 'n' Wells, Inc.
Registered Business Name
Wayne D Bolden 9/13/05
Signed Date

WV Department of Health and Human Resources
Bureau of Public Health
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

SW258
10/01

WELL COMPLETION REPORT

(s) 1-3-07 County Tucker Permit #: DW-47-06-16

own: Davis Area Name/Location Canaan Heights

Well Owner: Donny Williams Address: 2608 Highland Ave.

Telephone Number: Parkersburg, WV 26101

Well Driller: Jason Hyre Address: P.O. Box 156

Telephone Number: 304-924-6898 Rock Cave, WV 26234

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING
0-5	top soil & rock
5-50	sandstone
50-53	coal
53-65	shale
65-118	sandstone
118-174	shale (water)
174-179	coal
179-190	sandstone
190-191	soft formation (water)
191-220	sandstone

REMARKS:

Type of Well: Water Drilling Method: Rotary

Well Diameter: 6" Casing O.D.: 6 5/8"

Well Depth: 220' Date Completed: 9-16-06

CASING: Length 21 Feet Height above ground 2 Feet

☐ Steel ☐ Plastic ☐ Cast Iron

Other Galvanized
Type

SCREEN

☐ None Installed

Type PVC Diameter 4"

Slot/Gauge 3/8" holes Length 215

Set Between 5 Ft. and 220 Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)	147		
Pumping Rate (GPM)	15		
Pumping Level (Ft. Below Grade)			
Duration of Test (In Hours)			
Recovery Time to Static Level (In Hours)			

WELL HEAD

Pitless Adapter: Type, Make, Etc.

Well Cap: Type, Make, Etc. Royer

Well Seal: Type, Make, Etc.

Well Platform:

Length Width Thickness

Grouting: XX Yes ☐ No
All Public Water Supplies must be grouted.

ıereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record true to the best of my knowledge and belief.

Jason Hyre 573
Name Certification No.

Hyre's Well & Pump Service
Registered Business Name

Jason Hyre 1-3-07
Signed Date

WV Department of Health and Human Resources
Bureau for Public Health
Office of Environmental Health Services
ENVIRONMENTAL ENGINEERING DIVISION

SW258

WELL COMPLETION REPORT

Date(s) 9-18-07 County Tucker Permit #: DW-47-07-13

Town: Area Name/Location CAY AAN HEIGHTS

Well Owner: KEVIN SMITH Address: ↗

Telephone Number:

Well Driller: ROWAN DRILLING Address: RT 1 BOX 217R.

Telephone Number: 636-8922 BEVERLY WV. 26253

WELL LOG

DEPTH IN FEET	FORMATIONS: KIND, THICKNESS, AND IF WATER BEARING	REMARKS:
0 TO 30	SANDSTONE WHITE GRAY	Type of Well: DOMESTIC Drilling Method: DHH
		Well Diameter: 6 1/8 Casing O.D.: 6 5/8
30 TO 100	SANDSTONE GRAY	Well Depth: 156 Date Completed: 9-18-07
100 TO 156	BLACK SHALE	**CASING:** Length 21 Feet Height above ground ____ Feet
		☑ Steel ☐ Plastic ☐ Cast Iron
	WATER AT	Other ____ Type
	50 FT	
	100 FT	**SCREEN**
	120	☐ None Installed
		Type ____ Diameter ____
		Slot/Gauge ____ Length ____
		Set Between ____ Ft. and ____ Ft.

PUMPING OR BAILING TEST

DETAILS	#1	#2	#3
Static Water Level (Ft. Below Grade)			
Pumping Rate (GPM)	30		
Pumping Level (Ft Below Grade)	150		
Duration of Test (In Hours)	4		
Recovery Time to Static Level (In Hours)	1		

WELL HEAD

Pitless Adapter: Type, Make, Etc.

Well Cap: Type, Make, Etc. Boyer

Well Seal: Type, Make, Etc.

Well Platform: By owner

Length ____ Width ____ Thickness ____

Grouting: ☑ Yes ☐ No
All Public Water Supplies must be grouted.

1 BAG

I hereby certify that this well was drilled and constructed under my supervision, in compliance with all requirements of the referenced permit, and that this record is true to the best of my knowledge and belief.

ROWAN DRILLING — Name
450 — Certification No.
ROWAN DRILLING — Registered Business Name
Roy Rowan — Signed
9-18-07 — Date

DATE RECEIVED	June 30 2010	WATER WELL COMPLETION REPORT	SUBMITTED WITHIN 30 DAYS AFTER WELL IS COMPLETED
MM DD YY	PERMIT NO. DW-47-10-03		FILL IN THIS FORM COMPLETELY PLEASE PRINT OR TYPE

LOCATION OF WELL

Well Owner: Last Name Smith First Name Donald

Street/Road Pittsburg, PA County Tucker Zip Code

Latitude: _____ Deg _____ Min _____ Sec
Longitude: _____ Deg _____ Min _____ Sec
Acquired By: ☐ GPS ☐ Topo ☐ Other

AREA NAME/LOCATION: Cannan Heights lot #12

TYPE OF WELL:
☒ Potable ☐ Public Water Supply
☐ Geothermal ☐ Industrial
☐ Commercial ☐ Dewatering
☐ Irrigation ☐ Test/Exploratory
☐ Other

WELL LOG

Depth From (ft.)	Depth To (ft.)	State the kind of formation penetrated, their color, caves, and if water bearing with estimate flow (GPM).
0	1	Brown Sandy Clay (soft)
1	8	Brown Sandstone (very hard)
8	12	Brown Sandy Shale (soft)
12	17	Pinkish + Tanish Sandstone (very hard)
17	21	Dark Brown Sandstone (hard)
21	30	Gray Sandy Shale (soft)
30	35	Gray + Tanish Shale (soft)

If additional space is needed, use additional sheets and attach w/permit # at top.

DRILLING METHOD
☐ Cable Tool ☐ Rotary
☒ Rotary Hammer ☐ Other

Hole Diameter 6 (in)
Total depth 420 (ft)

CASINGS RECORD
MAIN CASING TYPE
☒ Steel ☐ Plastic
☒ Other Galvanized
Casing Diameter 6 5/8 (in)
Wall Thickness 0.188 (in)
Casing Length 62 (ft)

Other Casing or Liner Used
Type ☐ Steel ☒ Plastic
☒ Other F-480 Well Liner
Casing/Liner Diameter 4 (in)
Length 420 (ft) from 420 (ft)
to -4 (ft) below ground

SCREEN RECORD
☒ Not Installed ☐ Installed
Material: ☐ Bronze ☐ Plastic
Diameter of screen _____ (in)
Slot size _____
Length _____ (ft) from _____ (ft)
to _____ (ft)

GRAVEL PACK RECORD
Gravel Pack: ☐ Yes ☒ No
From _____ (ft) to _____ (ft)

GROUTING RECORD
Grouting Material:
☐ Cement ☒ Bentonite Clay
Other
No. of Bags: 14
Installation Method: Pump / Bail

PUMP INSTALLED
By Driller ☐ Yes ☒ No

ESTIMATED WELL YIELD
Estimated at 20 G.P.M
Static Water Level 209 (ft)
*Pumping level below land surface _____ (ft) after _____ hrs. at _____ G.P.M. (Estimated)
*Note: For Public Water Supply wells please submit required yield and drawdown tests.

WELL HEAD COMPLETION
Casing height above grade 1 (ft)
Type Of Well Cap Approx
Installed: Vermin Proof

VARIANCE ISSUED ☐ Yes ☒ No
Request Number

COMMENTS BY INSTALLER:
- H_2O 213' 1 gpm
- H_2O 308' Fractured Gray Sandstone 19 gpm
- 4x6 Packer Set at 340' to case off dry crack at 367'

Driller did not do pump

hereby certify that this well has been constructed in accordance with state rules and in conformance with ll conditions stated in the above captioned permit, and that the information presented herein is accurate nd complete to the best of my knowledge.

ompany Name Frame Drilling Co. WV Contractor No. WW00631
usiness Registration No. 1036-0948 Master Well Driller Certification No. 605, 151
laster Well Driller (print) Jack R. Frame III, Jack R. Frame II
laster Well Driller Signature Jack R. Frame III, Jack R. Frame II

ITE SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR ITEWORK IF DIFFERENT FROM MASTER DRILLER.)

ourneyman Well Driller Certification No. 731
ourneyman Well Driller (please print)
pprentice and Name (s)

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker Permit # DW 47-10-03

Well Owner Donald Smith Address

Well depth 420 Casing 62' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
35-38	Brown + Grayish Shale (soft)	145-151	Light Gray Sandstone (soft)
38-40	Light Brown Sandstone (soft)	151-156	Light Gray Sandstone (Med)
40-43	Brown Sandstone (Med)	156-161	Gray Sandstone (soft)
43-48	Dark Gray Sandy	161-178	Gray Sandstone (Med)
	Shale (soft)	178-207	Red Sandy Shale (soft)
48-49	Coal	207-213	Gray Shale (soft)
49-54	Light Gray Sandstone (Med)	213-235	Red Shale (soft)
54-67	Gray Sandstone (Med)	235-243	Gray Shale (soft)
67-73	Dark Gray Sandy	243-248	Gray Sandstone (hard)
	Shale (soft)	248-255	Pale Red Sandstone (Med)
73-98	Gray Sandstone (soft)	255-279	Red Shale (soft)
98-107	Light Gray Sandstone (hard)	279-308	Gray Sandstone (Med)
107-109	Gray Sandstone (Med)	308-316	Gray Sandstone (hard)
109-126	Dark Gray Sandy	316-333	Red Shale (soft)
	Shale (soft)	333-335	Gray Shale (soft)
126-132	Light Gray Sandstone (Med)	335-367	Red Shale (soft)
132-135	Dark Gray Sandstone (soft)	367-369	Gray Shale (soft)
135-145	Light Gray Sandstone	369-420	Red Shale (soft)
	(Med)		

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker

Permit # DW 47-10-03

Well Owner Donnid Smith Address

Well depth 420 Casing 62' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
35-38	Brown + Grayish Shale (soft)	145-151	Light Gray Sandstone (soft)
38-40	Light Brown Sandstone (soft)	151-156	Light Gray Sandstone (Med)
40-43	Brown Sandstone (Med)	156-161	Gray Sandstone (soft)
43-48	Dark Gray Sandy	161-178	Gray Sandstone (Med)
	Shale (soft)	178-207	Red Sandy Shale (soft)
48-49	Coal	207-213	Gray Shale (soft)
49-54	Light Gray Sandstone (Med)	213-235	Red Shale (soft)
54-67	Gray Sandstone (Med)	235-243	Gray Shale (soft)
67-73	Dark Gray Sandy	243-248	Gray Sandstone (hard)
	Shale (soft)	248-255	Pale Red Sandstone (Med)
73-98	Gray Sandstone (soft)	255-279	Red Shale (soft)
98-107	Light Gray Sandstone (hard)	279-308	Gray Sandstone (Med)
107-109	Gray Sandstone (Med)	308-316	Gray Sandstone (hard)
109-126	Dark Gray Sandy	316-333	Red Shale (soft)
	Shale (soft)	333-335	Gray Shale (soft)
126-132	Light Gray Sandstone (Med)	335-367	Red Shale (soft)
132-135	Dark Gray Sandstone (soft)	367-369	Gray Shale (soft)
135-145	Light Gray Sandstone	369-420	Red Shale (soft)
	(Med)		

/08

ST/CO USE ONLY
DATE RECEIVED

MM DD YY
___ ___ ___

DATE OF PUMP INSTALLATION

MM DD YY
5 27 10

WATER WELL PERMIT NO.

DW- 47-10-03

STATE OF WEST VIRGINIA WATER WELL PUMP INSTALLATION REPORT

FORM SW-262
THIS REPORT MUST BE SUBMITTED WITHIN 30 DAYS AFTER INSTALLATION IS COMPLETED

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

PUMP INSTALLATION LOCATION

Owner: LAST NAME Smith FIRST NAME Donald

STREET/ROAD | COUNTY Tucker | ZIP CODE

AREA NAME/LOCATION:
Canaan Heights Estates Lot 12

WATER SYSTEM USE: ☑ Potable ☐ Public Water Supply ☐ Geothermal ☐ Industrial ☐ Commercial ☐ Dewatering ☐ Irrigation ☐ Test/Exploratory ☐ Other ___

PUMPING EQUIPMENT

Type Pump: ☑ Submersible ☐ Jet
☐ Other (specify) ___
Pump Manufacturer: Myers
Pump Model: 2NFL152-8

INSTALLATION DETAILS

Well Diameter ___ inches
Well Depth 420 (Ft)
Static Water Level (from surface): 220 (Ft.)
Depth of pump: 410 (Ft.)
Riser Pipe: Material Plastic
Pressure Rating 160 (psi)

INSTALLATION DETAILS (CONT.)

Pitless: ☑ Pitless Adapter ☐ Pitless Unit
Pitless Manufacturer: Midwest
Pitless Model: JR-S-10
Method of Cutting Hole in Casing for Pitless: Drill
Storage Tank Model: WX202
Check Valves Locations: 410 270, 130, Outside casing
Well Disinfected: ☐ Yes ☑ No
By Whom: ___

COMMENTS BY INSTALLER

I hereby certify that this well has been constructed in accordance with state rules and that the information presented herein is accurate and complete to the best of my knowledge.

Pump Equipment Installed by :

Property Owner Name (Print) ___ **Owner Signature** ___
Pump Installation Test Passed on ___/___/___

Company Name Three-D Drilling **WV Contractor No.** 027870 **Business Franchise Number** 0026-3755
Master Well Driller Certification No. 489 **or Pump Installer Certification No.** ___
Master Well Driller (print) Roy E Wilson **Master Well Driller Signature** Roy E Wilson
Pump Installer (print) ___ **Pump Installer Signature** ___

SITE SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR SITEWORK IF DIFFERENT FROM MASTER DRILLER.

Journeyman Well Driller Certification No. ___
Journeyman Well Driller (please print) ___

Apprentice Name(s) ___, ___, ___

DIV/CO USE ONLY DATE RECEIVED MM DD YY	DATE THE WELL WAS COMPLETED MM DD YY 5 9 2011	STATE OF WEST VIRGINIA WATER WELL COMPLETION REPORT	FORM SW-258 THIS REPORT MUST BE SUBMITTED WITHIN 30 DAYS AFTER WELL IS COMPLETED
	PERMIT NO. DW-47-11-03		FILL IN THIS FORM COMPLETELY PLEASE PRINT OR TYPE

LOCATION OF WELL

Well Owner: Last Name Woodrill First Name Lewis

Street/Road New Castle, Va County Tucker Zip Code

Latitude: _____ Deg _____ Min _____ Sec
Longitude: _____ Deg _____ Min _____ Sec
Acquired By: ☐ GPS ☐ Topo ☐ Other

AREA NAME/LOCATION: Cannan Heights Lot #3

TYPE OF WELL: ☒ Potable ☐ Public Water Supply ☐ Geothermal ☐ Industrial ☐ Commercial ☐ Dewatering ☐ Irrigation ☐ Test/Exploratory ☐ Other

WELL LOG

Depth From (ft.)	Depth To (ft.)	State the kind of formation penetrated, their color, caves, and if water bearing with estimate flow (GPM).
0	5	Unconsolidated - dark brown Sandy Clay
5	7	Brown Sandstone (hard)
7	12½	Light Brown Sandy Shale (soft)
12½	14	Coal
14	19	Light Brown Sandstone (soft)
19	28	Gray Sandstone (hard)
28	29	Coal
29	48	Light Gray Sandstone (hard)
48	52	Gray Sandstone (hard)

If additional space is needed, use additional sheets and attach w/permit # at top.

DRILLING METHOD
☐ Cable Tool ☐ Rotary
☒ Rotary Hammer ☐ Other

Hole Diameter 6 (in)
Total depth 520 (ft)

CASINGS RECORD
MAIN CASING TYPE
☒ Steel ☐ Plastic
☒ Other Galvinized
Casing Diameter 6 5/8 (in)
Wall Thickness 0.188 (in)
Casing Length 42 (ft)

Other Casing or Liner Used
Type ☐ Steel ☒ Plastic
☐ Other See comments
Casing/Liner Diameter _____ (in)
Length _____ (ft) from _____ (ft) to _____ (ft)

SCREEN RECORD
☒ Not Installed ☐ Installed
Material: ☐ Bronze ☐ Plastic
Diameter of screen _____ (in)
Slot size _____
Length _____ (ft) from _____ (ft) to _____ (ft)

GRAVEL PACK RECORD
Gravel Pack: ☐ Yes ☒ No
From _____ (ft) to _____ (ft)

GROUTING RECORD
Grouting Material:
☐ Cement ☒ Bentonite Clay
Other _____
No. of Bags: 7
Installation Method: Pump/Pour

PUMP INSTALLED See comments
By Driller ☐ Yes ☒ No

ESTIMATED WELL YIELD
Estimated at 5 G.P.M
Static Water Level 316 (ft)
*Pumping level below land surface _____ (ft) after _____ hrs. at _____ G.P.M. (Estimated)
*Note: For Public Water Supply wells please submit required yield and drawdown tests.

WELL HEAD COMPLETION
Casing height above grade 1 (ft)
Type Of Well Cap Approx
Installed: Vermin Proof

VARIANCE ISSUED ☐ Yes ☒ No
Request Number _____

COMMENTS BY INSTALLER:
- F-480 Sch. 40 4" PVC Well Liner installed from bottom hole to approx. 4' below ground
- H2O 128' 2 gpm
- H2O 316' 1 gpm
- H2O 404' 1 gpm
- H2O 443' 1 gpm

Pump to be installed at intermediate

I hereby certify that this well has been constructed in accordance with state rules and in conformance with all conditions stated in the above captioned permit, and that the information presented herein is accurate and complete to the best of my knowledge.

Company Name Frame Drilling Co **WV Contractor No.** WA0311
Business Registration No. 1036-0948 **Master Well Driller Certification No.** 1805
Master Well Driller (print) Jack R. Frame III
Master Well Driller Signature _____

SITE SUPERVISOR (SIGNATURE OF DRILLER OR JOURNEYMAN RESPONSIBLE FOR SITEWORK IF DIFFERENT FROM MASTER DRILLER.)

Journeyman Well Driller Certification No. 731
Journeyman Well Driller (please print) Travis L. Frame
Apprentice and Name (s) _____, _____

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker Permit #DW 47-11-03

Well Owner Woodall Address Canaan Heights Lot #3

Well depth 520 Casing 42' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
52-54	Light Gray Sandstone	132-136	Gray Sandstone (hard)
	(Med)	136-143	Gray Shale (soft)
54-56	Light Gray Sandstone (hard)	143-144	Red Shale (soft)
56-62	Dark Gray Sandstone	144-145	Gray Shale (soft)
	(Med)	145-145½	Red Shale (soft)
62-80	Gray Sandstone (hard)	145½-148	Pale Red Sandstone
80-89	Dark Gray Sandstone		(Med)
	(Med)	148-157	Light Gray Sandstone
89-107	Gray Sandstone (Med)		(Med)
107-121	Light Gray Sandstone	157-183	Red Shale (soft)
	(Med)	183-190	Gray Sandstone (hard)
121-124	Light Tan Sandstone	190-259	Red Shale (soft)
	(hard)	259-292	Light Gray Sandstone
124-128	Dark Gray Sandstone		(hard)
	(soft)	292-307	Red Sandstone (Med)
128-130	Light Gray Sandstone	307-314	Gray Sandstone (Med)
	(hard)	314-316	Red Sandstone (Med)
130-132	Light Gray Sandstone		
	(soft)	316-325	Gray Sandstone (hard)

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker Permit #DW 47-11-03

Well Owner Woodall Address Cannaw Heights - hwd #3

Well depth 520 Casing 42' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
325-329	Gray Sandy Shale (Med)		
329-404	Red Shale (soft)		
404-417	Gray Shale (soft)		
417-443	Red Shale (soft)		
443-494	Light Red Shale		
	(soft)		
494-501	Gray Shale (Med)		
501-517	Light Red Shale		
	(soft)		
517-520	Gray Shale (soft)		

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker Permit #DW 47-11-03

Well Owner Woodall Address Cannon Heights Lot #3

Well depth 520 Casing 42' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
52-54	Light Gray Sandstone	132-136	Gray Sandstone (hard)
	(Med)	136-143	Gray Shale (soft)
54-56	Light Gray Sandstone (hard)	143-144	Red Shale (soft)
56-62	Dark Gray Sandstone	144-145	Gray Shale (soft)
	(Med)	145-145½	Red Shale (soft)
62-80	Gray Sandstone (hard)	145½-148	Pale Red Sandstone
80-89	Dark Gray Sandstone		(Med)
	(Med)	148-157	Light Gray Sandstone
89-107	Gray Sandstone (Med)		(Med)
107-121	Light Gray Sandstone	157-183	Red Shale (soft)
	(Med)	183-190	Gray Sandstone (hard)
121-124	Light Tan Sandstone	190-259	Red Shale (soft)
	(hard)	259-292	Light Gray Sandstone
124-128	Dark Gray Sandstone		(hard)
	(soft)	292-307	Red Sandstone (Med)
128-130	Light Gray Sandstone	307-314	Gray Sandstone (Med)
	(hard)	314-316	Red Sandstone (Med)
130-132	Light Gray Sandstone	[illegible]	
	(soft)	316-325	Gray Sandstone (hard)

Frame Drilling Company
PO Box 1907
Elkins, WV 26241
Tel: 304-636-6025
Fax: 304-636-0231

Well Completion Report

County Tucker Permit #DW 47-11-03

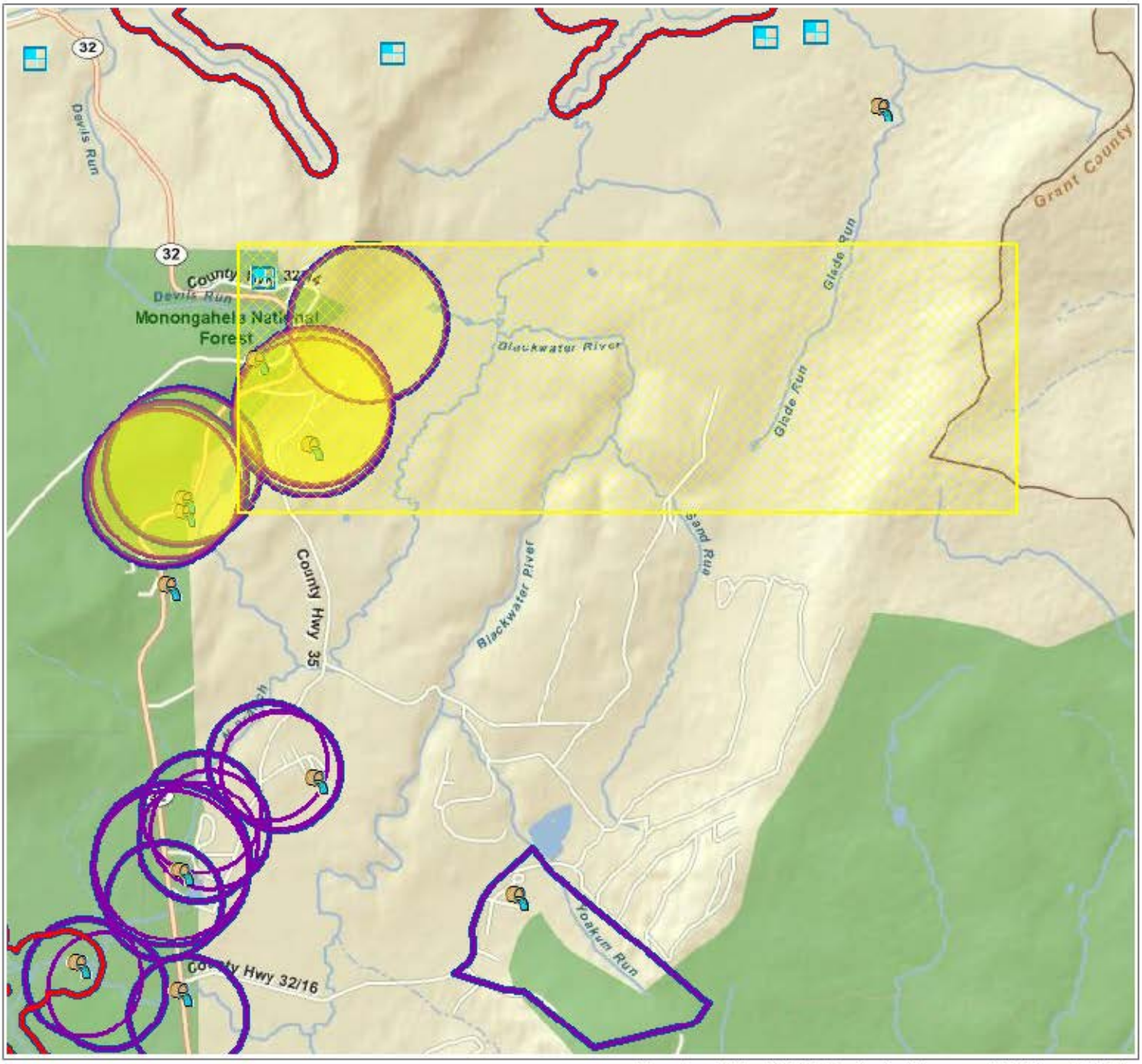
Well Owner Woodnill Address Canaan Heights - hole #3

Well depth 520 Casing 42' of Galvinized Steel

Comments:

Depth in feet	Formations	Depth in feet	Formations
325-329	Gray Sandy Shale (Med)		
329-404	Red Shale (soft)		
404-417	Gray Shale (soft)		
417-443	Red Shale (soft)		
443-494	Light Red Shale		
	(soft)		
494-501	Gray Shale (Med)		
501-517	Light Red Shale		
	(soft)		
517-520	Gray Shale (soft)		

WVMA Bearden Knob Firing Range



N

4 km

2 mi

Map Created by WV GIS Technical Center on Wed Sep 5 2012

User Comments:

Note: Approximate area of MRS shown by cross-hatched pattern.

Protection Areas

- Zone of Critical Concern
- Wellhead Protection Areas
- Secondary Wellhead Protection Areas

EPA Layers

- NPDES
- EPA Super Fund
- RCRA
- Toxic Release Inventory

DEP Layers

- Marcellus Wells - Permitted
- Marcellus Wells - Completed
- Marcellus Wells - Cancelled
- Abandoned Mine Site
- Solid Waste Facility
- Coal Dam
- Coal Permit Boundary
- DEP Oil & Gas Wells

Disclaimer:

This map is provided as a public service by the West Virginia Bureau for Public Health. The Bureau makes NO representation regarding completeness or accuracy of the data hereon. Efforts are made to verify and update the data used to generate this map. However, with data sets of this size and nature, eliminating all errors is difficult. Thus, the user assumes total responsibility for verification.

West Virginia Department of Health & Human Resources