AECOM

Draft Final
Feasibility Study Report
Camp O'Ryan Rifle Range, New York

Munitions Response Site NYHQ-008-R-02
New York Army National Guard

Army National Guard

Contract No. W9133L-14-D-0001
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Acronyms and Abbreviations

AECOM	AECOM Technical Services, Inc.
ALM	Adult Lead Methodology
ARAR	Applicable or Relevant and Appropriate Requirement
ARNG	Army National Guard
BCY	bank cubic yards
bgs	below ground surface
BLL	blood lead level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHE	CWM Hazard Evaluation Module
COC	Constituent of concern
COI	Contaminant of interest
COPEC	Contaminant of Potential Ecological Concern
CWM	Chemical Warfare Material
DERA	Defense Environmental Restoration Act
DMNA	Division of Military and Naval Affairs
DoD	Department of Defense
DU	Decision Unit
EHE	Explosive Hazard Evaluation Module
FS	Feasibility Study
GRA	general response action
HHE	Health Hazard Evaluation
HHRA	Human Health Risk Assessment
IEUBK	Integrated Exposure Uptake Biokinetic
ISM	Incremental Sampling Methodology
LTM	long-term management
LUC	Land Use Control
MC	munitions constituents
µg/dL	micrograms per deciliter
mg/kg	milligrams per kilogram
mm	millimeter
MRS	munitions response site
MRSPP	Munitions Response Site Prioritization Protocol
NCP	National Contingency Plan
NDNODS	Non-Department of Defense Non-Operation Defense Site
NYARNG	New York Army National Guard

NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
Parsons	Parsons Infrastructure and Technology
PbB	blood lead
PP	Proposed Plan
PV	Present Value
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
ROE	Right-of-entry
SLERA	Screening-Level Ecological Risk Assessment
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TMV	toxicity, mobility, or volume
U.S.	United States
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UU/UE	unlimited use/unrestricted exposure
XRF	x-ray fluorescence

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Executive Summary

The purpose of this Feasibility Study (FS) is to provide decision makers an overview of the development and analysis of remedial alternatives that address the Camp O'Ryan Rifle Range (NYHQ-008-R-02) Munitions Response Site (MRS) 2.

Camp O'Ryan MRS 2 Rifle Range is a former small arms range is located in Wethersfield, Wyoming County, New York. Camp O'Ryan was divided into three MRSs: Camp O'Ryan MRS 1 Pistol Range, Camp O'Ryan MRS 2 Rifle Range, and Camp O'Ryan MRS 3 Maneuvering Area. The Camp O'Ryan MRS 2 Rifle Range is located on the northern boundary of the 370-acre former Camp O'Ryan, which contains mostly gently rolling, forested terrain comprising deciduous trees with patches of open grass fields. The former small arms range was originally about 17.5 acres and was expanded to 42.41 acres as a result of the RI. The area outside of the Camp O'Ryan MRS 2, within the former Camp O'Ryan, was used by the New York Army National Guard (NYARNG) for both company and squad level training, including maneuver practicing and camping.

The Camp O'Ryan MRS 2 Rifle Range consists of a former 200-yard range with 50 targets and firing berms at distances of 100 and 200 yards and an earthen impact berm. The MRS 2 also includes a concrete retaining wall with target structures still intact. Small arms, including .30 caliber M1, were approved for use at Camp O'Ryan MRS 2; additional potential munitions used include .22, .38, and .45 caliber, 5.56 millimeter (mm) and 7.62mm. Live-fire training no longer occurs at the MRS 2. The property is privately owned and administered by the Edward N. George Estate. A portion of the property is owned by King Brothers Fireplace and Stove, Inc. The Camp O'Ryan MRS 2 was used by the NYARNG from 1949 to 1974 and then again from 1989 to 1994 (Parsons Infrastructure and Technology [Parsons], 2011). From 1949 to 1974, training areas included a rifle range, a pistol range, a tank driver training course, a range storage building, a field latrine, and a mess hall. From 1989 to 1994, it was documented that the MRS 2 was used for infantry training maneuvers, off-road driver training, and communication exercises. It is unknown if the ranges were reactivated in 1989 (Parsons, 2011).

The Remedial Investigation (RI), conducted between 2019 and 2020, compiled and evaluated information and data relating to the potential contamination associated with historical small arms training activities conducted at the Camp O'Ryan Rifle Range MRS 2. For the purpose of the RI, the MRS 2 was originally divided into three decision units (DUs) (100-Yard Firing Berm, Target Area, and Target Berm-Hillside), with two additional DUs added during the investigation to assess potential munitions constituents (MC) in sediment at a temporarily inundated area that collects surface water runoff at the base of the Target Berm (Target Berm-Ponded DU) and a seasonally flooded wetland on the east side of the Target Berm-Hillside (Wet Meadow DU).

Sampling for MC at the MRS 2 was completed at discrete and incremental sample (IS) locations.

Incremental Sampling Methodology Soil Sampling Exceedances

- 100-Yard Firing Berm: Human Health screening criterion met for lead. Ecological screening criteria exceedances for antimony and lead.
- Target Area: Human Health screening criterion exceedances for lead. Ecological screening criteria exceedances for antimony and lead.

- Target Berm-Hillside: Human Health screening criteria exceedances for lead and zinc. Ecological screening criteria exceedances for antimony, lead, and zinc.

Discrete Subsurface Soil Sampling Exceedances

- 100-Yard Firing Berm: Human Health screening criterion exceedance for lead. Ecological screening criteria exceedances for antimony and lead.
- Target Area: Human Health screening criterion exceedance for lead. Ecological screening criteria exceedances for antimony and lead.
- Target Berm-Hillside: Human Health screening criteria exceedances for copper, lead, and zinc. Ecological screening criteria exceedances for antimony, copper, lead, and zinc.

Target Berm-Ponded DU Sediment Exceedances:

- Human Health screening criteria exceedances for antimony and lead. Ecological screening criteria exceedances for antimony, copper, lead and zinc.

Wet Meadow DU Sediment Exceedances:

- Human Health screening criterion exceedances for lead. Ecological screening criteria exceedances for copper, lead, and zinc.

The remedial action objective is to prevent human exposure to lead above the New York State Department of Environmental Conservation's Soil Cleanup Objectives for residential exposure to lead (63 milligrams per kilogram) within the Camp O'Ryan Rifle Range MRS 2. The primary remedial goal is to prevent human contact with MC-contaminated soil. It is anticipated that any remediation conducted to remove exposure risks to human receptors will also reduce the exposure risk to ecological receptors. This estimation is appropriate given the size of the revised MRS 2, the associated inability to expose entire ecological populations compared to ecological individuals, and the lack of critical habitats within the MRS 2.

Because the RI sediment samples were collected from areas that are not perennially inundated, this FS is referring to all solid media as 'soil'. The same goals apply to soil and sediment and the remedy alternatives address sediment in the same manner as soil, thus there is no meaningful distinction between these media. The primary contaminant of concern present in soil at this MRS that presents an unacceptable risk to human health is lead, and therefore it influences the focus of the FS. It is anticipated that because antimony, copper, and zinc are all derived from the same source (i.e., spent bullets), risk of exposure for these MC metals will be concurrently reduced through remedial activities. This FS addresses the following general response actions: no action, LUCs, and MC-contaminated soil stabilization and removal with LUCs. Various technologies and process options were identified, evaluated, and developed into the following remedial action alternatives:

- No Action
- Land Use Controls (LUCs)

- Target Berm – Ponded DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with LUCs
- All DUs: MC-Contaminated Soil Stabilization and Excavation with Off-Site Disposal

These alternatives underwent detailed analysis during the FS, and **Table ES-1** presents the comparison of the alternatives.

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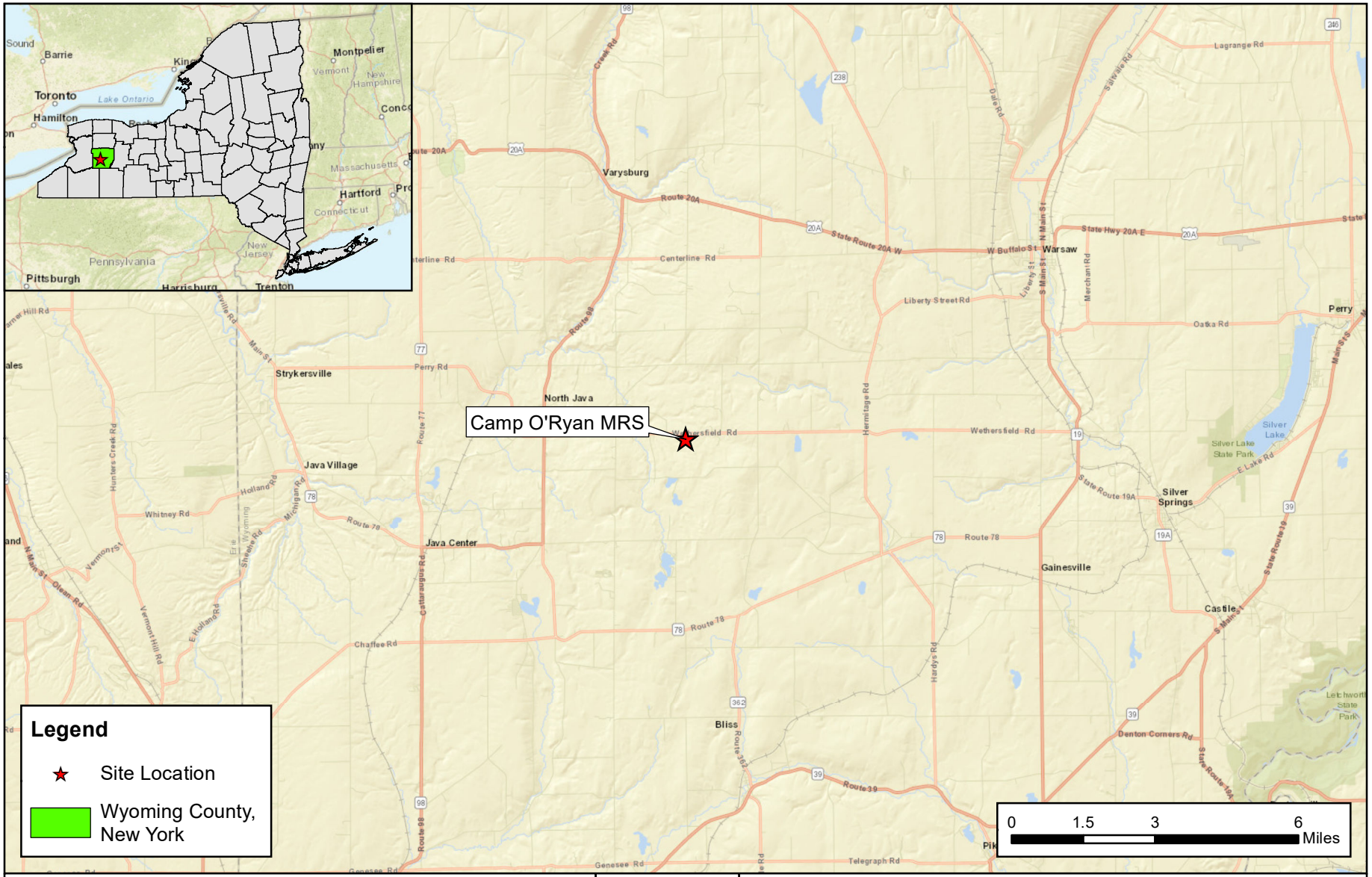

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SCALE	1:190,080	CHK BY	JW	6/2/2021
SOURCE	ARNG; State of New York, ESRI & Partners	PM	LS	6/2/2021

Camp O'Ryan Site Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure ES-1

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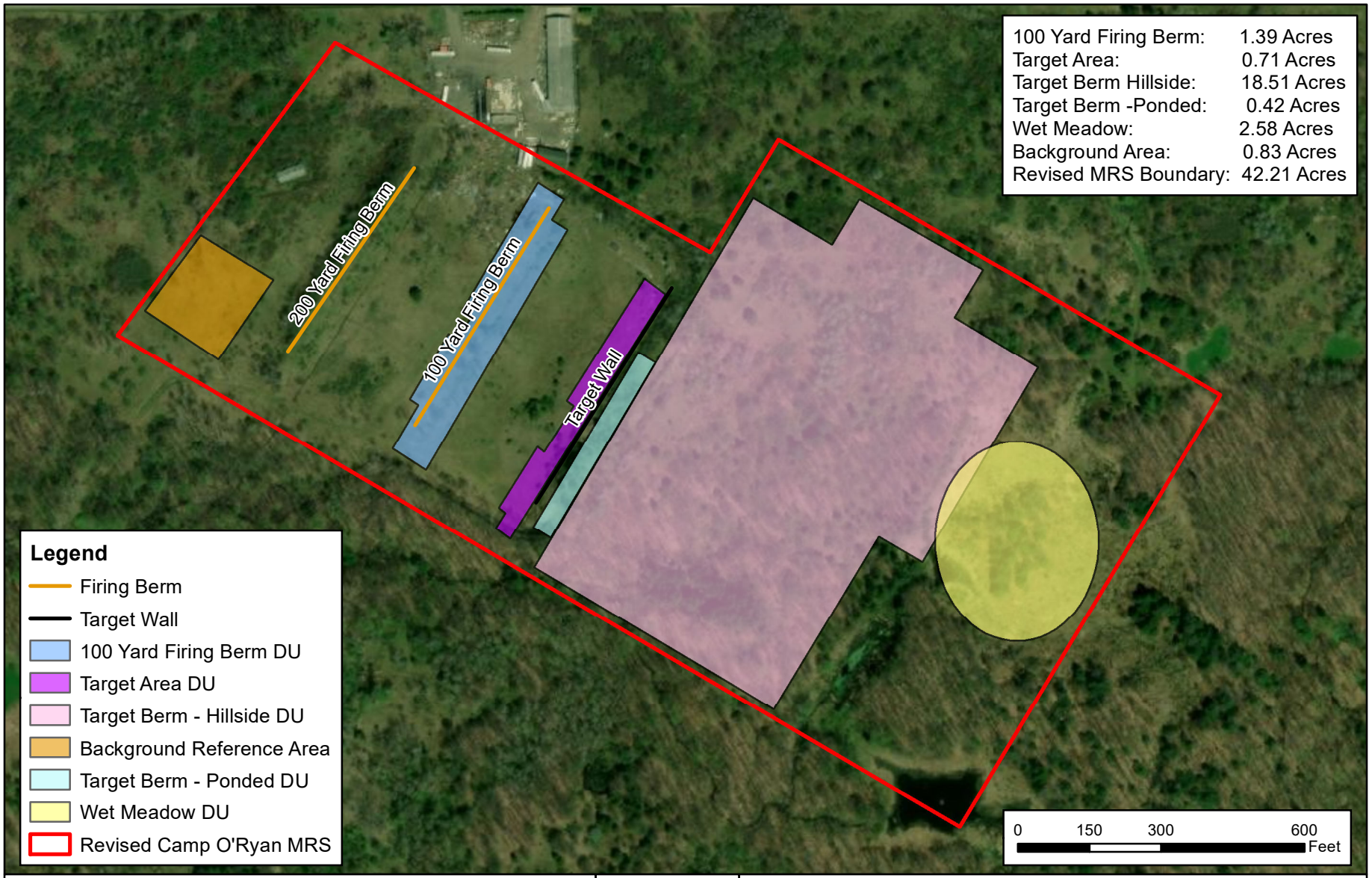

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	AS	11/20/2020

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Camp O'Ryan Revised MRS Boundary

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Figure ES-2

Prepared for: Army National Guard

TABLE ES-1
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
FOR MC-CONTAMINATED SOIL (NYHQ-008-R-02)

Screening Criteria		Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Target Berm - Ponded Area DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls	Alternative 4 All DUs: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste
Threshold	Overall Protection of Human Health and the Environment	○	○	◘	●
	Compliance with ARARs	○	○	●	●
Balancing	Long-Term Effectiveness	○	◘	◘	●
	Reduction of TMV Through Treatment	○	○	◘	●
	Short-Term Effectiveness	●	●	◘	◘
	Implementability	●	◘	◘	○
	Cost (x1,000)	$0	$153	$523	$26,140
Modifying (a)	State Acceptance	TBD	TBD	TBD	TBD
	Community Acceptance	TBD	TBD	TBD	TBD

Notes:

● Favorable ('YES' for threshold criteria)

◘ Moderately Favorable

○ Not Favorable ('NO' for threshold criteria)

ARAR = Applicable or Relevant and Appropriate Requirement
LUC = Land Use Control
MC = munitions constituents
TBD = To Be Determined
TMV = toxicity, mobility, or volume

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1 Introduction

This Feasibility Study (FS) report has been prepared in support of the Remedial Investigation (RI) / FS activities planned for the Camp O'Ryan Rifle Range Munitions Response Site 2 (MRS; Army Environmental Database Restoration Number NYHQ-008-R-02), located in New York (**Figure 1-1**). Non-Department of Defense (DoD) Non-Operational Defense Sites (NDNODS) are defense sites that were used exclusively by the Army National Guard (ARNG) and were never owned, leased, or otherwise possessed or used by the United States (U.S.) Army or other DoD component.

Based on results of the RI (AECOM Technical Services, Inc. [AECOM], 2021), the ARNG determined an FS should be conducted for the Camp O'Ryan Rifle Range MRS 2 (**Figure 1-2**). The FS was performed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and is part of the overall remedial action process.

Environmental work is being conducted at the MRS 2 by the ARNG Directorate and the New York ARNG (NYARNG). This project is being executed by AECOM, under ARNG Contract Number W9133L-14-D-0001, Delivery Order No. 0006, issued 20 September 2016 and modified 27 June 2017. Under this delivery order, AECOM is responsible for fully executing the FS at the Camp O'Ryan Rifle Range MRS 2.

1.1 Purpose

The purpose of this FS is to provide decision makers an overview of the development and analysis of remedial alternatives. The FS report is the basis for identifying a technically feasible and cost-effective remedial action that is protective of both human health and the environment. The overall objective of the remedial action alternatives considered for the MRS 2 is to reduce or eliminate potential contact with munitions constituents (MC)-contaminated soil by current and/or future site receptors.

The scope of the FS consists of the following steps, compliant with the requirements of the NCP (Code of Federal Regulations [CFR], Title 40, Part 300.430):

- Identify Applicable or Relevant and Appropriate Requirements (ARARs) and to be considered (TBC) criteria and develop remedial action objectives (RAOs).
- Develop the general response actions (GRAs) to satisfy the RAOs, including identification of the volumes or areas of soil to be addressed by the GRAs.
- Identify remedial technologies available to execute the GRAs and screen the technologies based on effectiveness, implementability, and relative cost.
- Assemble the selected remedial technologies into remedial alternatives using different GRA combinations, as appropriate.
- Conduct a detailed analysis of the alternatives based on the following criteria specified by the NCP (CFR, Title 40, Part 300.430[e][9]):

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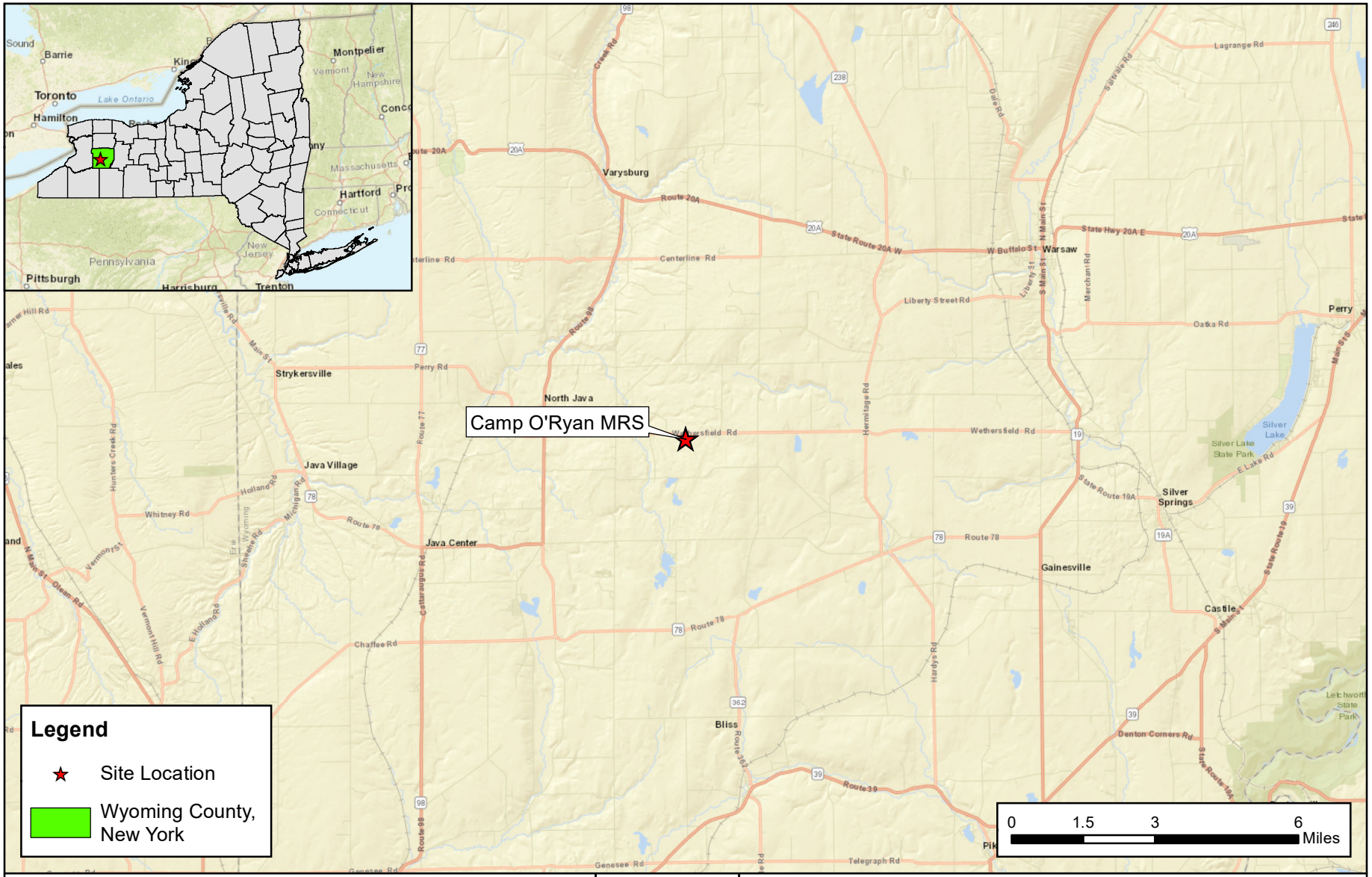

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PROJECT	FS through DD for Camp O'Ryan, NY MRS			
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SCALE	1:190,080	CHK BY	JW	6/2/2021
SOURCE	ARNG; State of New York, ESRI & Partners	PM	LS	6/2/2021

Camp O'Ryan Site Location

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Figure 1-1

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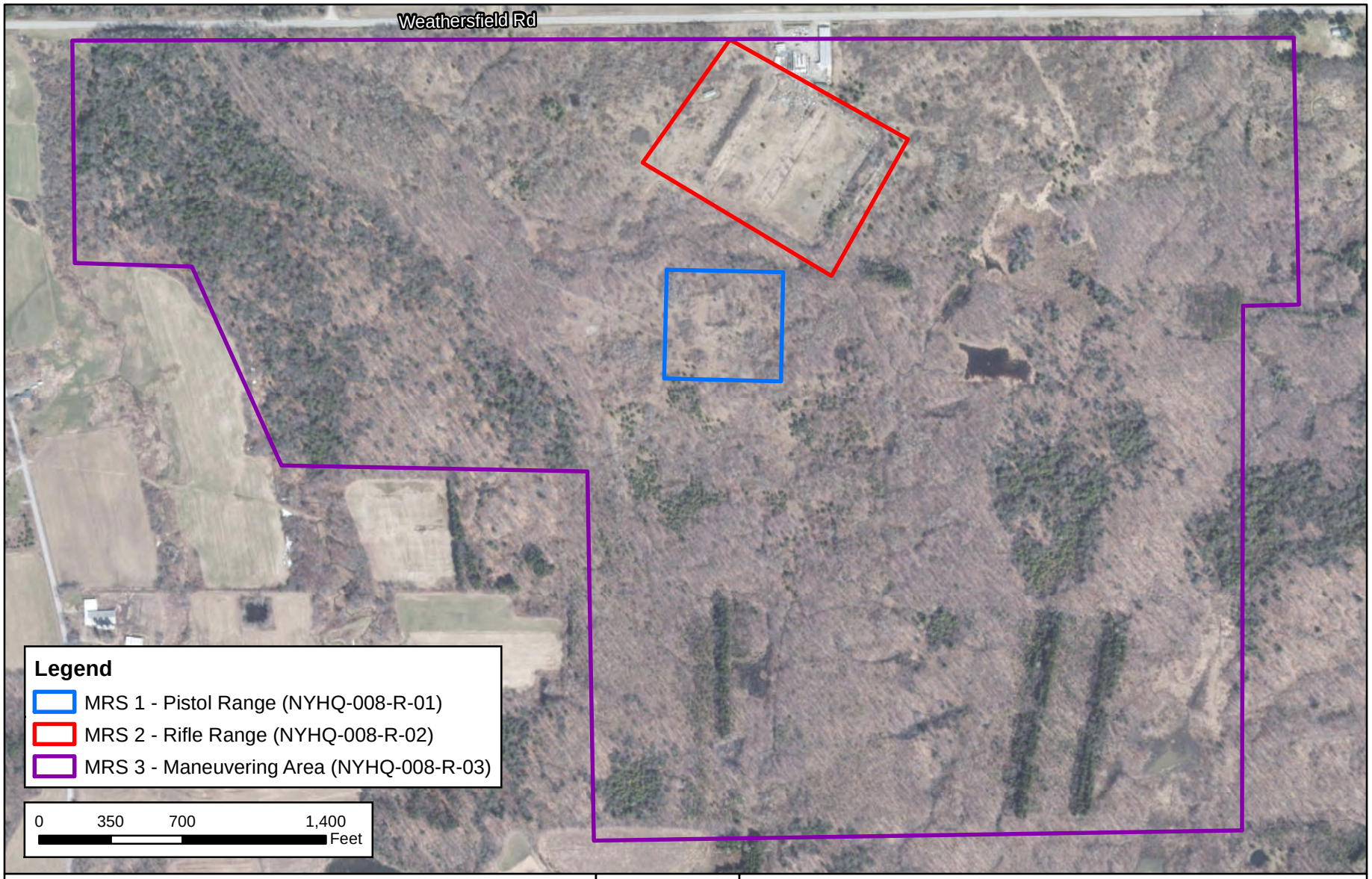

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SOURCE	ARNG; State of New York, ESRI & Partners	PM	LS	8/31/2018

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Camp O'Ryan Munitions Response Sites

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Figure 1-2

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Analyze considering two threshold criteria:

- Overall protection of human health and the environment
- Compliance with ARARs

Analyze considering additional five balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume (TMV) through treatment
- Short-term effectiveness
- Implementability (technical and administrative feasibility, and availability of materials and services)
- Cost

Analyze considering additional two modifying criteria (to be evaluated after regulatory agency review and public comment subsequent to the public comment period):

- State acceptance
- Community acceptance

1.2 Summary of Remedial Investigation Findings

The key findings of the RI (AECOM, 2021) relevant to development of RAOs and development and analysis of remedial alternatives are briefly summarized below.

1.2.1 MRS Background

1.2.1.1 Description

Camp O'Ryan MRS 2 Rifle Range is a former small arms range is located in Wethersfield, Wyoming County, New York (**Figure 1-1**). Camp O'Ryan was divided into three MRSs: Camp O'Ryan MRS 1 Pistol Range, Camp O'Ryan MRS 2 Rifle Range, and Camp O'Ryan MRS 3 Maneuvering Area (**Figure 1-2**). The Camp O'Ryan MRS 2 Rifle Range is located on the northern boundary of the 370-acre former Camp O'Ryan, which contains mostly gently rolling, forested terrain comprising deciduous trees with patches of open grass fields. The former small arms range was originally about 17.5 acres and was expanded to 42.41 acres as a result of the RI. The area outside of the Camp O'Ryan MRS 2, within the former Camp O'Ryan, was used by NYARNG for both company and squad level training including maneuver practicing and camping.

The firing direction at the Camp O'Ryan MRS 2 was to the southeast. The MRS 2 consists of a former 200-yard range with 50 targets and firing berms at distances of 100 and 200 yards and an earthen impact berm (**Figure 1-3**). The MRS 2 also includes a concrete retaining wall with target structures still intact. Small arms, including .30 caliber M1, were approved for use Camp O'Ryan MRS 2; additional potential munitions used include .22, .38, and .45 caliber, 5.56 millimeter (mm), and 7.62mm.

Live-fire training no longer occurs at the MRS 2. The property is privately owned and administered by the Edward N. George Estate and the King Brothers Fireplace and Stove, Inc. The MRS 2 is easily accessible off Wethersfield Road (Route 32). The range is located behind property owned by the King Brothers Fireplace and Stove, Inc. (3060 Wethersfield Rd, Gainesville, New York 14066) (New York State Department of Environmental Conservation [NYSDEC], 2009); the small parcel (4.83 acres, SBL-I06.2-61.2) borders the Camp O'Ryan MRS 2 to the north.

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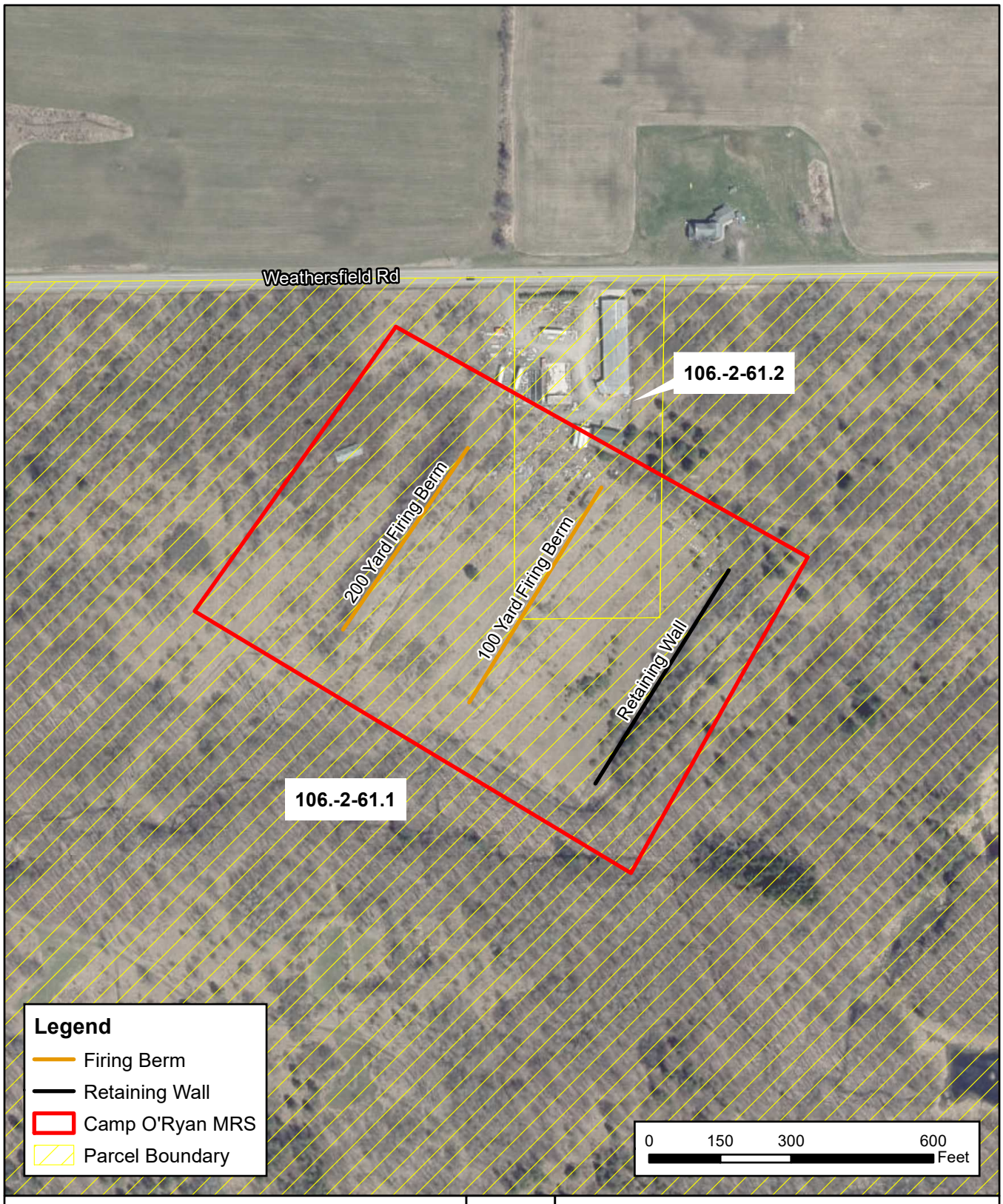

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PROJECT	RI through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	MS	9/1/2021
SCALE	1:3,600	CHK BY	JW	9/1/2021
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	LS	9/1/2021

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Camp O'Ryan Munitions Response Site Layout

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Figure 1-3

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1.2.1.2 History

Camp O'Ryan (also known as the North Java Rifle Range, the Wethersfield Training Area, and the Wethersfield Target Range and Maneuver Area) was located on 376 acres and was used by the NYARNG from 1949 to 1974 and then again from 1989 to 1994 (Parsons Infrastructure and Technology [Parsons], 2011 [Appendix H-3]). It is the understanding of the New York State Division of Military and Naval Affairs (DMNA) that the U.S. Army Corps of Engineers (USACE) leased the property from 1949 to 1974, based on a DMNA 2008 memorandum (DMNA, 2008). The property was previously owned and developed by the USACE and sold to Edward George, who leased it back to the USACE in 1949. From 1949 to 1974, training areas at the camp included a rifle range, a pistol range, and a tank driver training course; structures at the site included a range storage building, a field latrine, and a mess hall. The parcel of land the former mess hall occupied was subdivided from the original training camp and sold by the estate of Edward George, the property owner, in 1999. The former mess hall is currently owned and occupied by King Brothers Fireplace and Stove, Inc. The ranges were used by NYARNG units stationed in New York bases, including Batavia, Buffalo, Dunkirk, Jamestown, Medina, and Rochester (Parsons, 2011).

Camp O'Ryan was reactivated as a training area in 1989 and was used until 23 November 1994, when the lease was terminated. In a 1989 letter to the property owner, the NYARNG indicated that they planned on using the camp for infantry training maneuvers, including the setup and use of bivouac areas and field fortifications, off-road driver training, and communication exercises. It is unknown if the ranges were also reactivated in 1989. According to a 1986 NYARNG letter, the existing ranges did not meet the requirements of Army Regulation 385-63 (Range Safety) for the following reasons: 1) The maximum range of the M-16 extended past the property boundary; 2) Due to the topography of the area, berms or baffles would be required before the area could be used as a firing range; and 3) The property would have to be fenced to prevent unauthorized access (Parsons, 2011). The 1989 NYARNG letter to the property owner also indicated that in order for the ranges to be reactivated a safety analysis would need to be conducted and approved. No documentation was obtained during the data collection activities that confirmed that a safety analysis was ever conducted (Parsons, 2011).

1.2.2 Current and Future Land Use

Currently, the former rifle range is privately owned and administered by the Edward N. George Estate. A portion of the property is also owned by the King Brothers Fireplace and Stove, Inc., which must be accessed to enter the MRS 2. Live-fire training no longer occurs at the MRS 2.

Because the land is privately owned, there is potential that the MRS 2 could be used for residential and/or recreational purposes in the future.

1.2.3 Nature and Extent of MC Contamination

For the purpose of the RI, the MRS 2 was divided into three decision units (DUs) (the Target Area, the Target Berm, and 100 Yard Firing Berm) that reflect the distinct areas of potential MC-contamination, as indicated by site history and post-training construction activities. The investigation of these three areas focused on soil within the MRS 2. Two additional DUs were identified during RI field work: The Target Berm-Ponded DU and the Wet Meadow DU. Because the additional DUs are temporarily or semi-permanently flooded, the RI focused on sediment in these areas.

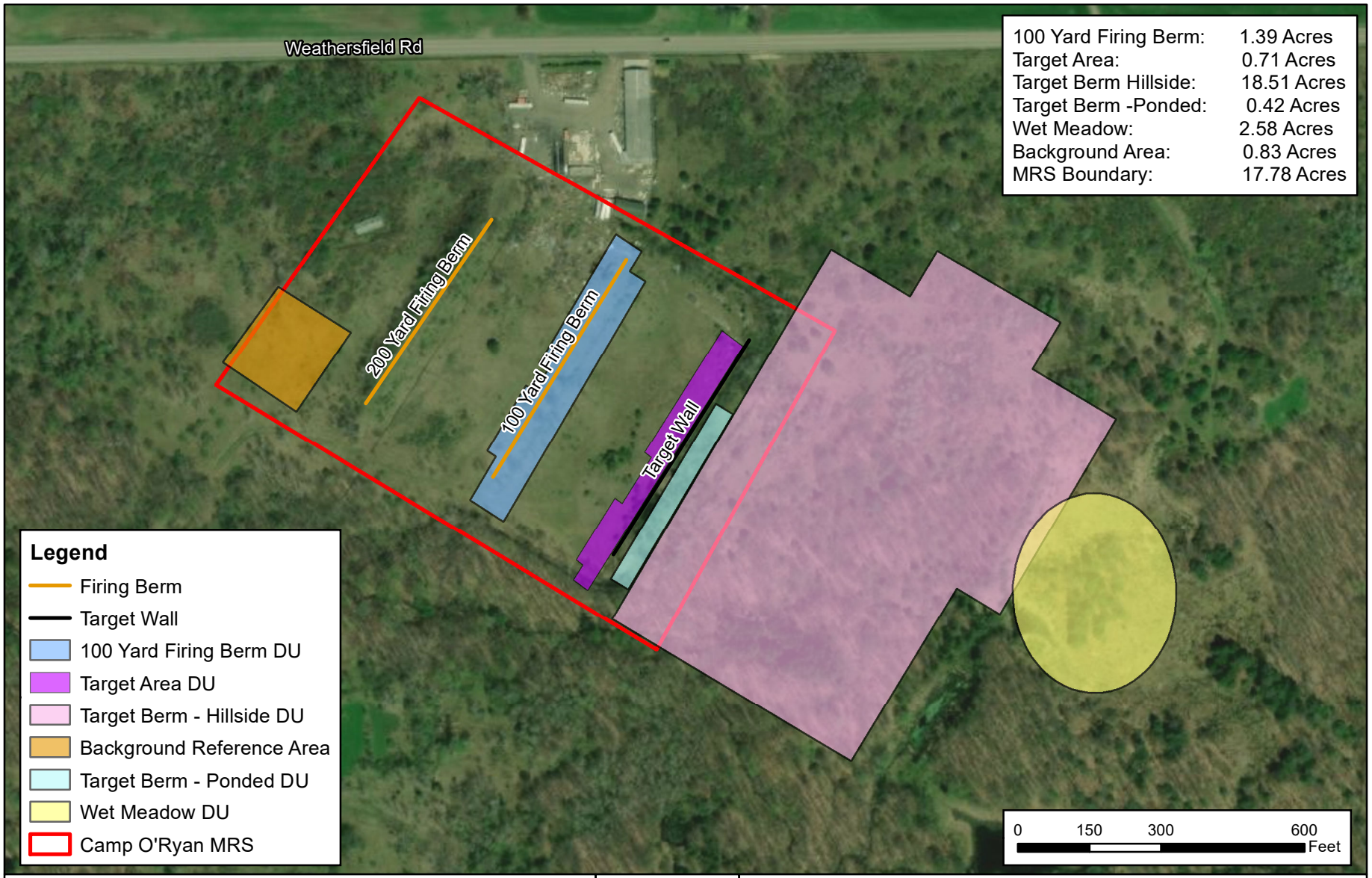
Small arms training debris include bullets, bullet fragments, and the related metals (lead, antimony, copper, and zinc) that are commonly part of small arm munitions, referred to as MC. The RI field activities included x-ray fluorescence (XRF) screening of discrete samples collected on a grid from each soil DU to evaluate the lateral extent of lead in soil. These results can be found in **Appendix A**, and the revised DUs are shown in **Figure 1-4.** Composite surface soil samples using incremental sampling methodology (ISM) were obtained for evaluating risks. The ISM provides an improved measure of the DU-wide concentration of lead to relative calculating a DU concentration based on limited discrete samples. Based on the XRF results, discrete samples at depth were subsequently collected and submitted for laboratory analysis. Discrete sediment samples were collected at the Target Berm-Ponded DU and Wet Meadow DU. Because MC metals are also naturally occurring, site-specific background reference ISM samples were collected and analyzed in an area on the western edge of the MRS 2 not affected by training activities. Details of the sampling methodology and results are documented in the Final RI Work Plan/Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP; AECOM, 2019) and the Final RI Report (AECOM, 2021). The findings at each DU are summarized below.

1.2.3.1 100-yard Firing Berm

The data collected at the 100-yard Firing Berm DU were sufficient to delineate the extent of small arms metals. Exceedances of the human health criterion for lead were observed in XRF screening results at the 100-yard Firing Berm DU and resulted in step-out sampling that enlarged the DU area to 1.39 acres (**Figure 1-5**). ISM sample results indicate that lead MC is present in soil at the human health screening criterion, and antimony concentrations are above its ecological screening criterion (**Table 1-1** and **Figure 1-6**). Two locations at the 100-yard Firing Berm DU were selected for discrete subsurface soil sampling. One location (grid #34) indicated that all MC were below human health and ecological screening criterion at the 12- to 18-inch below ground surface (bgs) depth, and as a result, the 24- to 30-inch bgs sample was not analyzed. The concentration of lead at the second discrete subsurface sample location (grid #39) exceeded its human health screening criterion, and the antimony concentration exceeded ecological screening criteria. As a result, the deeper 24- to 30-inch bgs sample was analyzed but did not exceed of ecological or human health screening criteria (**Figure 1-7** and **Table 1-2**).

1.2.3.2 Target Area

The data collected at the Target Area DU were sufficient to delineate the extent of small arms metals. Exceedances of the human health criterion for lead were observed in XRF screening results at the Target Area and resulted in step-out sampling that enlarged the DU area to 0.071 acres (**Figure 1-8**). ISM sample results indicate that lead is present in soil above its human health screening criterion, and antimony concentrations are above ecological screening criteria (**Table 1-1** and **Figure 1-6**). Two locations at the Target Area DU were selected for discrete subsurface soil sampling. One location (grid #4) indicated that all MC were below human health and ecological screening criterion at the 12- to 18-inch bgs depth, and as a result, the 24- to 30-inch bgs sample was not analyzed. The concentration of lead at the second discrete subsurface sample location (grid #14, 12- to 18-inch bgs depth) exceeded human health screening criterion, and the antimony concentration exceeded ecological screening criterion. As a result, the deeper 24- to 30-inch bgs sample was analyzed and demonstrated no exceedances of ecological or human health screening criteria (**Figure 1-9** and **Table 1-2**).



CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/20/2020
SCALE	1:3,600	CHK BY	JW	11/20/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	AS	11/20/2020

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Camp O'Ryan Revised DUs

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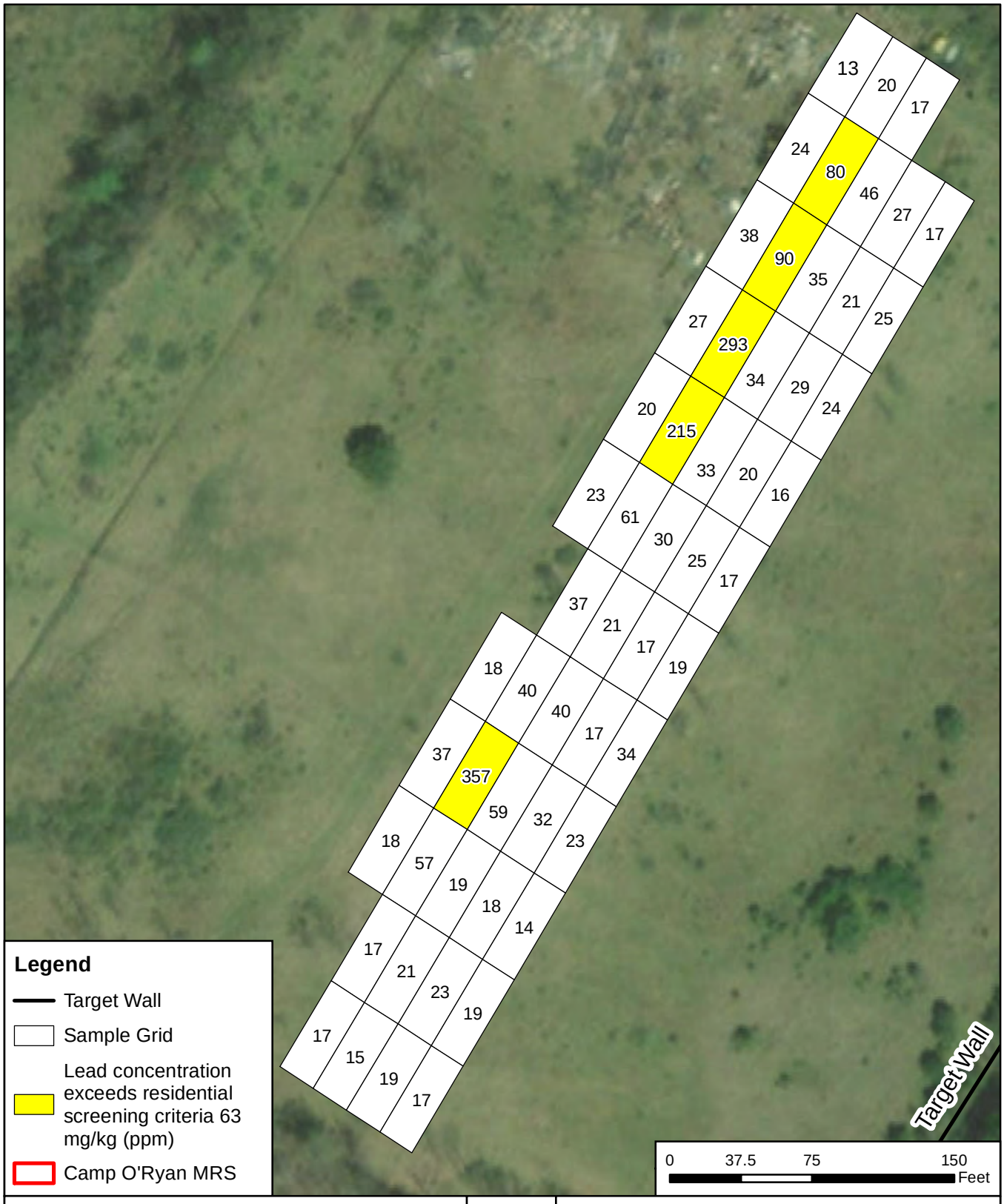
Figure 1-4



CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
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SCALE	1:900	CHK BY	JW	10/26/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	10/26/2020

100-Yard Firing Berm DU XRF Results

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Figure 1-5

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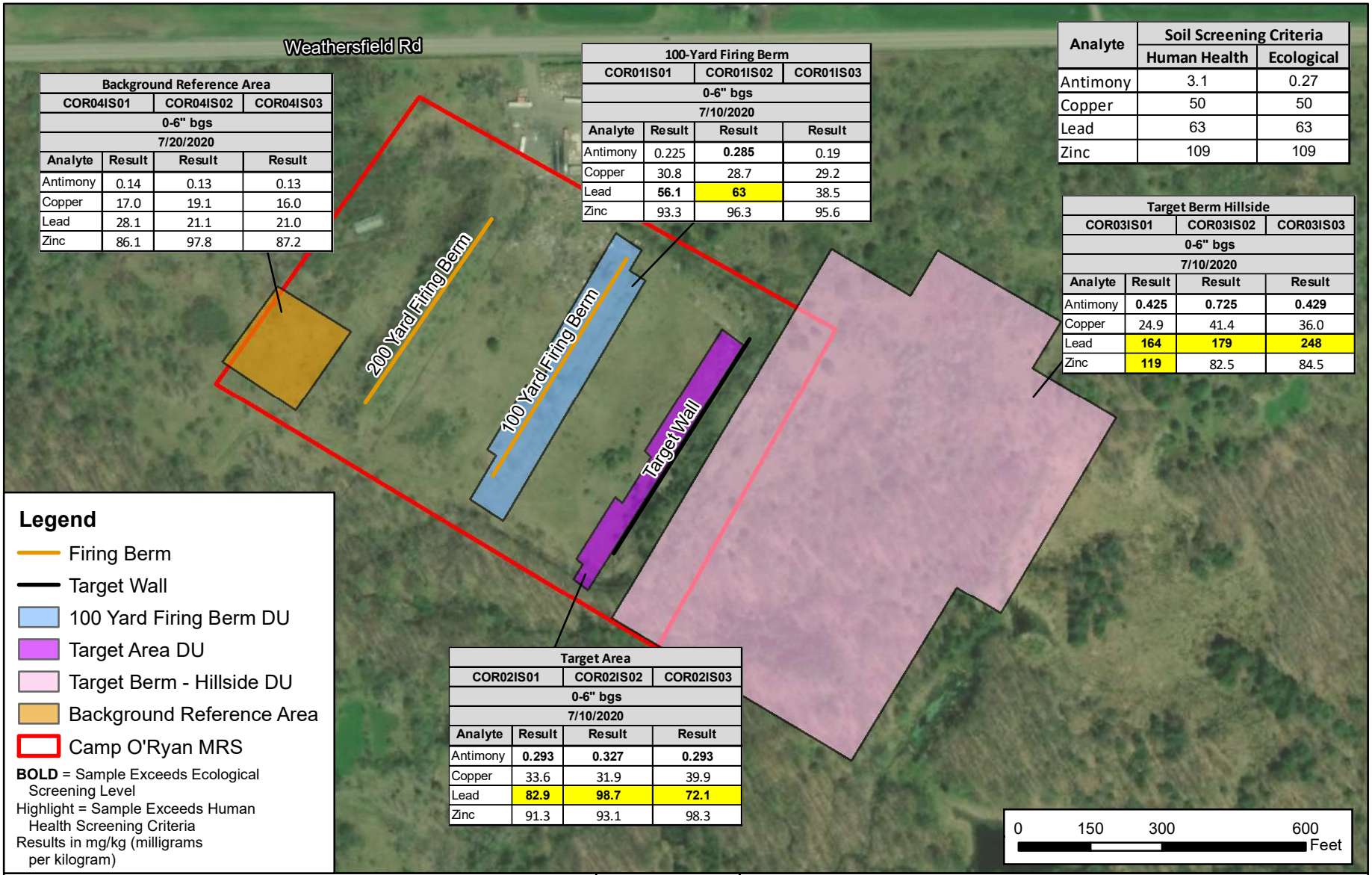

Background Reference Area			
COR04IS01	COR04IS02	COR04IS03	
0-6" bgs			
7/20/2020			
Analyte	Result	Result	Result
Antimony	0.14	0.13	0.13
Copper	17.0	19.1	16.0
Lead	28.1	21.1	21.0
Zinc	86.1	97.8	87.2

100-Yard Firing Berm			
COR01IS01	COR01IS02	COR01IS03	
0-6" bgs			
7/10/2020			
Analyte	Result	Result	Result
Antimony	0.225	**0.285**	0.19
Copper	30.8	28.7	29.2
Lead	**56.1**	**63**	38.5
Zinc	93.3	96.3	95.6

Analyte	Soil Screening Criteria	
	Human Health	Ecological
Antimony	3.1	0.27
Copper	50	50
Lead	63	63
Zinc	109	109

Target Berm Hillside			
COR03IS01	COR03IS02	COR03IS03	
0-6" bgs			
7/10/2020			
Analyte	Result	Result	Result
Antimony	**0.425**	**0.725**	**0.429**
Copper	24.9	41.4	36.0
Lead	**164**	**179**	**248**
Zinc	**119**	82.5	84.5

Target Area			
COR02IS01	COR02IS02	COR02IS03	
0-6" bgs			
7/10/2020			
Analyte	Result	Result	Result
Antimony	**0.293**	**0.327**	**0.293**
Copper	33.6	31.9	39.9
Lead	**82.9**	**98.7**	**72.1**
Zinc	91.3	93.1	98.3

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	12/4/2020
SCALE	1:3,600	CHK BY	JW	12/4/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	AS	12/4/2020

Camp O'Ryan ISM Results

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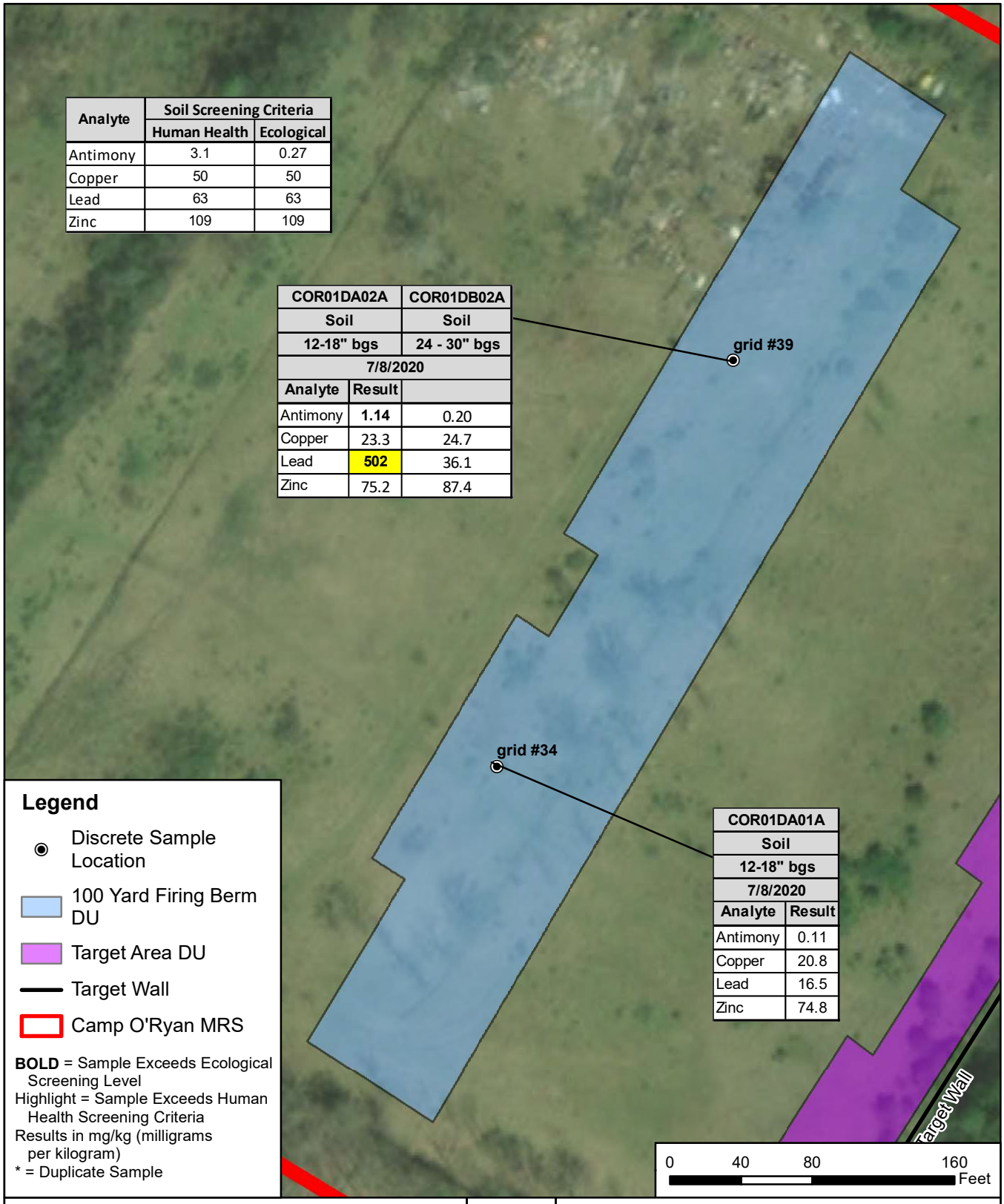
Figure 1-6



CLIENT	Army National Guard
PROJECT	FS through DD for Camp O'Ryan, NY MRS
REVISION NO	0
SCALE	1:960
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User	

GIS BY	GC	12/4/2020
CHK BY	JW	12/4/2020
PM	LS	12/4/2020

N

100-Yard Firing Berm DU Discrete Results

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Figure 1-7

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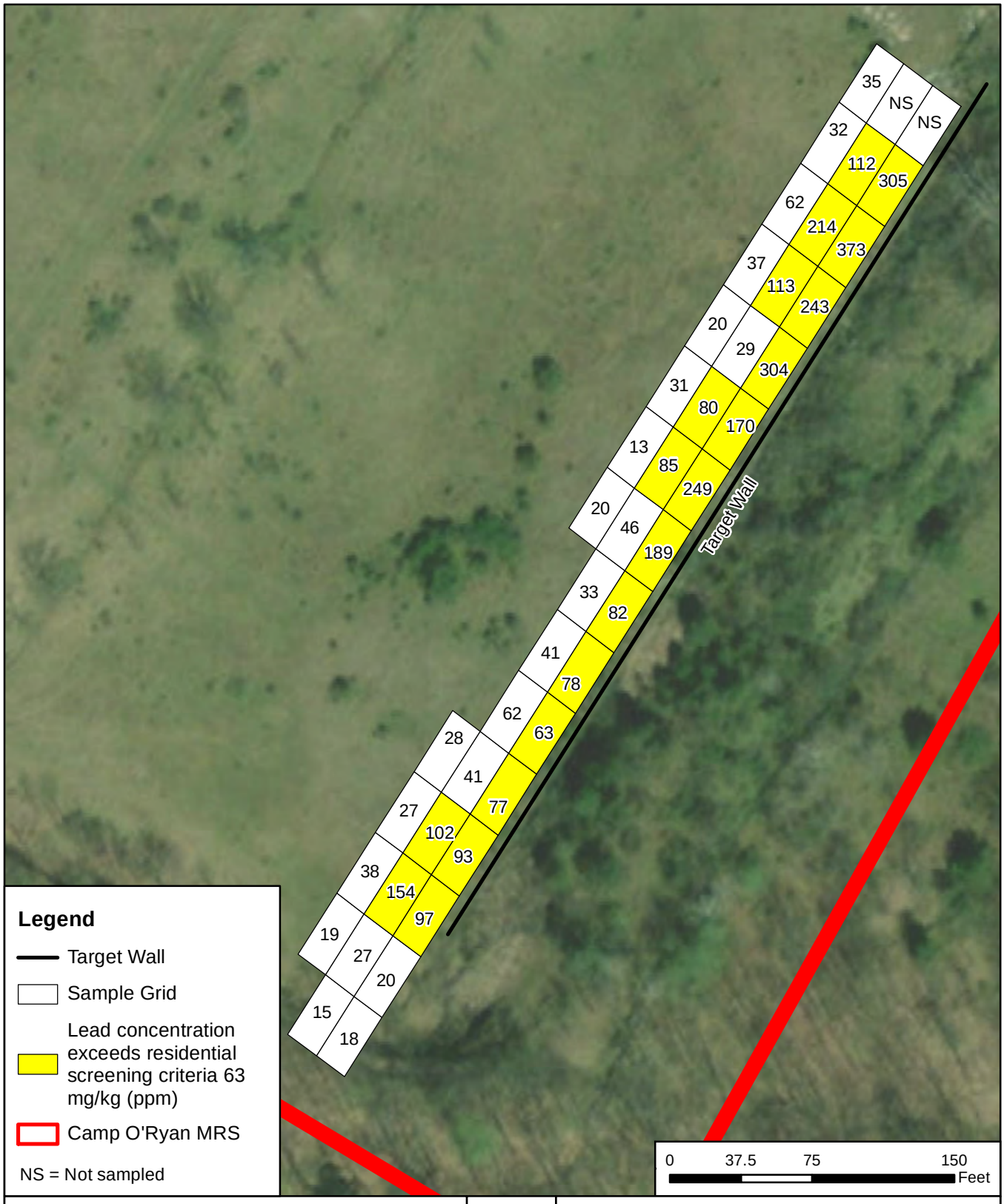

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	10/8/2020
SCALE	1:900	CHK BY	JW	10/8/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	10/8/2020

Target Area DU XRF Results

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Figure 1-8

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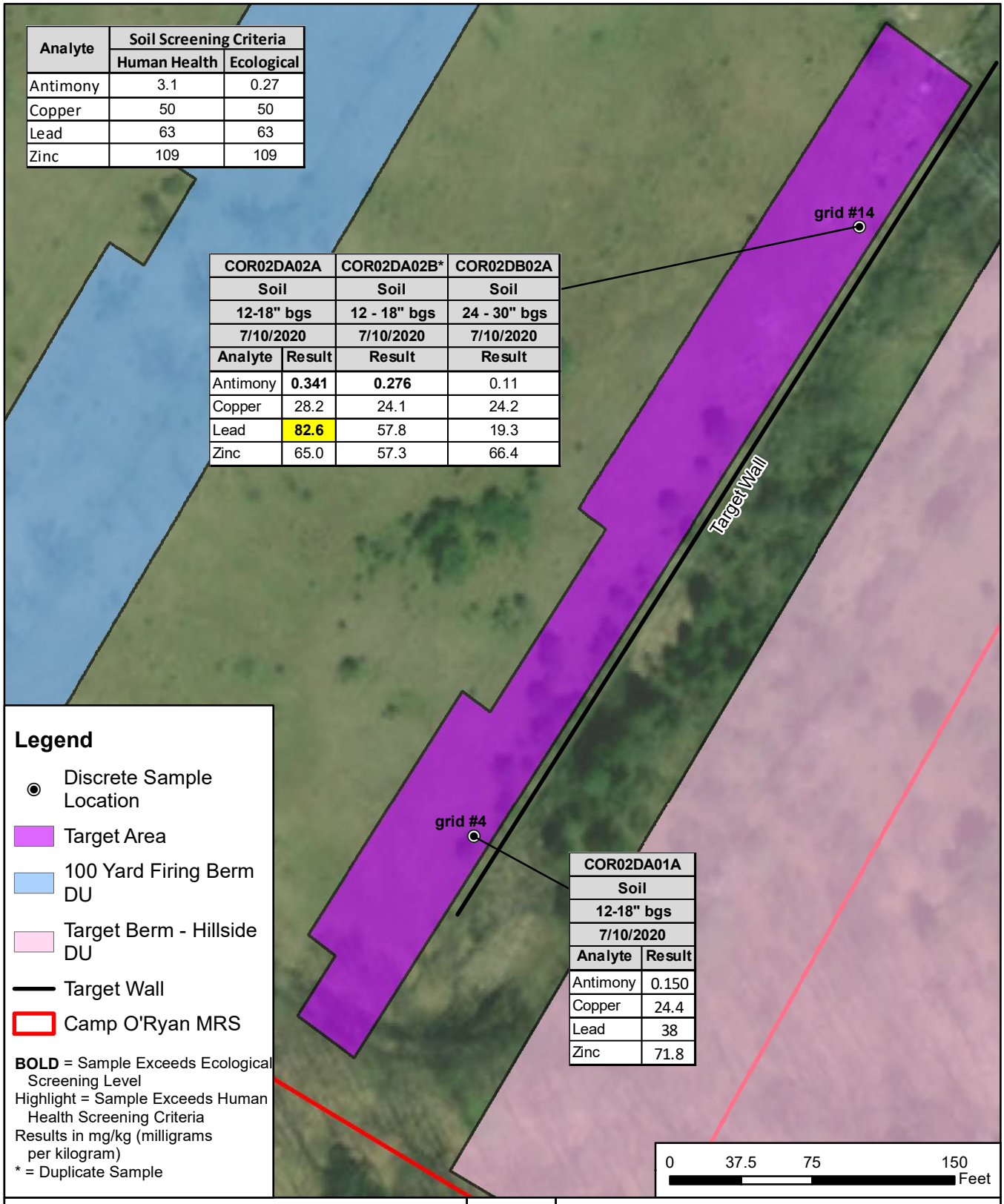

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/30/2020
SCALE	1:900	CHK BY	JW	11/30/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	11/30/2020

N

Target Area DU Discrete Results

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Figure 1-9

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Table 1-1 Incremental Sampling Results Summary

			Location:	100-Yard Firing Berm DU											
			Sample ID:	COR01IS01				COR01IS02				COR01IS03			
			Sample Depth (inches bgs):	0-6				0-6				0-6			
			Date Collected:	7/10/2020				7/10/2020				7/10/2020			
Analyte	Human Health Screening Level	Ecological Screening Level		Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)															
Antimony	3.1	0.27		0.225	N			**0.285**				0.19			
Copper	50	50		30.8	N			28.7				29.2			
Lead	63	63		56.1	NA			**63**				38.5			
Zinc	109	109		93.3				96.3				95.6			

			Location:	Target Area DU											
			Sample ID:	COR02IS01				COR02IS02				COR02IS03			
			Sample Depth (inches bgs):	0-6				0-6				0-6			
			Date Collected:	7/10/2020				7/10/2020				7/10/2020			
Analyte	Human Health Screening Level	Ecological Screening Level		Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)															
Antimony	3.1	0.27		**0.293**				**0.327**	N			**0.293**			
Copper	50	50		33.6				31.9	N			39.9			
Lead	63	63		**82.9**				**98.7**	NEA			**72.1**			
Zinc	109	109		91.3				93.1				98.3			

			Location:	Target Berm Hillside DU											
			Sample ID:	COR03IS01				COR03IS02				COR03IS03			
			Sample Depth (inches bgs):	0-6				0-6				0-6			
			Date Collected:	7/10/2020				7/10/2020				7/10/2020			
Analyte	Human Health Screening Level	Ecological Screening Level		Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)															
Antimony	3.1	0.27		**0.425**				**0.725**				**0.429**	N		
Copper	50	50		24.9				41.4				36.0	NA		
Lead	63	63		**164**				**179**				**248**	NA		
Zinc	109	109		**119**				82.5				84.5	A		

			Location:	Background Reference Area DU											
			Sample ID:	COR04IS01				CORIS0402				COR04IS03			
			Sample Depth (inches bgs):	0-6				0-6				0-6			
			Date Collected:	7/20/2020				7/20/2020				7/20/2020			
Analyte	Human Health Screening Level	Ecological Screening Level		Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)															
Antimony	3.1	0.27		0.14				0.13				0.13			
Copper	50	50		17.0				19.1				16.0			
Lead	63	63		28.1				21.1				21.0			
Zinc	109	109		86.1				97.8				87.2			

Notes:

Bold = Sample meets or exceeds Ecological Screening Level

Sample meets or exceeds Human Health Screening Level

mg/kg = milligrams per kilogram

bgs = below ground surface

LQ = Laboratory qualifier (LQ flags available in lab report)

VQ = Validiation qualifier

RC = Reason Code

N = pre-digestion spiked sample recovery is not within control limits

A = post-digestion spiked sample recovery is not within control limits

E = reported value is estimated because of the presence of interference (as indicated by serial dilution)

Table 1-2 Discrete Soil Sampling Results Summary

100-Yard Firing Berm DU

Sample ID:			COR01DA01A (#34)				COR01DA02A (#39)				COR01DB02A (#39)			
Decision Unit - XRF Location:			100-Yard Berm				100-Yard Berm				100-Yard Berm			
Media:			Soil				Soil				Soil			
Sample Depth (inches bgs):			12 - 18				12 - 18				24-30			
Date Collected:			7/8/2020				7/8/2020				7/8/2020			
Analyte	Human Health Screening Level (mg/kg) Soil	Ecological Screening Level (mg/kg) Soil	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)														
Antimony	3.1	0.27	0.11				**1.14**	N		m	0.20			
Copper	50	50	20.8				23.3	NE		m	24.7			
Lead	63	63	16.5				**502**	NA		m	36.1			
Zinc	109	109	74.8				75.2	EA		s	87.4			

Target Area DU

Sample ID:			COR02DA01A (#4)				COR02DA02A (#14)				COR02DA02B (#14)				COR02DB02A (#14)			
Decision Unit - XRF Location:			Target Area				Target Area				Target Area				Target Area			
Media:			Soil				Soil				Soil				Soil			
Sample Depth (inches bgs):			12 - 18				12 - 18				12 - 18				24-30			
Date Collected:			7/10/2020				7/10/2020				7/10/2020				7/10/2020			
Analyte	Human Health Screening Level (mg/kg) Soil	Ecological Screening Level (mg/kg) Soil	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)																		
Antimony	3.1	0.27	0.150	N			**0.341**				**0.276**				0.11	N	J	
Copper	50	50	24.4	NEA			28.2				24.1				24.2	E		
Lead	63	63	38	NA			**82.6**				57.8				19.3	NA		
Zinc	109	109	71.8	NEA			65.0				57.3				66.4	E		

Target Berm Hillside DU

Sample ID:			COR03DA01A (#1)				COR03DB01A (#1)				COR03DA02A (#40)				COR03DA02B (#40)				COR03DA03A (#46)				COR03DB03A (#46)			
Decision Unit - XRF Location:			Target Berm Hillside				Target Berm Hillside				Target Berm Hillside				Target Berm Hillside				Target Berm Hillside				Target Berm Hillside			
Media:			Soil				Soil				Soil				Soil				Soil				Soil			
Sample Depth (inches bgs):			12 - 18				24 - 25				12 - 18				24 - 30				12 - 18				24 - 30			
Date Collected:			7/9/2020				7/9/2020				7/10/2020				7/10/2020				7/10/2020				7/10/2020			
Analyte	Human Health Screening Level (mg/kg) Soil	Ecological Screening Level (mg/kg) Soil	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC	Result	LQ	VQ	RC
Total Metals by USEPA SW-846 Method 6020A (mg/kg)																										
Antimony	3.1	0.27	**0.447**				**1.00**				0.13				0.11				0.236	N*			0.096	J		
Copper	50	50	29.4				**86.8**				15.8				19.6				15.2				28.8			
Lead	63	63	34.2				**393**				22.1	B			24.6	B			**90.7**	NA			17.1			
Zinc	109	109	78.4				**110**				55.8				58.1				62.6	N			82.8			

Notes:

Bold = Sample exceeds Ecological Screening Level
Sample exceeds Human Health Screening Level
mg/kg = milligrams per kilogram
bgs = below ground surface
LQ = laboratory qualifier (LQ flag descriptions available in lab report)
VQ = validiation qualifier
RC = reason code
NA = not applicable

A = post-digestion spiked sample recovery is not within control limits
B = analyte detected in the laboratory method blank
E = reported value is estimated because of the presence of interference (as indicated by serial dilution)
N = pre-digestion spiked sample recovery is not within control limits
* = the duplicate sample analysis relative percent difference (RPD) is not within control limits
J = estimated

1.2.3.3 Target Berm Hillside

The data collected at the MRS 2 were sufficient to delineate the lateral extent of site-related MC contamination at the Target Berm-Hillside DU. Exceedances of the human health criterion for lead were observed in XRF screening results across the hillside, which resulted in step-out sampling enlarging the DU area to 18.51 acres (**Figure 1-10**). ISM results indicate that lead and zinc are present in soil above human health screening criteria, and antimony concentrations exceeded respective ecological screening values (**Figure 1-6** and **Table 1-1**).

Three locations at the Target Berm-Hillside DU were selected for discrete subsurface soil sampling based on elevated surface soil XRF lead results. The discrete subsurface soil sampling location (grid #1, 12- to 18-inch bgs depth) on the northwestern border of the DU closest to the Target Wall indicated that antimony concentrations exceeded ecological screening criteria, and as a result, the sample collected from the deeper interval was analyzed. The deeper sample was collected at 25 inches bgs due to refusal at a large cobble layer. The deeper sample indicated that concentrations of lead, copper, and zinc all exceeded human health screening criteria, and antimony remained above ecological screening criteria. These concentrations are likely due to mechanical movement of soil during active range use to fill in bullet pockets or the collection of bullet fragments against the hard cobble layer. Of the two other discrete subsurface soil sampling locations (grid #s 40 and 46), concentrations at the 12- to 18-inches bgs depth at grid #40 indicated that all MC were below human health and ecological screening criteria; thus, the next deeper sample was not analyzed. Concentrations of lead at grid #46 exceeded human health screening criterion and prompted analysis of the 24- to 30-inches bgs sample. The deeper sample had no exceedances of ecological or human health screening criteria (**Figure 1-11** and **Table 1-2**).

1.2.3.4 Target Berm – Ponded DU

At the Target Berm-Ponded DU, eight discrete sediment samples were collected from evenly spaced locations from south to north along a transect of the DU (**Figure 1-12**). Concentrations of lead exceeded human health screening criterion in all eight samples analyzed, and antimony also exceeded human health screening criterion in the sample with the highest lead concentration. All MC concentrations exceeded ecological screening criteria in six of the eight samples, and at least one MC concentration exceeded ecological screening criteria in all eight samples (**Table 1-3**).

1.2.3.5 Wet Meadow DU

At the Wet Meadow DU, eight discrete sediment samples were collected from evenly spaced locations around the circular DU (**Figure 1-13**). Thick vegetation and trees prevented the collection of samples from the center of the DU. Concentrations of lead exceeded human health screening criterion at four sample locations. Concentrations of lead and copper exceeded ecological screening criterion at four sample locations, and concentrations of zinc exceeded ecological screening criterion at six sample locations (**Table 1-3**).

Based on the results of the RI, the MRS 2 boundary was revised to include areas sampled in the expanded Target Berm-Hillside DU and the Wet Meadow DU; the revised acreage of the MRS 2 is 42.21 acres (**Figure 1-14**).

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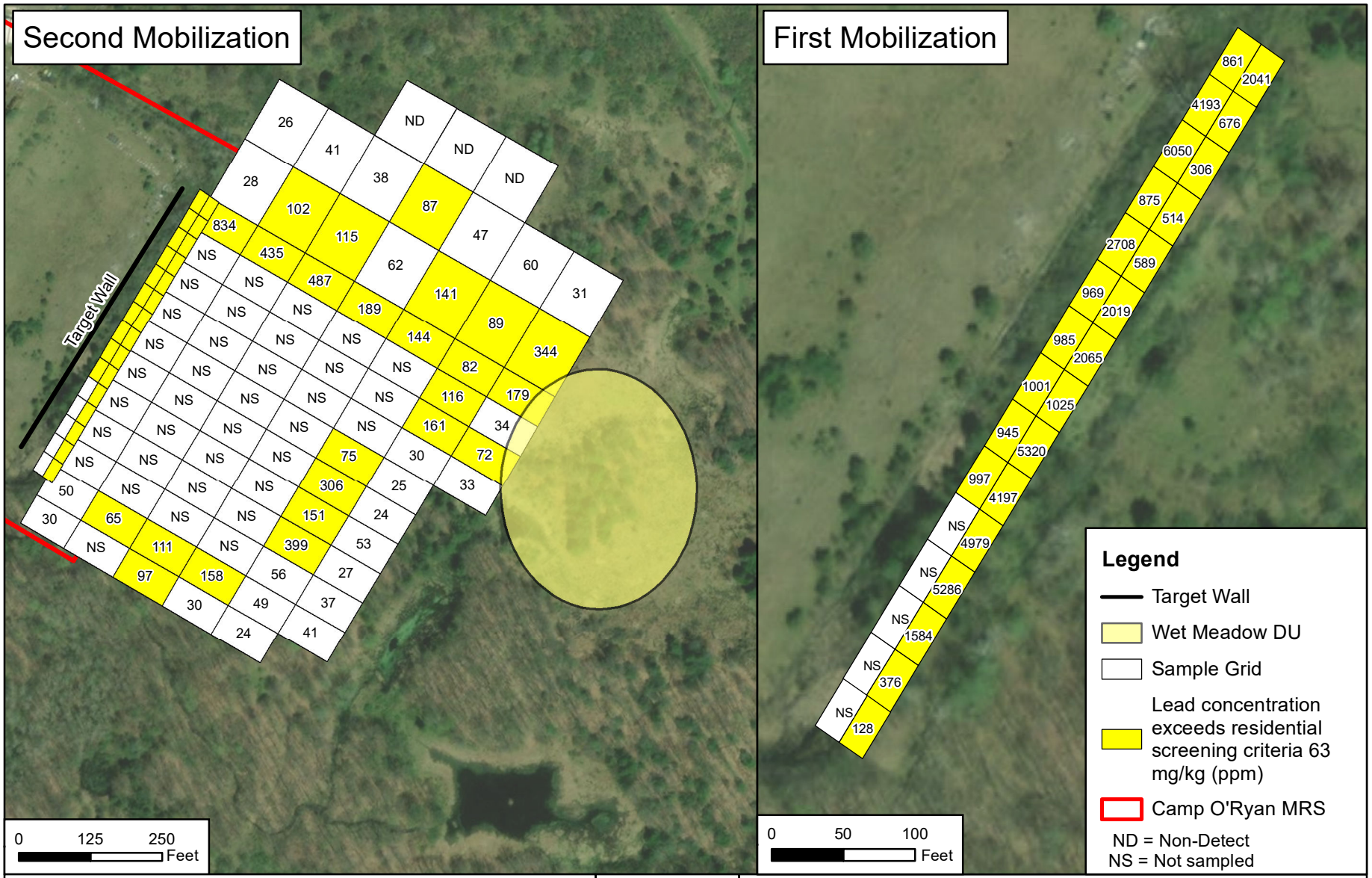

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PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/30/2020
SCALE	1:3,000	CHK BY	JW	11/30/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	LS	11/30/2020

Target Berm - Hillside DU XRF Results

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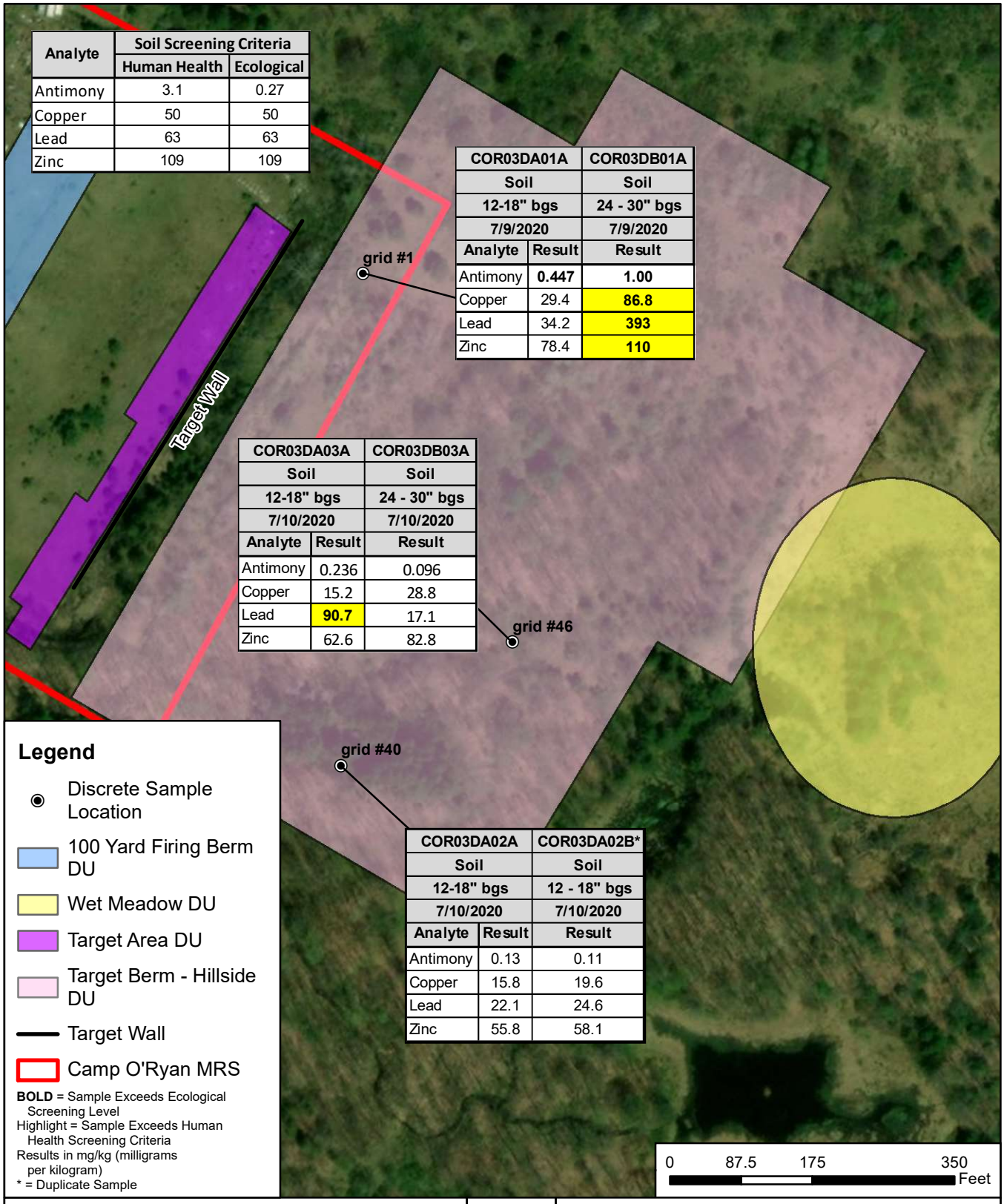
Figure 1-10

Prepared for: Army National Guard



Analyte	Soil Screening Criteria	
	Human Health	Ecological
Antimony	3.1	0.27
Copper	50	50
Lead	63	63
Zinc	109	109

COR03DA01A		COR03DB01A
Soil		Soil
12-18" bgs		24 - 30" bgs
7/9/2020		7/9/2020
Analyte	Result	Result
Antimony	**0.447**	**1.00**
Copper	29.4	**86.8**
Lead	34.2	**393**
Zinc	78.4	**110**

COR03DA03A		COR03DB03A
Soil		Soil
12-18" bgs		24 - 30" bgs
7/10/2020		7/10/2020
Analyte	Result	Result
Antimony	0.236	0.096
Copper	15.2	28.8
Lead	**90.7**	17.1
Zinc	62.6	82.8

COR03DA02A		COR03DA02B*
Soil		Soil
12-18" bgs		12 - 18" bgs
7/10/2020		7/10/2020
Analyte	Result	Result
Antimony	0.13	0.11
Copper	15.8	19.6
Lead	22.1	24.6
Zinc	55.8	58.1

Legend

- Discrete Sample Location
- 100 Yard Firing Berm DU
- Wet Meadow DU
- Target Area DU
- Target Berm - Hillside DU
- Target Wall
- Camp O'Ryan MRS

BOLD = Sample Exceeds Ecological Screening Level
Highlight = Sample Exceeds Human Health Screening Criteria
Results in mg/kg (milligrams per kilogram)
* = Duplicate Sample

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	12/4/2020
SCALE	1:2,100	CHK BY	JW	12/4/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	12/4/2020

Target Berm- Hillside DU Discrete Results

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Figure 1-11

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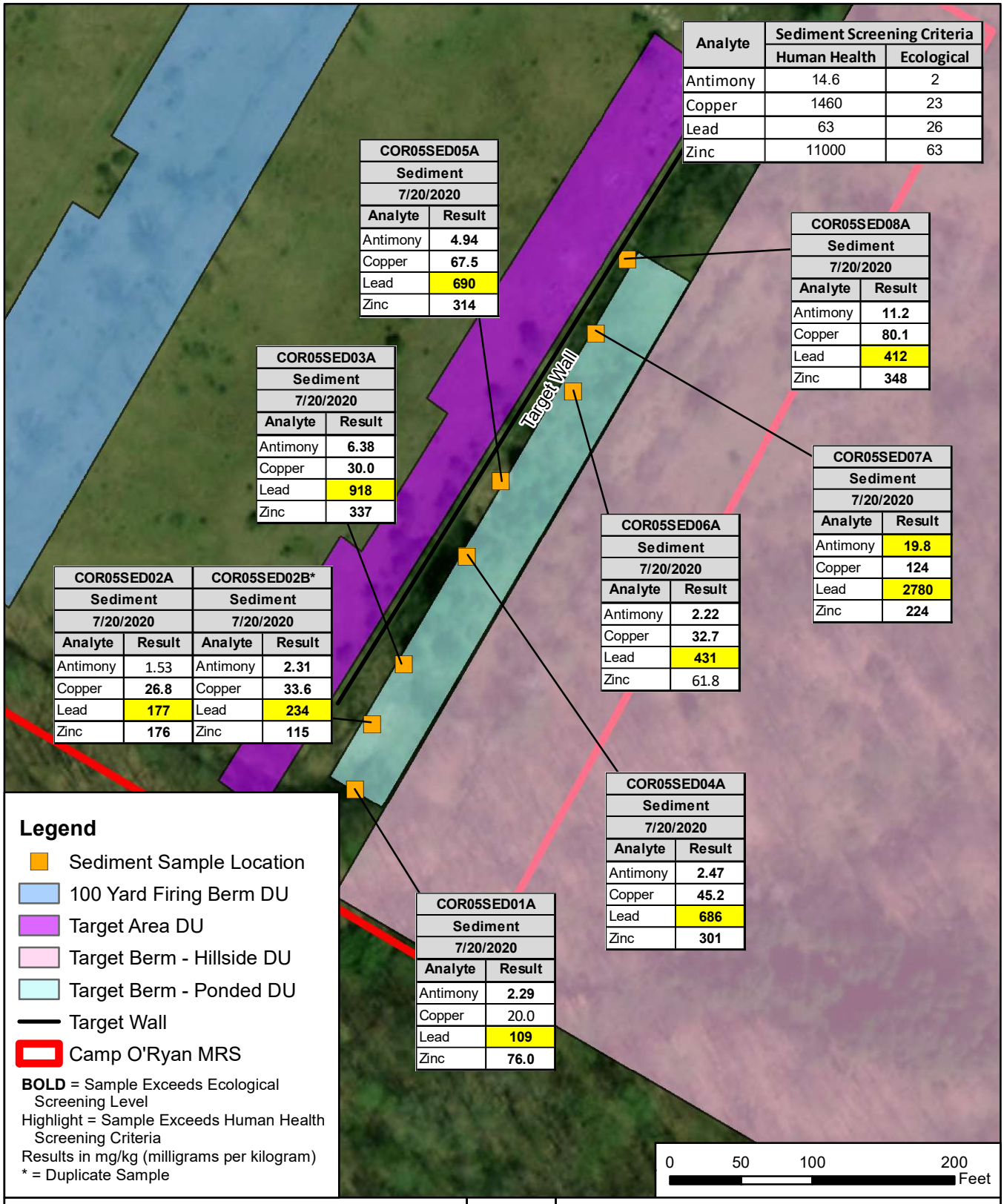

Analyte	Sediment Screening Criteria	
	Human Health	Ecological
Antimony	14.6	2
Copper	1460	23
Lead	63	26
Zinc	11000	63

COR05SED05A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	4.94
Copper	67.5
Lead	690
Zinc	314

COR05SED08A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	11.2
Copper	80.1
Lead	412
Zinc	348

COR05SED03A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	6.38
Copper	30.0
Lead	918
Zinc	337

COR05SED07A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	19.8
Copper	124
Lead	2780
Zinc	224

COR05SED06A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	2.22
Copper	32.7
Lead	431
Zinc	61.8

COR05SED02A		COR05SED02B*	
Sediment		Sediment	
7/20/2020		7/20/2020	
Analyte	Result	Analyte	Result
Antimony	1.53	Antimony	2.31
Copper	26.8	Copper	33.6
Lead	177	Lead	234
Zinc	176	Zinc	115

COR05SED04A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	2.47
Copper	45.2
Lead	686
Zinc	301

COR05SED01A	
Sediment	
7/20/2020	
Analyte	Result
Antimony	2.29
Copper	20.0
Lead	109
Zinc	76.0

Legend

- Sediment Sample Location
- 100 Yard Firing Berm DU
- Target Area DU
- Target Berm - Hillside DU
- Target Berm - Ponded DU
- Target Wall
- Camp O'Ryan MRS

BOLD = Sample Exceeds Ecological Screening Level
Highlight = Sample Exceeds Human Health Screening Criteria
Results in mg/kg (milligrams per kilogram)
* = Duplicate Sample

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/30/2020
SCALE	1:1,200	CHK BY	JW	11/30/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	11/30/2020

Target Berm- Ponded DU
Discrete Sediment Sample Results

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Figure 1-12

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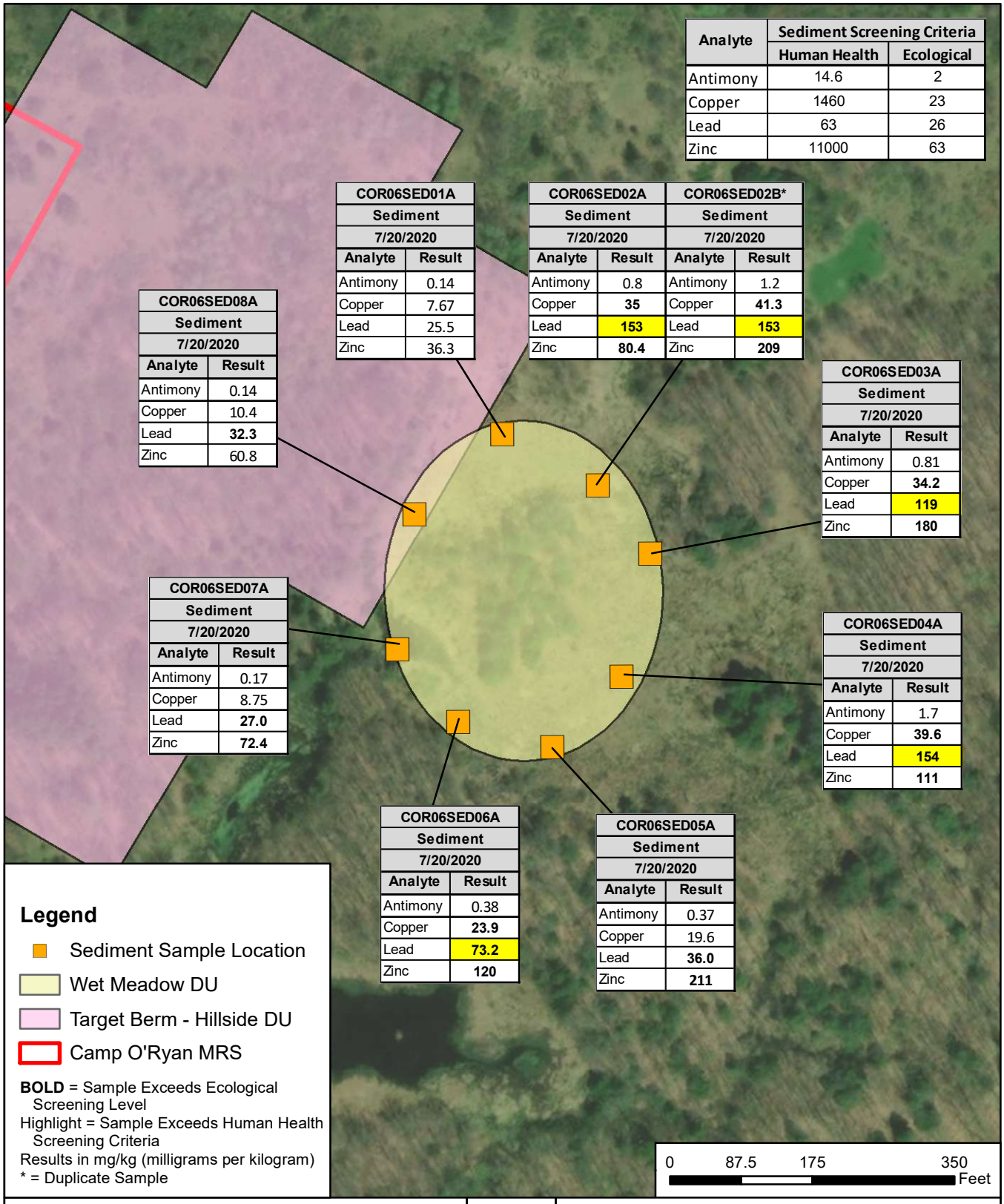

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	12/4/2020
SCALE	1:2,100	CHK BY	JW	12/4/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User		PM	LS	12/4/2020

N

Wet Meadow DU Sediment Sample Results

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Figure 1-13

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CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/20/2020
SCALE	1:3,600	CHK BY	JW	11/20/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	AS	11/20/2020

N

Camp O'Ryan Revised MRS Boundary

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Figure 1-14

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Table 1-3
Discrete Sediment Sample Results

Target Berm-Ponded DU

Analyte	Human Health Screening Level (mg/kg) Sediment	Ecological Screening Level (mg/kg) Sediment	Sample ID	Result	LQ	VQ	RC
			Decision Unit - XRF Location:	Target Berm - Ponded DU 5			
			Media:	Sediment			
			Sample Depth (inches bgs):				
			Date Collected:	7/20/2020			
Total Metals by USEPA SW-846 Method 6020A (mg/kg)							
Antimony	14.6	2	COR05SED01A	**2.29**			
			COR05SED02A	1.53			
			COR05SED02B	**2.31**			
			COR05SED03A	**6.38**			
			COR05SED04A	**2.47**	N		
			COR05SED05A	**4.94**			
			COR05SED06A	**2.22**			
			COR05SED07A	**19.8**			
			COR05SED08A	**11.2**			
Copper	1460	23	COR05SED01A	20.0			
			COR05SED02A	**26.8**			
			COR05SED02B	**33.6**			
			COR05SED03A	**30.0**			
			COR05SED04A	**45.2**	A		
			COR05SED05A	**67.5**			
			COR05SED06A	**32.7**			
			COR05SED07A	**124**			
			COR05SED08A	**80.1**			
Lead	63	26	COR05SED01A	**109**			
			COR05SED02A	**177**			
			COR05SED02B	**234**			
			COR05SED03A	**918**			
			COR05SED04A	**686**	N*A		
			COR05SED05A	**690**			
			COR05SED06A	**431**			
			COR05SED07A	**2780**			
			COR05SED08A	**412**			
Zinc	11000	63	COR05SED01A	**76.0**			
			COR05SED02A	**176**			
			COR05SED02B	**115**			
			COR05SED03A	**337**			
			COR05SED04A	**301**	EA		
			COR05SED05A	**314**			
			COR05SED06A	61.8			
			COR05SED07A	**224**			
			COR05SED08A	**348**			

Wet Meadow DU

Analyte	Human Health Screening Level (mg/kg) Sediment	Ecological Screening Level (mg/kg) Sediment	Sample ID	Result	LQ	VQ	RC
			Decision Unit - XRF Location:	Sediment Wetland Meadow DU 6			
			Media:	Sediment			
			Sample Depth (inches bgs):				
			Date Collected:	7/20/2020			
Total Metals by USEPA SW-846 Method 6020A (mg/kg)							
Antimony	14.6	2	COR06SED01A	0.14	J		
			COR06SED02A	0.8	J		
			COR06SED02B	1.2			
			COR06SED03A	0.81	J		
			COR06SED04A	1.7			
			COR06SED05A	0.37			
			COR06SED06A	0.38	J		
			COR06SED07A	0.17			
			COR06SED08A	0.14			
Copper	1460	23	COR06SED01A	7.67			
			COR06SED02A	**35**			
			COR06SED02B	**41.3**			
			COR06SED03A	**34.2**			
			COR06SED04A	**39.6**	A		
			COR06SED05A	19.6			
			COR06SED06A	**23.9**			
			COR06SED07A	8.75			
			COR06SED08A	10.4			
Lead	63	26	COR06SED01A	25.5			
			COR06SED02A	**153**			
			COR06SED02B	**153**			
			COR06SED03A	**119**			
			COR06SED04A	**154**	N*A		
			COR06SED05A	**36.0**			
			COR06SED06A	**73.2**			
			COR06SED07A	**27.0**			
			COR06SED08A	**32.3**			
Zinc	11000	63	COR06SED01A	36.3			
			COR06SED02A	**80.4**			
			COR06SED02B	**209**			
			COR06SED03A	**180**			
			COR06SED04A	**111**	A		
			COR06SED05A	211			
			COR06SED06A	**120**			
			COR06SED07A	**72.4**			
			COR06SED08A	60.8			

Notes:

Bold = Sample exceeds Ecological Screening Level

Sample exceeds Human Health Screening Level

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

bgs = below ground surface

LQ = laboratory qualifier (LQ flag descriptions available in lab report)

VQ = validiation qualifier

RC = reason code

NA = not applicable

A = post-digestion spiked sample recovery is not within control limits

E = reported value is estimated because of the presence of interference (as indicated by serial dilution)

N = pre-digestion spiked sample recovery is not within control limits

J = estimated

* = the duplicate sample analysis relative percent difference (RPD) is not within control limits

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1.2.4 Risk Assessment Summary

Analytical data generated during the RI were compared with risk-screening criteria to evaluate whether past munitions-related practices have resulted in contaminant releases exceeding human health or ecological screening criteria.

1.2.4.1 Human Health

Due to MC concentrations in soil at each DU exceeding human health screening criteria, a Human Health Risk Assessment (HHRA) was conducted. The results of the HHRA screening identified lead as a soil constituent of potential concern. The remaining MC metals were eliminated from further evaluation due to adverse health effects from exposure being unlikely. Non-cancer hazard calculations were conducted for the following scenarios: construction worker child site visitor/recreational user, adult site visitor/recreational user, outdoor worker, hypothetical child resident, and hypothetical adult resident. The U.S. Environmental Protection Agency (USEPA)'s Adult Lead Methodology (ALM) and Integrated Exposure Uptake Biokinetic (IEUBK) models were used to estimate receptor blood lead (PbB) concentrations from exposure to lead in soil. The ALM model was used to evaluate soil exposure to the site visitor/recreational user (adult), outdoor worker, and future construction worker receptors. The IEUBK model was used to evaluate soil exposure to the hypothetical child resident and child site visitor/recreational user.

Lead modeling results at the 100-yard Firing Berm DU, Target Area DU, and Target Berm-Hillside DU indicated that adverse health effects are not likely for the potential receptors exposed to soil with model results being below target blood lead level (BLL) and probability percent thresholds.

Results at the Wet Meadow DU indicated that adverse health effects are not likely for potential receptors exposed to sediment due to model results being below the BLL and probability percent threshold.

The hypothetical child resident and child site visitor/recreational user IEUBK model results were above the target BLL and probability threshold at the Target Berm-Ponded DU.

If the USEPA and NYSDEC revised their policy for the target BLL (i.e., 10 micrograms per deciliter [µg/dL] to 5 µg/dL), then adverse health effects are possible from exposure to surface soil for the child receptors at the Target Berm-Hillside DU. Also, adverse health effects would be possible for the outdoor worker, construction worker, and the child site visitor/recreational user from exposure to sediment at the Target Berm-Ponded DU.

1.2.4.2 Ecological

Because antimony, lead, and zinc concentrations in soil at all three soil DUs exceeded the ecological screening criteria, a Screening-Level Ecological Risk Assessment (SLERA) was conducted. The purpose of the SLERA was to identify the potential risks to ecological receptors exposed to site-related contaminants of interest (COIs) in environmental media and determine which contaminants of potential ecological concern (COPECs), if any, could exert adverse effects to potential ecological receptor populations. The results of the SLERA, Baseline Ecological Risk Assessment Step 3 COPEC refinement, and consideration of the uncertainties present in the evaluation support the following conclusion for the MRS 2:

- There is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk.

    - Negligible Risk
        - Soil macroinvertebrate community
        - Benthic macroinvertebrate community (Wet Meadow DU)
        - Terrestrial wildlife community
        - Aquatic and semi-aquatic wildlife community
        - Groundwater to surface water pathway
- The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.
    - Benthic macroinvertebrate community (Target Berm-Ponded DU)
- Constituents of Concern (COCs)
    - Lead was identified as a direct contact based COC in sediment at the Target Berm-Ponded DU within the Camp O'Ryan Rifle Range MRS 2.

1.2.5 Munitions Response Site Prioritization Protocol

In accordance with the DoD Primer for MRS Prioritization Protocol (MRSPP; DoD, 2007), the overall MRSPP priority for the Camp O'Ryan Rifle Range MRS 2 (NYHQ-008-R-02) is 4. The Explosive Hazard Evaluation Module (EHE) and Chemical Warfare Material (CWM) Hazard Evaluation Module (CHE) module ratings were each No Known or Suspected Hazard, but the Health Hazard Evaluation (HHE) rating was C, which corresponds to an MRSPP priority of 4. No new information has been found since the RI regarding the MRS 2, and therefore, the MRSPP rating is unchanged (**Appendix B**).

1.2.6 Conclusions and Recommendations

Based on the results of the RI, MC in soil and sediment within the MRS 2 have been sufficiently characterized. MC does not appear to be migrating beyond the immediate vicinity of the target feature DUs, with only minimal impact observed at the adjacent Wet Meadow DU. The MRS 2 boundary was revised to include the expanded Target Berm-Hillside DU and the added Wet Meadow DU (**Figure 1-14**). The presence of unacceptable risks to human health at the Target Berm-Ponded DU warrants an FS for the Camp O'Ryan Rifle Range MRS 2. It was also determined that a potential exists for adverse ecological effects to the benthic macroinvertebrate community at this DU. The next step after an FS would be to prepare a proposed plan to convey this finding to the public, followed by a decision document to formally document the remediation plan at the MRS 2.

2 Identification and Screening of Technologies

The development of remedial action alternatives involves establishing the RAO, developing GRAs, and identifying and screening remedial technologies and process options.

2.1 Remedial Action Objective

RAOs are site-specific objectives that are established based on the nature and extent of contamination, potential for human and environmental exposure, and ARARs. The RAO and ARARs for the Camp O'Ryan Rifle Range MRS 2 are presented first. The possible response actions to achieve the RAO are then discussed.

2.1.1 Munitions Constituents

Lead concentrations exceeded the human health screening criteria (63 milligrams per kilogram [mg/kg]), and ecological screening criteria (63 mg/kg) at Camp O'Ryan Rifle Range MRS 2. The MRS 2 was considered to pose a risk to human health and the environment based on the elevated lead concentrations and the possibility of receptor exposure.

- The RAO for MC is to prevent human exposure to lead above NYSDECs Soil Cleanup Objective (63 mg/kg) within Camp O'Ryan Rifle Range MRS 2. The primary remedial goal is to prevent human contact with MC-contaminated soil. The MC RAO will address the likelihood of exposure to workers, residents, visitors, and trespassers such that an acceptable condition of negligible risk of injury or exposure due to dermal contact or incidental ingestion with MC-contaminated soil is achieved. It is anticipated that any remediation conducted to remove exposure risks to human receptors will also reduce the exposure risk to ecological receptors as well. This estimation is appropriate given the size of the revised MRS 2 and the lack of critical habitats within the MRS 2.

2.1.2 ARARs

Federal environmental statutes and regulations were evaluated to determine whether they were ARARs (**Table 2-1**).

As defined in the NCP, "Applicable Requirements" are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable (40 CFR 300.5).

"Relevant and Appropriate Requirements" are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well suited to the particular site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable (40 CFR 300.5).

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TABLE 2-1
FEDERAL AND STATE APPLICABLE OR RELEVANT
AND APPROPRIATE REQUIREMENTS

Standard, Requirement, Criteria or Limitation	Citations	Description	ARAR Type	Applicability to Site
Solid and Hazardous Waste Management				
RCRA Miscellaneous Units	40 CFR Part 264.601, Subpart X*	Environmental performance standards that require miscellaneous units be located, designated, constructed, operated, maintained and closed in a manner that will prevent any release that may have adverse effects on human health and the environment.	Chemical and Action	ARAR/Applicable to soils containing elevated levels of lead at concentrations that may affect human health.
RCRA Military Munitions Rule	40 CFR Part 266, Subpart M*	Identifies when military munitions become solid waste, and, if these wastes are also hazardous under this subpart or 40 CFR part 261, the management standards that apply to these wastes.	Action	ARAR/Applicable if military munitions (i.e. soil containing lead from small arms waste) meeting the definition of a solid waste are encountered during the remedial action.

Notes:

* = The ARARs include 40 CFR 266 Subpart M and 264.601 Subpart X, to the extent that there is a cleanup standard, standard of control, or other substantive requirement that specifically addresses a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance found at the Camp O'Ryan Rifle Range MRS.

RCRA = Resource Conservation and Recovery Act

USEPA = United States Environmental Protection Agency

MRS= Munitions Response Site

MC = Munitions Constituents

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Section 121(d) of CERCLA requires that remedial actions be evaluated to determine if they meet any standard requirement, criteria, or limitation under any federal environmental law; any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation; and any standards, criteria, or limitations that are determined to be ARARs. The NCP requires compliance with ARARs during and upon completion of remedial actions. Under limited circumstances, ARARs for on-site remedial actions may be waived.

ARARs are identified on a site-specific basis using a two-part analysis: (1) determining whether a given requirement is applicable or if it is not applicable, and (2), determining whether a requirement is relevant and appropriate (USEPA, 1988). To determine whether a requirement is relevant and appropriate, characteristics of the remedial action, the hazardous substances present, and the physical characteristics of the site must be compared to those addressed in the statutory or regulatory requirement. In some cases, a requirement may be relevant but not appropriate, given site-specific circumstances; such a requirement would not be an ARAR for the site. In other cases, only part of a requirement will be considered relevant and appropriate. When it is determined that a requirement is both relevant and appropriate, the requirement must be complied with to the same degree as if it were applicable (USEPA, 1988).

Remedial actions may have to comply with three functional groups of ARARs:

- Chemical-specific ARARs are health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. The chemical ARARs may be used to set cleanup levels for the chemicals of concern in the designated media or to set a safe level of discharge (e.g., air emission or wastewater discharge) where a discharge occurs as a part of the remedial action.
- Action-specific ARARs generally set performance, design, or other similar operational controls or restrictions on particular activities related to management of hazardous substances or pollutants. These requirements address specific activities that are used to accomplish a remedy. Action-specific requirements do not determine the remedial action; rather, they indicate how a selected remedial action alternative must be designed, operated, or managed.
- Location-specific ARARs are restrictions placed on the types of activities that may occur in particular locations. Location-specific ARARs generally prevent damage to unique or sensitive areas, such as floodplains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place.

On 27 May 2021, ARNG requested ARARs from NYSDEC, and on 1 June 2021, a response was received. The statutes and regulations that were considered to be location-specific ARARs and are being carried forward for this FS are presented in **Table 2-1**. The table includes comments regarding the applicability or relevance and appropriateness of the ARAR. Dependent on the chosen alternative, final ARARs (statutes and regulations) will be determined by the ARNG and NYARNG in consultation with NYSDEC and/or other appropriate federal and state agencies and documented in the Record of Decision (ROD).

2.2 General Response Actions

GRAs are broad classes of medium-specific actions intended to satisfy the RAO. A GRA to achieve UU/UE is required by CERCLA and/or the Defense Environmental Restoration Act (DERA). The following GRAs (excluding No Action) are applicable for satisfying the RAO previously discussed in **Section 2.1**:

- No Action
- Land Use Controls (LUCs)
- Soil Stabilization and Excavation with Off-Site Disposal with LUCs

2.2.1 No Action

The No Action GRA is required to satisfy the NCP requirement of 40 CFR 300.430(e)(6), which is to consider No Action as a baseline response against which the other remedial response actions are compared. The No Action GRA does not include any actions that would fulfill the RAO.

2.2.2 Land Use Controls

In general, LUCs are mechanisms to restrict the use of or limit access to real property to prevent or reduce the risk of exposure to MC-contaminated soil. The three general categories of LUC mechanisms available to achieve this objective are physical, legal, and administrative. The legal LUCs described below are considered proprietary controls; the physical LUCs described below are considered educational controls; and the administrative LUCs described below include both proprietary and educational controls.

The MRS 2 is privately owned; therefore, the implementation of any LUC is conditionally feasible; the private owners would have to voluntarily participate in any LUC implementation.

Legal LUCs would include proprietary controls, such as environmental easements or deed restrictions as an option. Legal LUCs are not enforceable by the ARNG or NYSDEC. LUCs for the Camp O'Ryan Rifle Range MRS 2 will not result in conditions that allow for unlimited use/unrestricted exposure (UU/UE) at the MRS 2; therefore, Five-Year Reviews are required under CERCLA Section (§) 121(c) and NCP, CFR §300.430(f)(4)(ii)) to ensure that the remedy continues to be protective of human health and the environment.

Physical LUCs would include educational controls, such as the posting of signs. Administrative LUCs also include educational controls and would include the development of public outreach and educational programs, as well as educational notice posting. Administrative LUCs may also include proprietary controls such as environmental notices, which are informational documents filed in public land records that inform prospective purchasers of an interest in the property that contamination exists on the property. Administrative LUCs are not retained, as they involve recurring labor efforts and are inappropriate for the MRS. In addition, the implementability of LUCs is subject to approval from both landowners.

The LUCs would specifically seek to restrict land use at the MRS 2 through physical (educational control) and legal (proprietary control) mechanisms. Successful implementation of LUCs is contingent upon the cooperation and active participation of the existing landowners, ARNG, NYARNG, and other government agencies to protect the public from MC hazards.

2.2.3 MC-Contaminated Soil Mitigation with LUCs

MC-contamination is present in soil at the Target Berm - Ponded DU at levels that pose unacceptable risk to human health. MC-contamination is also present in soil DUs but not at levels that pose an unacceptable risk to human health. MC-contaminated soil mitigation can be accomplished by the combined activities of in-situ MC-contaminated soil treatment, soil removal, transport, and disposal.

2.3 Identification and Screening of Remedial Technologies

2.3.1 Identification and Screening of Technologies

Technologies were identified that are relevant to executing the GRAs identified in **Section 2.2**. **Table 2-2** shows the relationship between the GRAs and the potential technologies, including the various technology goals, technology names, and technology process options (different ways a technology can be implemented). As an initial screening, remedial technologies and process options were evaluated based on their technical implementability and general applicability to the conditions at the MRS 2. All the remedial technologies and process options identified in **Table 2-2** are technically feasible and applicable to the MRS 2 and retained for evaluation.

2.3.2 Evaluation of Technologies

This section identifies and screens the remedial technologies available to execute the GRAs identified in **Section 2.2**. A brief description of each of these technologies/process options is summarized in **Table 2-3** and discussed below.

Using the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988), the various technologies and technology process options identified in **Table 2-4** and **Table 2-5** were evaluated with respect to three criteria: effectiveness, implementability, and cost.

- **Effectiveness**: Based on demonstrated ability of technologies to achieve remediation goals, potential impacts to human health and the environment during implementation, and reliability of the technology/process option to mitigate conditions at the site. The effectiveness analysis is based on engineering judgment, and each process option is evaluated as to whether effectiveness is low, medium, or high relative to other process options in the same technology.
- **Implementability**: Based on factors such as: safety; constructability; regulatory and public support; compatibility with reasonably anticipated future land use; and availability of material, equipment, technical expertise, or off-site treatment and disposal facilities. The implementability analysis is based on engineering judgment, and each process option is evaluated as to whether implementability is low, medium, or high relative to other process options in the same technology.

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TABLE 2-2
GRAs AND POTENTIALLY APPLICABLE TECHNOLOGIES

General Response Action	Potentially Applicable Technologies		
	Goal	**Technology**	**Process Option**
No Action	Baseline Comparison	None	None
Land Use Controls	Reduce Exposure to MC-contaminated Media	Physical Mechanisms	Signs (educational controls)
			Fences (engineering controls)
		Legal Mechanisms	Deed Restrictions (proprietary controls)
			Negative Easements / Restrictive Covenants (proprietary controls)
			Land Use Plans / Ordinances / Permits (governmental controls)
		Administrative Mechanisms	Public Awareness Programs (educational controls)
MC-contaminated Soil Mitigation	MC-contaminated Soil Removal	Excavation	Manual Excavation
			Mechanized Excavation
		On-Site Extraction	Soil Washing
			Acid Leaching
		Treatment	Phytoextraction
			In-situ Stabilization
	MC-contaminated Soil Disposal	Non-hazardous Waste Transport and Disposal	Transport and Offsite Disposal

Notes:
GRA = general response action
MC = munitions constituents

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TABLE 2-3
POTENTIALLY APPLICABLE TECHNOLOGIES AND PROCESS OPTION DESCRIPTIONS

Potentially Applicable Technologies			Description
Purpose	**Technology**	**Process Option**	
No Action	None	None	No remedial action to address the MC-contaminated soil.
Land Use Controls	Physical Mechanisms	Signs (educational controls)	Install signage around affected areas to warn potential receptors of MC-contaminated soil risks within the MRS. Must be periodically inspected and maintained.
		Fences (engineering controls)	Install fencing around affected areas to physically control access to the areas. The fencing must be periodically inspected and maintained.
	Legal Mechanisms	Deed Restrictions (proprietary controls)	Limitations on land use are typically included in the property deed and describe restrictions on the use of property. Third parties (not the property owner) identify the restrictions and assure they are included in the deed. Such restrictions prohibit current and future landowners from engaging in land use activities that would otherwise increase the risk of exposure to MC-contaminated soil, such as excavation if subsurface MC-contaminated soil is suspected.
		Negative Easements / Restrictive Covenants (proprietary controls)	Negative easements (also referred to as restrictive covenants) are obligations not to use land in specified ways that would otherwise result in unacceptable risk of exposure to MC-contaminated soil. Negative easements are similar to deed restrictions except that negative easements do not bind to land through deeds.
		Land Use Plans / Ordinances / Permits (governmental controls)	Land Use Plans describe the manner by which land can be developed and used and can be written in a manner to minimize potential contact with MC-contaminated soil. The plans can become legally binding through the zoning process enforced by municipal authorities. Ordinances are legislation enacted by a municipal authority and can be written in a manner to reduce the risk of exposure to MC-contaminated soil. Permits are documents that must be secured prior to conducting activities such as construction. Through the process of securing a permit controls can be established that would reduce the risk of exposure to MC-contaminated soil.

TABLE 2-3
POTENTIALLY APPLICABLE TECHNOLOGIES AND PROCESS OPTION DESCRIPTIONS

Potentially Applicable Technologies			Description
Purpose	**Technology**	**Process Option**	
Land Use Controls	Administrative Mechanisms	Public Awareness Programs (educational controls)	Public education programs educate the public about procedures to follow in the event that known or suspected MC-contaminated soil is observed, intended to reduce the risk of exposure to MC-contaminated soil, and the potential risks associated with exposure to MC-contaminated soil. Public education programs vary in scope, but may include these common elements: community awareness meetings, informational pamphlets, fact sheets, formal education sessions, and websites.
MC-contaminated Soil Removal	Excavation	Manual Excavation	Removes contaminated soils from their current location where human or environmental exposure can occur. Hand excavation can support on-site consolidation of contaminated soil or moving soil to other locations for treatment or disposal. Hand excavation consists of digging contaminated soil using commonly available hand tools, such as shovels, pick axes, and trowels.
		Mechanized Excavation	Removes contaminated soils from their current location where human or environmental exposure can occur. Mechanized excavation can support on-site consolidation of contaminated soil or moving soil to other locations for treatment or disposal. This method uses commonly available mechanical excavating equipment such as a backhoe or excavator.
	On-Site Extraction	Soil Washing	Uses washing solutions such as water, surfactant, and chelating agent to remove or reduce soil contaminant concentrations and facilitate on-site reuse of the treated soil.
		Acid Leaching	Converts lead sulfate and lead dioxide to lead carbonate, which is soluble in fluosilicic acid. Lead is recovered from the leaching solution by electrowinning, and the acid is recycled back into the leaching process. Further leaching with nitric acid may increase lead movement.
	Treatment	Phytoextraction	Lead can be uptaken by plant roots and subsequently accumulate in plant tissue, which can be harvested and properly disposed of.
		In-situ Stabilization	Renders lead less prone to leaching and may reduce bioavailability. Potential binders include portland cement, lime-fly ash, thermoplastic binders (asphalt), and sorbents such as activated carbon, clays, zeolites, and anhydrous sodium silicate.

TABLE 2-3
POTENTIALLY APPLICABLE TECHNOLOGIES AND PROCESS OPTION DESCRIPTIONS

Potentially Applicable Technologies			Description
Purpose	**Technology**	**Process Option**	
MC-contaminated Soil Disposal	Non-hazardous Waste Transport and Disposal	Transport and Offsite Disposal	Removes soil from the site and disposes of it as non-hazardous waste either by testing to confirm a non-hazardous status or treatment to change hazardous soil to non-hazardous.

Notes:
cm = centimeter
GPS = Global Positioning System
LUC = Land Use Control
MC = munitions constituents
MRS = munitions response site

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TABLE 2-4
LAND USE CONTROLS AND CONSTRUCTION SUPPORT
DETAILED SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Potentially Applicable Technologies			Effectiveness	Implementability	Cost	Representative Systems	Screening Comments
Purpose	**Technology**	**Process Option**					
Land Use Controls	Physical Mechanisms	Signs (educational controls)	**Medium:** Can be effective, particularly in situations where signs can be placed at the locations where the public is likely to see the sign, such as at trail heads. Less effective in situations where there are multiple routes to access the area of MC-contaminated soil or if potential receptors choose to ignore the signs.	**High:** Easily implemented, will require approval from property owner.	**Medium:** Recurring maintenance is a requirement	Signs	**Medium / Retained:** Implementability of this technology is contingent on the participation and cooperation of the land owner, NYSDEC, and other government agencies.
		Fences (engineering controls)	**Medium-High:** Reduces the probability of MC-contaminated soil exposure compared to signs, by creating a physical barrier. However, fences can be breached relatively easily if the potential receptor is determined to do so.	**Low:** Moderately difficult to implement, will require approval from property owner.	**Medium:** Recurring maintenance is a requirement	Fences	**Low / Not Retained:** The MRS is privately owned and involves ongoing O&M costs
	Legal Mechanisms	Deed Restrictions (proprietary controls)	**Medium:** Can be effective because they are legally binding. However, if property owners don't carefully read the deed they may be unaware of land use restrictions described in the deed.	**Medium:** NYSDEC may be able to enforce deed restrictions on private property, but is contigent on the partipation and cooperation of the landowner, NYSDEC and other government agencies	**Low-High:** The cost range is large and depends on how rigorously the property owner may strive to avoid the deed restriction, potentially including seeking legal representation.	Legal	**Medium / Retained:** Implementability of this technology is contingent on the participation and cooperation of the land owner, NYSDEC, and other government agencies.
		Negative Easements / Restrictive Covenants (proprietary controls)	**Medium:** Can be effective; however, this assumes property owners are aware of the land use restrictions and agree to abide by them.	**Medium:** NYSDEC may be able to enforce negative easements on private property, but is contigent on the partipation and cooperation of the landowner, NYSDEC and other government agencies	**Low-High:** The cost range is large and depends on how rigorously the property owner may strive to avoid the land use restriction, potentially including seeking legal representation.	Legal	**Medium / Retained:** Implementability of this technology is contingent on the participation and cooperation of the land owner, NYSDEC, and other government agencies
		Land Use Plans / Ordinances / Permits (governmental controls)	**Medium:** Can be effective for activities such as excavation associated with planned new construction since this activity is the traditional domain of this LUC technology. However, there is uncertainty whether other intrusive land use activities, such as tilling associated with gardening, could be controlled.	**Low:** Can be difficult to implement due to the democratic nature of municipal authorities which is a time-consuming characteristic. The MRS property is not owned by DoD.	**Low-High:** The cost range is large and depends on how rigorously the property owner may strive to influence the municipal authority concerning the nature of the land use restrictions.	Legal	**Low / Not Retained:** Implementability of this technology is contingent on the participation and cooperation of the land owner, NYSDEC, and other government agencies. Costs can be large

TABLE 2-4
LAND USE CONTROLS AND CONSTRUCTION SUPPORT
DETAILED SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Potentially Applicable Technologies			Effectiveness	Implementability	Cost	Representative Systems	Screening Comments
Purpose	**Technology**	**Process Option**					
Land Use Controls	Administrative Mechanisms	Public Awareness Programs / Notices (educational controls)	**Medium:** Educational components work very well when tailored to the specific populations at risk of exposure through behavior modification. Multiple formats are available for use to convey information to target groups, and periodic inspections can be used to verify effectiveness in the future at both MRSs.	**Low:** Can be difficult to implement because land owners typically are not inclined to agree to limit how they use their property. Limitations may potentially jeopardizing the property re-sale value, assuming disclosure of the limitation to perspective property buyers. The MRS property is not owned by DoD.	**Medium-High:** Costs are variable based on level of effort.	Administrative to produce informational materials and provide training materials.	**Low / Not Retained:** The MRS is privately owned and involves ongoing O&M costs

Notes:
DoD = Department of Defense
LUC = Land Use Control
MRS = Munitions Response Site
NDNODS = Non-DoD Non-Operational Defense Sites
RI = Remedial Investigation

TABLE 2-5
MC-CONTAMINATED SOIL REMOVAL AND DISPOSAL
DETAILED SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Potentially Applicable Technologies			Effectiveness	Implementability	Cost	Representative Systems	Screening Comments
Purpose	**Technology**	**Process Option**					
MC-contaminated Soil Removal	Excavation	Manual Excavation	**Low:** Removal of contaminated soils from the MRS can effectively eliminate the exposure risks for on-site human health and ecological receptors at small sites. Effectiveness is highly limited due to the quantity of soil expected to be removed.	**High:** Hand excavation is easy to conduct and requires simple tools rather than heavy equipment. However, efficiency can be low when excavating large areas and deep excavations.	**High:** Capital: High LTM: Low	Shovel	**Low / Not retained:** Hand excavation can be very costly and time-consuming when excavating large areas.
		Mechanized Excavation	**High:** Removal of contaminated soils from the MRS can effectively eliminate the exposure risks for on-site human health and ecological receptors.	**Medium:** Mechanized excavation requires heavy and specialized equipment and skilled operators. This method would be more efficient than hand excavation, and it provides a higher level of safety for workers.	**Medium:** Capital: High LTM: Low	Tracked mini-excavator, excavator, or wheeled backhoe. Multiple manufacturers.	**High / Retained:** High effectiveness and efficiency and relatively low cost.
	On-Site Extraction	Soil Washing	**Medium:** Effective method for removing lead from contaminated soil. The efficiency may vary depending on the site-specific conditions (i.e., soils). The process produces residuals such as contaminated solids, wastewater, and wastewater sludge that need further treatment.	**Low:** Soil washing requires a very specialized treatment unit and skilled operator to implement. The process also requires large quantities of water and a power supply, and usually includes a complicated soil separation process.	**High:** Capital: High LTM: Low	Surfactants Chelating Agent	**Low / Not Retained:** High cost and low implementability.
		Acid Leaching	**Low:** The efficiency may vary depending on the site-specific conditions, and the application is limited. The process produces residuals such as contaminated solids, wastewater, and wastewater sludge that need further treatment.	**Low:** Acid leaching requires a very specialized treatment unit and skilled operator to implement.	**High:** Capital: High LTM: Low	Electrowinning	**Low / Not Retained:** High cost and low implementability.
	Treatment	Phytoextraction	**Low:** The effects of uptake or degradation of lead can only be achieved at a certain phase of plant growth. MC would remain in soil, and the risk of receptor exposure through potentially complete pathways would continue to exist for a long period of time. The removal effectiveness varies with site-specific conditions.	**Low:** Plants need to be maintained and harvested to achieve MC removal. The harvested plants may require further treatment.	**High:** Capital: High LTM: High	Trees Shrubbery	**Low / Not Retained:** Low effectiveness and implementability with high cost.
		In-situ Stabilization	**Medium-High:** The application of stabilization/fixation can reduce the mobility of MC in the soil; however, MC would remain in soil. The stabilization effectiveness varies with site-specific characteristics.	**Low-Medium:** The process of mixing the binders/stabilizers with contaminated soil can be complicated and may require specialized equipment.	**Medium:** Capital: Medium LTM: Medium	Portland Cement Lime Fly Ash, Thermoplastic binders Sorbents (carbon, clays, zeolites, and anhydrous sodium silicate)	**Medium-High / Retained:** Will be required for the excavated soil to pass TCLP testing for disposal as a non-hazardous waste.

TABLE 2-5
MC-CONTAMINATED SOIL REMOVAL AND DISPOSAL
DETAILED SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

Potentially Applicable Technologies			Effectiveness	Implementability	Cost	Representative Systems	Screening Comments
Purpose	**Technology**	**Process Option**					
MC-contaminated Soil Disposal	Non-hazardous Waste Transport and Disposal	Transport and Offsite Disposal	**High:** Effectively eliminates the exposure risks for on-site human health and ecological receptors by complete removal of contaminated soil from the MRS.	**High:** Contaminated soil would be shipped off site for disposal. Easy to implement using commercially available vendors with required equipment. Soil can be handled in large quantities.	**Low:** Capital: Low LTM: None	Approved off-site landfill	**High / Retained:** High effectiveness and low cost.

Notes:

LTM = long term monitoring
MC = munitions constituents
MRS = Munitions Response Site
TCLP = toxicity characteristic leaching procedure

- **Cost**: Based on overall cost, including capital costs and long-term management (LTM) costs. Capital costs are based on the amount of equipment needed and the cost of performing the process option. LTM costs are based on the relative cost after initial implementation of the process option. The cost analysis is based on engineering judgment, and each process option is evaluated as to whether costs are low, medium, or high relative to other process options in the same technology. A comprehensive discussion of costing procedures used during the FS is contained in *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USEPA, 2000).

These evaluation criteria were used to screen and identify technologies and process options that were judged to be effective and workable at the MRS 2 and to eliminate those that will not work. The technologies screening results are presented in the following sections for each of the following categories:

- LUCs
- MC-contaminated Soil Removal
- MC-contaminated Soil Treatment and Disposal

2.3.2.1 Land Use Controls

Physical, Legal, and Administrative LUC mechanisms are available via engineering and institutional controls. LUC technology screening results are summarized in **Table 2-4** and individually discussed below for each technology and technology process option.

Physical Mechanisms

Physical mechanisms are engineered and/or educational controls to restrict access to areas where MC-contaminated soil and groundwater may be present or educate possible receptors of the danger of the contamination so that they may voluntarily self-restrict their interaction with the contamination. Physical mechanisms options include:

- Fences (engineering controls)
- Warning signs (educational controls)

Fencing may be installed around affected areas to physically control access to the areas. Signs may be installed around affected areas to warn people about the presence of MC-contaminated soil. The fencing and signs must periodically be inspected and maintained, which involves recurring maintenance costs.

The MRS 2 is privately owned. The U.S. Army cannot unilaterally impose the requirement to construct signs or fences on the property. Warning signs are more easily implementable, when compared to fencing and are more appropriate for the MRS due to the varying terrain and thick vegetation. The viability of physical LUCs via educational controls (i.e. warning signs) at the MRS 2 is medium, and this technology is retained.

Legal Mechanisms

Legal mechanisms are governmental and/or proprietary controls that restrict land use or control access to areas where MC-contaminated soil may be present via non-physical means. Legal mechanisms options include:

- Proprietary controls: Deed restrictions (limitations on land use) / negative easements / restrictive covenants
- Governmental controls: Land use plans / ordinances / permits

Limitations on land use are typically included in the property deed and describe restrictions on the use of property. Third parties (not the property owner) identify the restrictions and assure they are included in the deed. Deed restrictions may also be referred to as a private land-use restrictions, restrictive covenants, negative easements, or equitable servitudes. Such restrictions prohibit current and future landowners from engaging in land use activities that would otherwise increase the risk of exposure to MC-contaminated soil, such as excavation, if subsurface MC-contaminated soil.

Negative easements (also referred to as restrictive covenants) are obligations not to use land in specified ways that would otherwise result in unacceptable risk of exposure to MC-contaminated soil. Negative easements are similar to deed restrictions (limitations on land use) except that negative easements do not bind to land through deeds. The DoD (Defense Environmental Restoration Plan, 2012) describes planning requirements to implement such easements, and such planning is formally documented via a LUC implementation plan. The implementation plan is an internal management tool that explains how LUCs will be established and documented and defines who will be responsible for maintaining and managing them. The implementation plan should be incorporated into the site master plan or its equivalent. At a minimum, the implementation plan shall describe the location of the land subject to the LUC; explain the LUC and generally allowed uses; specify the duration of the LUC; reference the location of the pertinent LUC records; provide for modifications to the LUC as site conditions change; and specify the frequency and requirements of LUC inspections and indicate whether any of these inspections are part of the process for other environmental programs.

Deed restrictions and negative easements are generally easy to implement technically and administratively and have little continuing cost once the restriction or easement has been set by NYSDEC; they also have no physical presence at the site in terms of fences, signs, and notices which are required by physical and administrative LUCs.

Land use plans describe the manner by which land can be developed and used and can be written in a manner to minimize potential contact with MC-contaminated soil. The plans can become legally binding through the zoning process enforced by municipal authorities. Ordinances are legislation enacted by a municipal authority and can be written in a manner to reduce the risk of exposure to MC-contaminated soil. Permits are documents that must be secured prior to conducting activities such as construction. Through the process of securing a permit, controls that would reduce the risk of exposure to MC-contaminated soil can be established. Legal LUCs are not enforceable by the ARNG. NYSDEC may be able to enforce legal LUCs. The MRS 2 is

privately owned. Successful implementation of LUCs is contingent upon the cooperation and active participation of the existing landowners/users, ARNG, NYSDEC, and other government agencies to protect the public from MC hazards. The implementation of a legal LUC via governmental or proprietary controls is conditionally feasible; the private owner would have to voluntarily participate in any LUC implementation. The viability of legal mechanisms at the MRS 2 is medium, and this LUC mechanism is retained.

Administrative Mechanisms

Administrative mechanisms generally are focused on public awareness programs (educational controls). Administrative mechanisms options may include the following:

- Public notices
- Public awareness program

Public notices communicate to the public information intended to reduce the risk of exposure to MC-contaminated soil. Examples include notices in newspapers, notices communicated by mail, radio, television, or internet-based social media sites.

Public awareness programs educate the public about procedures to follow in the event that known or suspected MC-contaminated soil is observed and are intended to reduce the risk of exposure to MC-contaminated soil. Commonly, the programs seek to educate the public to follow these procedures if known or suspected MC-contaminated soil are observed: recognize the known or suspected MC-contaminated soil, retreat from the known or suspected MC-contaminated soil, and report the known or suspected MC-contaminated soil and the potential risks associated with exposure to MC-contaminated soil. The education program includes details concerning how to report potential MC-contaminated soil. Public awareness programs vary in scope but may include these common elements: community awareness meetings, informational pamphlets, fact sheets, formal education sessions, and websites. While not part of the remedy, Five-Year Reviews would be completed to assess if the LUCs were implemented and evaluate the effectiveness and protectiveness of the remedy to human health and the environment.

Administrative LUCs can be difficult to implement because landowners typically are not inclined to agree to limit how they use their property. Limitations may potentially jeopardize the property re-sale value, assuming disclosure of the limitation to perspective property buyers.

The MRS 2 is privately owned. The U.S. Army cannot unilaterally impose the requirement for administrative LUCs. Therefore, the viability of legal mechanisms at the MRS 2 is low, and this technology is not retained.

2.3.2.2 MC-Contaminated Soil Removal

MC contamination above screening values can be removed from the surface and subsurface manually, by mechanized means, extracted from the soil by washing or leaching, and treated with phytoremediation or stabilized in-situ. Common MC removal technologies are summarized below:

- Manual Excavation: Removes affected soils from their current location where human or environmental exposure can occur. Excavation can support moving soil to other locations

for treatment or disposal. Hand excavation consists of digging contaminated soil using commonly available hand tools, such as shovels, pickaxes, and trowels.

- Mechanized Excavation: Removes affected soils from their current location, where human or environmental exposure can occur. Excavation can support moving soil to other locations for treatment or disposal. This method uses commonly available mechanical excavating equipment, such as a backhoe or excavator.
- Soil Washing: Uses washing solutions such as water, surfactant, and chelating agent to remove or reduce soil contaminant concentrations and facilitate on-site reuse of treated soil.
- Acid Washing: Converts lead sulfate and lead dioxide to lead carbonate, which is soluble in fluorosilicic acid. Lead is recovered from the leaching solution by electrowinning, and the acid is recycled back to the leaching process. Further leaching with nitric acid may increase lead movement.
- Phytoextraction: Plant root systems can uptake lead, which can accumulate in plant tissue. The plant tissue can be harvested, analyzed, and disposed of based on the analytical results.
- In-situ Stabilization: Renders lead less prone to leaching and may reduce bioavailability. Potential binders include Portland cement, lime-fly ash, thermoplastic binders (asphalt), and sorbents such as activated carbon, clays, zeolites, and anhydrous sodium silicate.

Table 2-5 summarizes the MC-contaminated soil removal technology screening results. The following MC removal technologies were retained for development into one remedial alternative:

- Mechanized Excavation
- In-situ Stabilization

2.3.2.3 MC-Contaminated Soil Treatment and Disposal

MC disposal refers to the transportation and disposal of waste at a licensed facility, which is further discussed below:

- Transport and Offsite Disposal: Removes affected soil from the site and disposes of it as non-hazardous waste, either by testing to confirm a non-hazardous status or treatment to change the status from hazardous to non-hazardous by such means as soil stabilization for example.

Table 2-5 summarizes the MC-contaminated soil disposal technology screening results.

2.4 Summary

Table 2-6 summarizes the technologies screening results. The "retained" technologies will be developed into two remedial alternatives in **Section 3**.

TABLE 2-6
GRAs AND POTENTIALLY APPLICABLE TECHNOLOGIES

Technologies			Retained
Purpose	**Technology**	**Process Option**	
Land Use Controls	Physical Mechanisms	Signs (educational controls)	**YES**
		Fences (engineering controls)	No
	Legal Mechanisms	Deed Restrictions (proprietary controls)	**YES**
		Negative Easements / Restrictive Covenants (proprietary controls)	**YES**
		Land Use Plans / Ordinances / Permits (governmental controls)	No
	Administrative Mechanisms	Public Awareness Programs / Notices (educational controls)	No
MC-contaminated Soil Removal and Disposal	Excavation	Manual Excavation	No
		Mechanized Excavation	**YES**
	On-Site Extraction	Soil Washing	No
		Acid Leaching	No
	Treatment	Phytoextraction	No
		In-situ Stabilization	**YES**
	Non-hazardous Waste Transport and Disposal	Transport and Offsite Disposal	**YES**

Notes:
GRA = general response action
MC = munitions consituents

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3 Development of Alternatives for MC-Contaminated Soil

The retained technologies have been assembled for MC-contaminated soil into the following remedial alternatives for Camp O'Ryan Rifle Range MRS 2:

- Alternative 1 – No Action
- Alternative 2 – LUCs
- Alternative 3 – Target Berm – Ponded DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with Additional LUCs
- Alternative 4 – All DUs: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous

Table 3-1 identifies the associated GRA, technologies, and process options for each of these alternatives. A GRA to achieve UU/UE is required by CERCLA and/or DERA.

3.1 Alternative 1 – No Action

The No Action alternative provides a comparative baseline against which other alternatives can be evaluated. Under this alternative, no remedial action will be taken to change the current existing condition at the MRS 2. The MRS 2 will be left "as is", with no LUCs, containment, removal, treatment, or other mitigating actions, and assumes no action would be taken regarding residual small arms training debris. This alternative is required by the NCP for baseline comparison purposes (40 CFR 300.430[e][6]). This alternative will have no capital, operations and maintenance (O&M), or periodic costs.

3.2 Alternative 2 – LUCs

Risks related to contact with MC-impacted soil may be managed for the Camp O'Ryan Rifle Range MRS 2 through a limited action alternative consisting of physical and legal LUCs. The implementation of a physical LUC through educational controls would include the posting of warning signs along the MRS boundary. The implementation of a legal LUC through proprietary controls would include environmental easements (e.g., deed restrictions). Legal LUCs are not enforceable by the ARNG. NYSDEC may be able to enforce legal LUCs. LUCs for Camp O'Ryan will not result in conditions that allow for UU/UE at the MRS 2, therefore, Five-Year Reviews would be required under CERCLA Section (§) 121(c) and NCP, CFR §300.430(f)(4)(ii)). A statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy continues to be protective of human health and the environment.

The LUCs would specifically seek to warn users of potential MC-contamination and restrict land use at the MRS 2. Successful implementation of LUCs is contingent upon the cooperation and active participation of the existing landowners/users, NYSDEC, and other government agencies to protect the public from MC hazards.

The implementation of any LUC is conditionally feasible; the private landowners would have to voluntarily participate in any LUC implementation. UU/UE would not be achieved under the LUC alternative.

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TABLE 3-1
REMEDIAL ALTERNATIVES FOR MC-CONTAMINATED SOIL
(NYHQ-008-R-02 MRS)

Technologies / Process Options			GRA	Alternative 1	Alternative 2	Alternative 3	Alternative 4*
Purpose	**Technology**	**Process Option**		**No Action**	**Land Use Controls**	**Target Berm - Ponded Area DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls**	**All DUS: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste**
No Action	NA	NA	No Action	**X**	--	--	--
Land Use Controls	Physical Mechanisms	Signs (educational controls)	LUCs	--	**X**	**X**	--
	Legal Mechanisms	Deed restrictions/Negative easements (proprietary controls)	LUCs	--	**X**	**X**	--
MC-contaminated Soil Removal	Excavation	Mechanized Excavation	Removal and Disposal	--	--	**X**	**X**
	Treatment	In-situ Stabilization		--	--	**X**	**X**
MC-contaminated Soil Disposal	Non-Hazardous Waste Transport and Disposal	Transport and Offsite Disposal		--	--	**X**	**X**

Notes:
* = Alternative has the potential to achieve unlimited use/urestricted exposure
GRA = general response action
LUCs = Land Use Controls
MC = munitions constituents
NA = Not applicable
X= Selected Technology/Process

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3.3 Alternative 3 – Target Berm-Ponded DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with Additional Land Use Controls

Alternative 3 involves stabilization, excavation, and off-site disposal of the lead-contaminated soil with concentrations above established human health screening criteria (63 mg/kg) at the Camp O'Ryan Rifle Range MRS 2 that pose unacceptable risk to human health: the Target Berm-Ponded DU. No other DUs demonstrated unacceptable risk in the HHRA performed during the 2021 RI (AECOM, 2021). The excavation would eliminate the risk of encountering MC-contaminated soil but would not achieve UU/UE at other areas of the MRS 2. The MRS 2 is privately owned. Approval from the property owner would be needed to implement this remedy.

Based on the results of the RI, the extent of MC-contaminated soil at the Target Berm-Ponded DU was determined to cover 0.42 acres (approximately 1% of the MRS 2) to a depth of 1 foot (AECOM, 2021). The initial estimate of contaminated soil to be stabilized and removed is 678 bank cubic yards (BCY).

Prior to excavation, soil will undergo waste classification by sampling and analysis conducted per the requirements of the Resource Conservation and Recovery Act (RCRA) Part 261, which establishes standards for generators of solid and hazardous waste and Subtitle D solid waste disposal facilities.

Application of the "20 times rule" to the maximum detected total lead concentration indicates that soil may need to be stabilized in-situ for the excavated soil to pass toxicity characteristic leaching procedure (TCLP) criteria and allow disposal as nonhazardous waste. Soil with lead concentrations above landfill disposal criteria will undergo in-situ soil stabilization consisting of the following:

- Mixing a reagent (e.g., Portland cement), ensuring adequate reagent contact and distribution in soil, to stabilize lead prior to excavation.
- Post-treatment sampling and TCLP analysis of stabilized soil to evaluate stabilization effectiveness.
- If the soil is found to be a hazardous waste, it will be determined if RCRA Land Disposal Restrictions apply (40 CFR Part 268).

Following soil stabilization, characterization samples will again be collected and analyzed for TCLP lead. If contaminant concentrations remain above landfill disposal criteria, additional treatment, sampling, and analysis will be completed. If, after multiple soil stabilization efforts, areas of soil remain above disposal criteria, then soil exceeding criteria from these areas will be disposed of at an approved RCRA Subtitle C disposal facility. Soil that has undergone stabilization successfully will be excavated and disposed of at an appropriate disposal facility. For cost-estimation purposes, it is assumed that all excavated soil will be successfully stabilized.

Lead concentrations in confirmation samples will be measured using XRF in soil with sufficiently low moisture content. Where moisture is too high, samples will not be evaluated in the field using XRF. Instead, discrete samples will be taken and submitted for laboratory analysis to determine if concentrations are below 63 mg/kg. If sample results by XRF or laboratory analysis indicate lead concentrations are above the delineation value of 63 mg/kg, an additional 0.5 feet of soil will be removed, and the area will be re-evaluated by XRF or discrete sampling until lead concentrations are below 63 mg/kg. Soil excavation and subsequent sampling and analysis will proceed until the

results indicate the contaminant concentrations are below their established screening criteria. However, excavation will not advance to the area of the Target Berm - Hillside DU due to health and safety concerns related to dense vegetation and steep slopes.

Soil will be excavated with heavy equipment with enclosed cabs to minimize the potential for worker exposure to contaminated soil. Erosion control and air and dust monitoring will be implemented to prevent any contamination to the surrounding soils, site workers, and any run-off. Soil will be mixed with stabilizers using the excavation equipment, and this process will occur in one, 12-inch lift. Excavated soil will be loaded directly into haul trucks that will wait at the excavation areas and transported off-site to a licensed disposal facility. During excavation, care will be taken to avoid damaging existing roads, fencing, or structures located outside the excavation subareas. Haul trucks will be properly labeled, licensed, and insured for the transportation of soil. When transporting contaminated soil, transport vehicles will be fitted with a tarp or other covering to prevent wind dispersal of material during transport. Before departing from the MRS 2, vehicles will be inspected to ensure the material is properly sealed in the vehicle and "dry" decontaminated to remove visible soil accumulation from the vehicle body, undercarriage, and tires so no potentially contaminated soil is tracked onto the roadways. Because all excavated materials are anticipated to be non-hazardous after undergoing stabilization, this decontamination process is appropriate. If, after multiple soil stabilization efforts, areas of soil remain above disposal criteria, then vehicle decontamination will be reassessed to include "wet" decontamination, wash water collection and sampling, containerizing of liquid IDW, and coordination for appropriate disposal.

Backfill sources would be sampled and submitted for approval prior to use. Excavated areas would be backfilled, graded, and returned to pre-excavation conditions. Right-of-entry (ROE) would be obtained from the landowners, and its conditions followed. Closure documentation would be completed for the remedial action.

Based on the RI, the lead-contaminated removal action area is approximately 0.42 acres (**Figure 3-1),** to a depth of 1 ft. The excavation area excludes the Target Berm – Hillside DU due to dense vegetation and steep slopes preventing excavation activities. It is assumed the excavated soil will require stabilization and will be done in one 12-inch-deep pass. Therefore, excavation will be conducted to a maximum depth of 1 ft, resulting in a minimum disposal volume of 678 BCY of soil. The removal action is estimated to take approximately 8 days, which include one (1) day for characterization sampling, one (1) days for pre-, post-, and final-topographic surveys, one (1) day for vegetation clearing, three (3) days for stabilization, excavation, XRF sampling, transport and disposal, one (1) day for confirmation sampling, and one (1) day for site restoration.

Alternative 3 also includes the implementation of physical and legal LUCs at the MRS 2. The implementation of a physical LUC through educational controls would include the posting of warning signs every 200 feet, along the entire MRS boundary. The implementation of a legal LUC through proprietary controls would include environmental easements (e.g., deed restrictions). Legal LUCs are not enforceable by the ARNG. NYSDEC may be able to enforce legal LUCs. Such LUCs would specifically seek to warn users of the potential MC-contamination and to restrict disturbance to soil in the entire MRS 2. Alternative 3 will not result in conditions that allow for UU/UE at the MRS 2; therefore, Five-Year Reviews are required under CERCLA to ensure the remedy continues to be protective of human health and the environment.

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	6/18/2021
SCALE	1:3,600	CHK BY	JW	6/18/2021
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	LS	6/18/2021

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Camp O'Ryan - Target Berm Ponded DU Excavation Area

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

Prepared for: Army National Guard

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The successful implementation of LUCs is contingent upon the cooperation and active participation of the existing landowner, ARNG, NYARNG, and other government agencies to protect from MC hazards.

3.4 Alternative 4 – All DUs: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous

Alternative 4 involves stabilization, excavation, and off-site disposal of the lead-contaminated soil with concentrations above established human health screening criteria (63 mg/kg) at all Camp O'Ryan Rifle Range MRS 2 DUs. This alternative would excavate areas where no unacceptable risk to human health was identified, but where lead concentrations in soil meet or exceed 63 mg/kg. The excavation would eliminate the risk of encountering MC-contaminated soil and achieve UU/UE at the MRS 2. The MRS 2 is privately owned. Approval from the property owner would be needed to implement this remedy.

Based on the results of the RI, the extent of MC-contaminated soil was determined to cover 20.54 acres to a depth of 2 ft2-ft and cover a 3-acre area to a depth of 1 foot at the Target Berm-Ponded DU (in total, approximately 48.7% of the MRS 2) (**Figure 3-2**) (AECOM, 2021). The initial estimate of MC-contaminated soil to be stabilized and removed is 66,276 BCY and an additional 4,840 BCY of MC-contaminated soil to be stabilized and removed from the Target Berm-Ponded DU. The excavation area includes the DUs identified by the HHRA where adverse health effects are possible for human receptors.

Prior to excavation, significant vegetation clearing will need to be completed as the majority of the MRS 2 is densely vegetated. MC-contaminated soil will undergo waste classification by sampling and analysis conducted per the requirements of the RCRA Part 261, which establishes standards for generators of solid and hazardous waste and Subtitle D solid waste disposal facilities.

Application of the "20 times rule" to the maximum detected total lead concentration indicates that MC-contaminated soil may need to be stabilized in-situ for the excavated MC-contaminated soil to pass TCLP criteria and allow disposal as nonhazardous waste. MC-contaminated soil with lead concentrations above landfill disposal criteria will undergo in-situ stabilization consisting of the following:

- Mixing a reagent (e.g., Portland cement), ensuring adequate reagent contact and distribution in MC-contaminated soil, to stabilize lead prior to excavation.
- Post-treatment sampling and TCLP analysis of stabilized soil to evaluate stabilization effectiveness.
- If the soil is found to be a hazardous waste, it will be determined if RCRA Land Disposal Restrictions apply (40 CFR Part 268).

Following MC-contaminated soil stabilization, characterization samples will again be collected and analyzed for TCLP lead. If contaminant concentrations remain above landfill disposal criteria, additional treatment, sampling, and analysis will be completed. If, after multiple stabilization efforts, areas of soil remain above disposal criteria, then soil exceeding criteria from these areas will be disposed of at an approved RCRA Subtitle C disposal facility. Soil that has undergone stabilization successfully will be excavated and disposed of at an appropriate disposal facility. For cost-estimation purposes, it is assumed that all excavated soil will be successfully stabilized.

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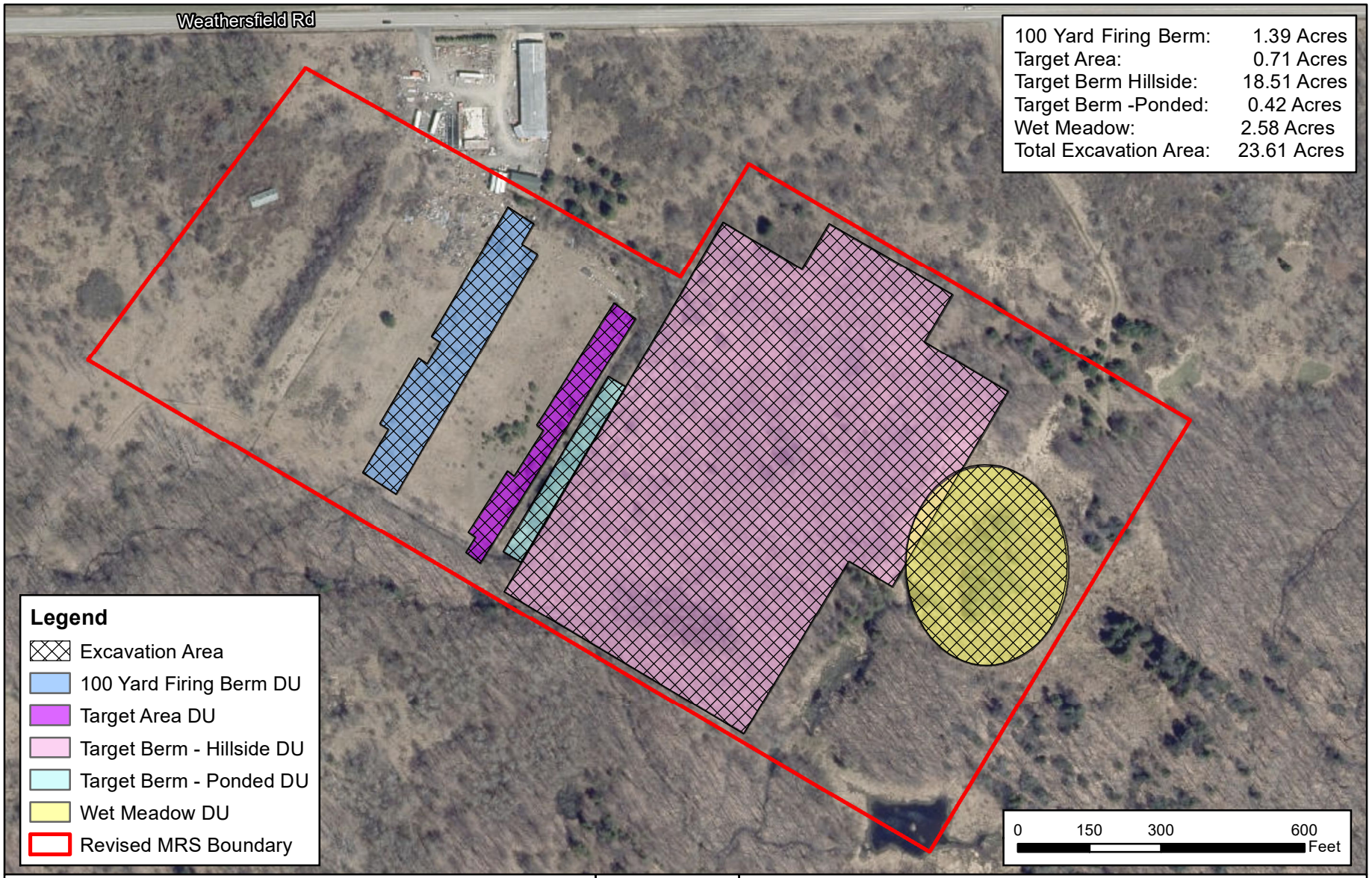

CLIENT	Army National Guard			
PROJECT	FS through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	6/18/2021
SCALE	1:3,600	CHK BY	JW	6/18/2021
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	LS	6/18/2021

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Camp O'Ryan - Excavation Areas

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-2

Prepared for: Army National Guard

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Lead concentrations in confirmation samples will be measured using XRF in soil with sufficiently low moisture content. Where moisture is too high, samples will not be evaluated in the field using XRF. Instead, discrete samples will be taken and submitted for laboratory analysis to determine if concentrations are below 63 mg/kg. If sample results by XRF or laboratory analysis indicate lead concentrations are above the delineation value of 63 mg/kg, an additional 0.5 ft of soil will be removed, and the area will be re-evaluated by XRF or discrete sampling until lead concentrations are below 63 mg/kg. Soil excavation and subsequent sampling and analysis will proceed until the results indicate the contaminant concentrations are below their established screening criteria.

MC-contaminated soil will be excavated with heavy equipment with enclosed cabs to minimize the potential for worker exposure to contaminated soil. Erosion control and air and dust monitoring will be implemented to prevent any contamination to the surrounding soils, site workers, and any run-off downslope. Soil will be mixed with stabilizers using the excavation equipment; this will occur in incremental, 12-inch lifts. Excavated soil will be loaded directly into haul trucks waiting in the excavation areas and transported off-site to a licensed disposal facility. During excavation, care will be taken to avoid damaging existing roads, fencing, or structures located outside the excavation subareas. Haul trucks will be properly labeled, licensed, and insured for the transportation of soil. When transporting contaminated soil, transport vehicles will be fitted with a tarp or other covering to prevent wind dispersal of material during transport. Before departing from the MRS 2, vehicles will be inspected to ensure the material is properly sealed in the vehicle and "dry" decontaminated to remove visible soil accumulation from the vehicle body, undercarriage, and tires so no potentially contaminated soil is tracked onto the roadways. Because all excavated materials are anticipated to be non-hazardous after undergoing stabilization, this decontamination process is appropriate. If, after multiple soil stabilization efforts, areas of soil remain above disposal criteria, then vehicle decontamination will be reassessed to include "wet" decontamination, wash water collection and sampling, containerizing of liquid IDW, and coordination for appropriate disposal. Backfill sources would be sampled and submitted for approval prior to use. Excavated areas would be backfilled, graded, and returned to pre-excavation conditions. ROE would be obtained from the landowners, and its conditions would be followed. Closure documentation would be completed for the remedial action.

Based on the results of the RI, the extent of MC-contaminated soil was determined to cover 20.45 acres to a depth of 2 ft, and the extent of MC-contaminated soil at the Target Berm-Ponded DU was determined to cover over 3 acres to a depth of 1 ft. Soil excavation will result in a minimum disposal volume of 66,276 BCY of soil, and excavation at the Target Berm-Ponded DU will result in a minimum disposal volume of 4,840 BCY of soil. The removal action is estimated to take approximately 570 days, which includes one (1) day for characterization sampling, ten (10) days for vegetation clearing, one (1) week for pre-, post-, and final-topographic surveys, fifty-seven (57) weeks for stabilization, excavation, XRF sampling/, transport and disposal, one (1) week for confirmation sampling, and one (1) week for site restoration.

This alternative has the potential to achieve UU/UE.

3.5 Screening of Individual Alternatives

Further screening of individual alternatives was not necessary. All alternatives discussed in **Section 3** are evaluated further in **Section 4**.

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4 Detailed Analysis of Alternatives

This section presents the analysis and assessment of each alternative with respect to the evaluation criteria specified by the NCP (CFR, Title 40, Part 300.430 [e][9]).

4.1 Introduction

The nine criteria identified by the NCP are divided into three functional categories:

- Threshold criteria
- Primary balancing criteria; and
- Modifying criteria

4.1.1 Threshold Criteria

Assessments against the following two criteria relate directly to statutory findings that must ultimately be made in the ROD; therefore, these are categorized as "threshold" criteria, since an alternative may not be implemented without meeting them. These two criteria are:

- Overall Protectiveness of Human Health and the Environment
- Compliance with ARARs

4.1.1.1 Overall Protectiveness of Human Health and the Environment

This criterion assesses whether the alternatives can adequately protect human health and the environment in both the short- and long-term and from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposure. Overall protection of human health and the environment draws on the attainment of RAOs and assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

4.1.1.2 Compliance with ARARs

This criterion assesses whether the alternatives attain Federal or State ARARs (**Table 2-1**) or provide grounds for invoking a waiver. Final ARARs and compliance determinations will be made by the ARNG/NYARNG in consultation with the NYSDEC, and/or other appropriate Federal and State agencies in the ROD.

4.1.2 Balancing Criteria

The following five balancing criteria are the primary criteria upon which the detailed analysis is based:

- Long-Term Effectiveness and Permanence
- Reduction of TMV through Treatment
- Short-Term Effectiveness
- Implementability
- Cost

4.1.2.1 Long-Term Effectiveness and Permanence

This criterion assesses the alternatives for the long-term effectiveness and permanence after remedial action has been implemented and the RAOs have been attained, along with the degree of certainty that the alternative will prove successful. Factors considered, as appropriate, include:

- Magnitude of residual risks
- Adequacy and reliability of controls

Magnitude of residual risks concerns risks remaining from untreated MC in soil or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals should be considered to the degree that they remain hazardous, taking into account their TMV and propensity to bioaccumulate.

Adequacy and reliability of controls concerns controls such as containment systems and institutional controls necessary to manage treatment residuals and untreated MC in soil. This factor addresses the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative; and the potential exposure pathways and risks posed should the remedial action need replacement.

For an MRS with MC-contaminated soil, the ability to maintain protection of human health and the environment over time will typically fall into categories associated with LUCs. The evaluation of long-term effectiveness and permanence of LUCs will take into account the administrative feasibility of maintaining the LUCs and the potential risk/hazard, should they fail, as well as mechanisms like the CERCLA Five-Year Review process to evaluate on a periodic basis the long-term effectiveness and permanence, as well as protectiveness, of the alternative. If UU/UE is achieved, then the above are not required.

4.1.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion assesses the degree to which alternatives employ recycling or treatment that reduce TMV, including how treatment is used to address the principal threats posed by the site. While no threat is posed by the MRS 2, residual small arms training debris are present, and active treatment is an option for addressing this debris (such as MC in soil). Factors that will be considered, as appropriate, include the following:

- Treatment or recycling processes the alternatives employ and the materials they will treat;
- Amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled;
- Degree of expected reduction in TMV of the waste due to treatment or recycling and the specification of which reduction(s) are occurring;
- Degree to which the treatment is irreversible;
- Type and quantity of residuals that will remain following treatment; and
- Degree to which treatment reduces the inherent hazards posed by the principal threats at the site.

4.1.2.3 Short-Term Effectiveness

This criterion assesses the short-term impacts of alternatives considering the following:

- Short-term risks that might be posed to the community during implementation of an alternative;
- Potential impacts on workers during remedial action and the effectiveness and reliability of mitigation measures during implementation;
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures during implementation; and
- Time until remedial protection is achieved.

4.1.2.4 Implementability

This criterion assesses the ease or difficulty of implementing the alternatives by considering the following types of factors as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.
- Administrative feasibility, including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions).
- Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and availability of prospective technologies.

4.1.2.5 Cost

The types of costs that will be assessed include the following:

- Capital costs, including both direct and indirect costs;
- Annual O&M costs; and
- Net present value (PV) of capital and O&M costs.

PV cost is the total cost of an alternative over time in terms of today's dollar value. Estimates are expected to be accurate within a range of +50% to -30%. **Appendix C** presents the basis of the cost estimates. The costs developed for each alternative are based on vendor quotes, literature values, professional experience, and engineering judgment. The level of detail utilized in these elements is considered appropriate for choosing between alternatives, but the estimates are not intended for use in detailed budget planning.

Final costs will depend on actual labor and material costs, actual site conditions, market conditions, final project scope, final project schedule, productivity, and other variable factors. As a result, the final costs will vary from the estimates presented in this FS; however, these factors should not affect the relative cost differences between the alternatives.

4.1.3 Modifying Criteria

The final two criteria, the "modifying factors," will be evaluated following receipt of comments on the FS and the Proposed Plan (PP). These criteria are:

- Regulatory Acceptance
- Community Acceptance

4.1.3.1 Regulatory Acceptance

This assessment reflects the State's (or support agency's) apparent preferences among or concerns about alternatives.

4.1.3.2 Community Acceptance

This assessment reflects the community's apparent preferences for or concerns about alternatives. Prior to remedy selection, the community is provided with an opportunity to review the subsequent PP during the public comment period. If requested by the public, a community meeting could be scheduled during the public comment period to provide the opportunity for the public to express concerns and ask questions.

4.2 Individual Analysis of Alternatives for MC-Contaminated Soil

The detailed analyses of the four alternatives developed for NYHQ-008-R-02 MRS 2 are discussed below.

4.2.1 Alternative 1 – No Action

Alternative 1 leaves the MRS 2 in its present condition with no LUCs or remedial actions.

4.2.1.1 Threshold Criteria

This section presents the Threshold Criteria for Alternative 1.

Overall Protection of Human Health and the Environment

Alternative 1 does not provide any means of mitigating MC-contaminated soil at the MRS 2. The MC would not be removed, reduced, or controlled through engineering or LUCs. The No Action alternative is not capable of achieving the RAO.

Compliance with ARARs

The identified ARARs (**Table 2-1**) only apply to alternatives that include active remediation.

4.2.1.2 Balancing Criteria

This section presents the Balancing Criteria for Alternative 1.

Long-Term Effectiveness and Permanence

This alternative would not provide long-term effectiveness or permanence. The RAO would not be met because MC-contaminated soil would remain at the MRS 2, and controls would not be implemented to remove control exposures. Alternative 1 does not provide long-term effectiveness or permanence, and this criterion is not met.

Reduction of TMV through Treatment

No treatment would be provided; therefore, there would be no reduction of TMV, and as a result, Alternative 1 does not meet this criterion. However, should the property owner disturb the areas of MC-contaminated soil, they would risk exposure to MC-contamination.

Short-Term Effectiveness

No actions would be taken so there would be no short-term risks to the community or workers. Therefore, Alternative 1 meets this criterion.

Implementability

No activities are proposed; therefore, this alternative would be technically and administratively implementable. Therefore, this criterion is met.

Cost

There are no costs associated with Alternative 1.

4.2.2 Alternative 2 – Land Use Controls

Alternative 2 involves physical and legal LUCs at the MRS 2. Physical LUCs (educational controls) would include the posting of warning signs along the MRS boundary. Legal LUCs (proprietary controls) would include environmental easements (e.g. deed restrictions). Legal LUCs are not enforceable by the ARNG. NYSDEC may be able to enforce legal LUCs. LUCs for the Camp O'Ryan Rifle Range will not result in conditions that allow for UU/UE at the MRS 2. Therefore, Five-Year Reviews are required under CERCLA Section (§) 121(c) and NCP, CFR §300.430(f)(4)(ii)) to ensure that the remedy continues to be protective of human health and the environment.

4.2.2.1 Threshold Criteria

This section presents the Threshold Criteria for Alternative 2.

Overall Protection of Human Health and the Environment

Alternative 2 reduces potential human exposure to MC-contaminated soil by using physical and legal LUCs, such as warning signs (educational controls) and environmental easements (proprietary controls), seeking to warn users of potential MC-contamination, and restrict land use at the MRS 2. Alternative 2 does not eliminate or reduce MC-contamination, and therefore, this alternative is not considered protective of ecological receptors.

Compliance with ARARs

If required, environmental easements (e.g. deed restrictions) will be implemented in accordance with applicable guidance documents.

4.2.2.2 Balancing Criteria

This section presents the Balancing Criteria for Alternative 2.

Long-Term Effectiveness and Permanence

The soil containing elevated MC would remain at the MRS 2 indefinitely. The effectiveness of this alternative is contingent upon the cooperation and active participation of the existing land owners/users, ARNG, NYARNG, and other government agencies. Maintaining the LUCs in the long term is physically and administratively feasible. Alternative 2 does not eliminate the possibility of lead leaching and migrating into the environment and allows for ecological exposure to MC-contaminated soil.

Reduction of TMV through Treatment

Active treatment would not be implemented, and the soil containing elevated MC would remain at the MRS 2. This alternative does not meet the TMV criterion.

Short-Term Effectiveness

This alternative involves light construction activities; therefore, there would be no short-term impacts to the community, workers, or environment. Approximately 6 months would be required to establish LUCs associated with Alternative 2, and the behavior of site workers and visitors would be expected to change immediately thereafter. Therefore, this alternative meets this criterion.

Implementability

Alternative 2 is considered technically and administratively feasible. Warning signs can be easily implemented at the MRS. Fence posting would create technical challenges due to the terrain and vegetation at the MRS and is therefore more difficult to implement. There are minimal technical difficulties associated with this alternative, and the materials and services needed to implement this alternative are available. Alternative 2 has only light construction activities to implement.

Legal LUCs are not enforceable by the ARNG; however, they may be enforceable by the NYSDEC. Implementation of any LUC is conditionally implementable; the private landowners would have to voluntarily participate in any LUC implementation and cooperate with NYSDEC to establish and enforce the LUCs.

Cost

The cost estimates include the total cost for implementation of Physical and Legal LUCs, and CERCLA Five Year Reviews. Detailed backup for the cost estimates is presented in **Appendix C**. The estimated cost for Alternative 2 is:

- Capital: $42,698
- O&M/Periodic: $110,260
- Total: **$152,958**
- Total PV: $128,356

4.2.3 Alternative 3 – Target Berm-Ponded DU Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with Additional Land Use Controls

Alternative 3 involves excavation at the Target Berm – Ponded DU at the MRS 2, which is the only DU that poses unacceptable risk to human health due to MC in soil. Excavation will stop at the Target Berm – Hillside DU due to health and safety concerns related to heavy vegetation and steep slopes. Soil will be sampled and characterized to determine the waste classification, prior to excavation. Soil with lead concentrations above landfill disposal criteria will be stabilized by intermixing Portland cement and then re-characterized. If contaminant concentrations remain above landfill disposal criteria, additional treatment, sampling, and analysis will be completed. If, after multiple soil stabilization efforts, areas of soil remain above disposal criteria, then soil exceeding criteria from these areas will be disposed of at an approved RCRA Subtitle C disposal facility. This alternative is intended to achieve UU/UE within the remediated DU.

Lead concentrations in confirmation samples will be measured using XRF in soil with sufficiently low moisture content. Where moisture is too high, samples will not be evaluated in the field using XRF. Instead, discrete samples will be taken and submitted for laboratory analysis to determine if concentrations are below 63 mg/kg. If sample results by XRF or laboratory analysis indicate lead concentrations are above the delineation value of 63 mg/kg, an additional 0.5 feet of soil will be removed, and the area will be re-evaluated by XRF or discrete sampling until lead concentrations are below 63 mg/kg. Soil excavation and subsequent sampling and analysis will proceed until the results indicate the contaminant concentrations are below their established screening criteria. The entire MRS 2 is privately owned, and approval from the property owner will be needed to implement of this remedy.

Alternative 3 also involves physical and legal LUCs at the MRS 2. Physical LUCs (educational controls) would include the posting of warning signs along the MRS boundary. Legal LUCs (proprietary controls) would include environmental easements (e.g. deed restrictions). Legal LUCs are not enforceable by the ARNG. NYSDEC may be able to enforce legal LUCs. LUCs for the Camp O'Ryan Rifle Range in areas not remediated and above the cleanup goal will not result in conditions that allow for UU/UE at the MRS 2. Implementation of any LUC is conditionally implementable; the private landowners would have to voluntarily participate in any LUC implementation and cooperate with NYSDEC to establish and enforce the LUCs

4.2.3.1 Threshold Criteria

This section presents the Threshold Criteria for Alternative 3.

Overall Protection of Human Health and the Environment

Alternative 3 reduces or eliminates potential human exposure to MC-contaminated soil by direct removal and disposal. The removal of MC-contaminated soil effectively eliminates the exposure hazard to the potential human and ecological receptor in the Target Berm – Ponded DU area. Due to the excavation area stopping at the edge of the Target Berm – Hillside DU, potential human and ecological exposure to contaminated soil remains, though the area will be controlled by LUCs and was not determined to pose unacceptable risk to human health during the HHRA.

Alternative 3 reduces potential human exposure to MC-contaminated soil in the areas not excavated by using legal LUCs (proprietary controls), such as environmental easements (e.g. deed

restrictions), and physical LUCs (educational controls; e.g. warning signs) seeking to restrict land use at the MRS 2. Alternative 3 does not eliminate or reduce MC-contamination in these areas; therefore, this alternative is not considered protective of ecological receptors in areas outside of the Target Berm – Ponded DU.

Compliance with ARARs

Planning would be required to comply with chemical-specific, location-specific, and action-specific ARARs. ARARs identified included regulations on the transportation, storage, treatment, and disposal of lead contaminated soil. Soil will be excavated in accordance with applicable guidance documents.

Environmental Easements for other areas of the MRS 2 not undergoing stabilization and excavation will be implemented in accordance with applicable guidance documents.

4.2.3.2 Balancing Criteria

This section presents the Balancing Criteria for Alternative 3.

Long-Term Effectiveness and Permanence

Alternative 3 provides a high level of long-term effectiveness and permanence for the Target Berm – Ponded DU through the implementation and completion of soil treatment, excavation, and disposal, and it would immediately reduce the risks to acceptable levels for human receptors in this area at the MRS 2, though the risk for exposure to contaminants in soil at the other DUs would persist.

The soil containing elevated MC in other areas of the MRS 2 would remain indefinitely. The effectiveness of this alternative is contingent upon the cooperation and active participation of the existing landowners/users, ARNG, NYARNG, and other government agencies. Maintaining the LUCs in the long term is physically and administratively feasible. Alternative 3 does not eliminate the possibility of lead leaching and migrating into the environment and allows for ecological exposure to MC-contaminated soil.

Reduction of TMV through Treatment

Contaminated soil excavation and off-site disposal would immediately reduce the volume of contaminated soil at the site. Alternative 3 provides effective control and elimination in mobility and toxicity at the Target Berm – Ponded DU by stabilizing MC in the soil and removing the source of MC-contaminated soil from the MRS 2. Alternative 3 would satisfy the statutory preference for treatment as a principal element of the remedy and would reduce the mobility of leachable lead.

For all other areas, active treatment would not be implemented, and the soil containing elevated MC would remain at the MRS 2. This alternative does not meet the TMV criterion in the areas not excavated.

Short-Term Effectiveness

Soil excavation and off-site disposal could potentially have additive short-term impacts at the MRS 2. Potential short-term impacts may include increased traffic on public roads used by the haul trucks to transport excavated soil and backfill; however, these potential impacts are expected to be

minimal and would not require extensive planning. MC-contaminated soil poses a low to moderate risk to the site workers during excavation activities. Appropriately trained personnel, safety procedures (i.e., air monitoring, dust control, erosion and slope stability control), protective equipment, and approved planning documents would be used to reduce impacts on the workers, environment, and community. Time to complete this alternative will be dependent on characterization and confirmation sampling. The alternative duration is estimated to take approximately 5 days, and the target excavation area is 0.42 acres, to a depth of 1 foot.

Approximately 6 months would be required to establish LUCs associated with Alternative 3, and the behavior of site workers and visitors would be expected to change immediately thereafter; therefore, this alternative meets this criterion.

Implementability

Alternative 3 remedial treatment is considered relatively easy to implement technically and administratively, as the excavation area is relatively small and shallow. Some vegetation clearing would be required to create access to the DUs for treatment and excavation. The equipment needed to complete this alternative are readily available. There are no technical difficulties associated with additional legal LUCs, and the materials and services needed to implement this alternative are available. The implementation of soil stabilization and landfill disposal is dependent on regulator acceptance.

The MRS 2 is privately owned; therefore, implementation of Alternative 3 is conditionally implementable. Legal and physical LUCs are not enforceable by the ARNG; however, they may be enforceable by the NYSDEC. The private landowners would have to voluntarily participate in any LUC implementation and cooperate with NYSDEC to establish and enforce the LUCs across the entire MRS 2.

Cost

The cost estimates include the total cost for implementation of the MC-contaminated soil stabilization, excavation and disposal. Detailed backup for the cost estimates is presented in **Appendix C**. The estimated cost for Alternative 3 is as follows:

- Capital: $413,082
- O&M/Periodic: $110,260
- Total: **$523,342**
- Total PV: $498,736

These costs assume soil stabilization would achieve non-hazardous disposal criteria. If soil stabilization is unsuccessful, costs would increase to accommodate hazardous waste transportation and disposal, vehicle decontamination, and IDW handling.

4.2.4 Alternative 4 – MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste

Alternative 4 involves excavation of all DUs in the MRS 2 (100-Yard Firing Berm DU, Target Area DU, Target Berm – Hillside DU, Target Berm – Ponded DU, and Wet Meadow DU). Soil will be sampled and characterized to determine the waste classification, prior to excavation. Soil

with lead concentrations above landfill disposal criteria will be stabilized by intermixing Portland cement and then re-characterized. If contaminant concentrations remain above landfill disposal criteria, additional treatment, sampling, and analysis will be completed. If, after multiple soil stabilization efforts, areas of soil remain above disposal criteria, then the soil exceeding criteria from these areas will be disposed of at an approved RCRA Subtitle C disposal facility. This alternative is intended to achieve UU/UE.

Lead concentrations in confirmation samples will be measured using XRF in soil with sufficiently low moisture content. Where moisture is too high, samples will not be evaluated in the field using XRF. Instead, discrete samples will be taken and submitted for laboratory analysis to determine if concentrations are below 63 mg/kg. If sample results by XRF or laboratory analysis indicate lead concentrations are above the delineation value of 63 mg/kg, an additional 0.5 feet of soil will be removed, and the area will be re-evaluated by XRF or discrete sampling until lead concentrations are below 63 mg/kg. Soil excavation and subsequent sampling and analysis will proceed until the results indicate the contaminant concentrations are below their established screening criteria. The entire MRS 2 is privately owned. Approval from the property owners will be needed to implement of this remedy.

There are significant health and safety concerns involved with Alternative 4 due to dense vegetation throughout the MRS 2 as well as several steep slopes in some of the DUs.

4.2.4.1 Threshold Criteria

This section presents the Threshold Criteria for Alternative 4.

Overall Protection of Human Health and the Environment

Alternative 4 reduces or eliminates potential human exposure to MC-contaminated soil by direct removal and disposal. The removal of MC-contaminated soil effectively eliminates the exposure hazard to the potential human and ecological receptor at the MRS 2. Alternative 4 would require restoration to mitigate potential damage to the natural environment after remediation.

Compliance with ARARs

Planning would be required to comply with chemical-specific, location-specific, and action-specific ARARs. ARARs identified included regulations on the transportation, storage, treatment, and disposal of lead contaminated soil. Soil will be excavated in accordance with applicable guidance documents.

4.2.4.2 Balancing Criteria

This section presents the Balancing Criteria for Alternative 4.

Long-Term Effectiveness and Permanence

Alternative 4 provides a high level of long-term effectiveness and permanence through the implementation and completion of soil treatment, excavation and disposal, and would immediately reduce the risks to acceptable levels for human receptors in this area at the MRS 2.

Reduction of TMV through Treatment

Contaminated soil excavation and off-site disposal would immediately reduce the volume of contaminated soil at the site. Alternative 4 provides effective control and elimination in mobility and toxicity by stabilizing MC in the soil and removing the source of MC-contaminated soil from the MRS 2 and can potentially result in UU/UE. Alternative 4 would satisfy the statutory preference for treatment as a principal element of the remedy and would reduce the mobility of leachable lead.

Short-Term Effectiveness

Soil excavation and off-site disposal could potentially have additive short-term impacts at the MRS 2. Potential short-term impacts may include increased traffic on public roads used by the haul trucks to transport excavated soil and backfill; however, these potential impacts are expected to be minimal and would not require extensive planning. MC-contaminated soil poses a low to moderate risk to the site workers during excavation activities. Appropriately trained personnel, safety procedures (i.e., air monitoring, dust control, erosion and slop stability control), protective equipment, and approved planning documents would be used to reduce impacts on the workers, environment, and community. Time to complete this alternative will be dependent on characterization and confirmation sampling. The alternative duration is estimated to take approximately 570 days, the target excavation area is 20.54 acres to a depth of 2 feet for soil at most DUs, and over 3 acres to a depth of 1 foot for soil at the Target Berm – Ponded DU.

Implementability

Alternative 4 is considered difficult to implement technically and administratively due to the large area of excavation, the dense vegetation throughout the MRS 2, the steep slopes on the Target Berm – Hillside DU, and the length of time required to complete this alternative. Successful implementation of this alternative is contingent upon the cooperation and active participation of the private landowners, ARNG/NYARNG, and other government during remedy implementation.

Cost

The cost estimates include the total cost for implementation of the MC-contaminated soil stabilization, excavation and disposal. Detailed backup for the cost estimates is presented in **Appendix C**. The estimated cost for Alternative 4 is as follows:

- Capital: $26,139,900
- O&M/Periodic: $0
- Total: **$26,139,900**
- Total PV: $26,139,900

These costs assume soil stabilization would achieve non-hazardous disposal criteria. If soil stabilization is unsuccessful, costs would increase to accommodate hazardous waste transportation and disposal, vehicle decontamination, and IDW handling.

4.3 Comparative Analysis of Alternatives for MC-Contaminated Soil

The purpose of the comparative analysis is to evaluate the relative performance of all alternatives

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TABLE 4-1
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
FOR MC-CONTAMINATED SOIL (NYHQ-008-R-02)

Screening Criteria		Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Target Berm - Ponded Area DU: Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls	Alternative 4 All DUs: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste
Threshold	Overall Protection of Human Health and the Environment	○	○	◘	●
	Compliance with ARARs	○	○	●	●
Balancing	Long-Term Effectiveness	○	◘	◘	●
	Reduction of TMV Through Treatment	○	○	◘	●
	Short-Term Effectiveness	●	●	◘	◘
	Implementability	●	◘	◘	○
	Cost (x1,000)	$0	$153	$523	$26,140
Modifying (a)	State Acceptance	TBD	TBD	TBD	TBD
	Community Acceptance	TBD	TBD	TBD	TBD

Notes:

● Favorable ('YES' for threshold criteria)

◘ Moderately Favorable

○ Not Favorable ('NO' for threshold criteria)

ARAR = Applicable or Relevant and Appropriate Requirement
LUC = Land Use Control
MC = munitions constituents
TBD = To Be Determined
TMV = toxicity, mobility, or volume

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4.3.1.1 Overall Protection of Human Health and the Environment

Alternatives 1 and 2 do not provide protection of both human health and the environment. Alternatives 3 and 4 are protective of human health and the environment by reducing or eliminating the MC-contaminated soil from the MRS 2. Alternative 4 could achieve UU/UE at the MRS 2.

4.3.1.2 Compliance with ARARs

There are no ARARs associated with Alternative 1. The NYSDECs Soil Cleanup Objective is 63 mg/kg. The cleanup objective is based on complete exposure pathways and is considered by

NYSDEC to be protective for human receptors over a lifetime. MC-contaminated soil will remain in-situ for Alternatives 1 and 2. Partial or complete removal of MC-contaminated soil under Alternatives 3 and 4 would be performed to comply with all ARARs.

4.3.2 Balancing Criteria

A comparative analysis of these five Balancing Criteria is presented below.

4.3.2.1 Long-Term Effectiveness and Permanence

Alternatives 3 and 4 would provide the best long-term effectiveness and permanence. Alternatives 1 and 2 would not be effective or permanent in the long-term. The long-term effectiveness of Alternative 2 is contingent upon the cooperation and active participation of the existing landowners/users, NYSDEC, and other government agencies to warn and protect the public from MC hazards. Maintaining the LUCs in the long-term is physically and administratively feasible. Alternative 2 does not eliminate the possibility of lead leaching and migrating into the environment or mitigate the risk to potential future residents from contacting/handling contaminated soil. Alternatives 3 and 4 would provide long-term effectiveness in reducing or eliminating the possibility of lead leaching and migrating into the environment from the associated excavation areas. Alternative 4 would be highly effective and permanent as all MC-impacted soil would be removed. Alternative 4 could allow for UU/UE of the MRS 2.

4.3.2.2 Reduction of TMV through Treatment

Alternatives 1 and 2 would not reduce the TMV at the MRS 2. Alternatives 3 and 4 would satisfy the statutory preference for treatment as a principal element of the remedy and would reduce the mobility of leachable lead. Alternative 3 would be moderately effective in meeting the removal action objectives and would reduce the toxicity of the contaminated soil at Target Berm – Ponded Area DU (the only DU identified with unacceptable risk to human health) because the material will be stabilized, removed, and disposed off-site in a RCRA Subtitle D landfill. Alternative 4 would be very effective in meeting the removal action objectives and would reduce the toxicity of the contaminated soil throughout the MRS 2 since all contaminated the material would be stabilized and disposed off-site in a RCRA Subtitle D landfill.

4.3.2.3 Short-Term Effectiveness

Alternative 2 would be the most effective in the short term, whereas Alternatives 3 and 4 would be less effective in the short term due to required site disturbance and handling of the contaminated soil. Because there are minimal to no construction or operation activities associated with Alternatives 1 or 2, there would be no additional risks to the community, site workers, or the environment. Approximately 6 months would be required to establish LUCs associated with Alternative 2, and the behavior of site workers and visitors would be expected to change immediately thereafter.

Exposure to contaminants during implementation of the in-situ soil treatment portion of Alternatives 3 and 4 would be minimal because the material handling would be conducted using appropriate equipment and following proper health and safety procedures. Alternatives 3 and 4 consist of transporting the soil off-site and creates additional potential risks that must be evaluated.

4.3.2.4 Implementability

Alternative 1 would be implementable as it requires no action. Alternative 2 can be implemented by NYSDEC with the cooperation of the landowners; there are minimal technical difficulties associated with this alternative, and the materials and services needed to implement this alternative are available. Alternative 3 is considered relatively easy to implement, technically and administratively, as the excavation area is relatively small and shallow. Some vegetation clearing would be required to create access to the DUs for treatment and excavation. Alternative 4 is considered difficult to implement technically, administratively, and with heightened safety concerns due to the large area of excavation, the dense vegetation throughout the MRS 2, the steep slopes across the Target Berm – Hillside DU, and the length of time required to complete this alternative. Alternatives 3 and 4 require approval and acceptance of hazardous excavated material by a disposal facility. This factor could also impact the implementability of Alternatives 3 and 4.

Successful implementation of Alternatives 2, 3 and 4, is contingent upon the cooperation and active participation of the private landowners, NYARNG, and other government agencies to protect the public from MC hazards in the short term during remedy implementation and in the long-term where LUCs are applied.

4.3.2.5 Cost

The net PV costs for each remedial alternative are presented in **Table 4-2**. As shown in this table, Alternative 1 incurs no cost to implement, while Alternative 4 would be the costliest to implement. The detailed cost estimate is presented in **Appendix C**.

4.3.3 State Acceptance

State acceptance will be assessed based on regulatory review of this FS and forthcoming PP. Modifying criteria (State and Community Acceptance) are considered in the remedy selection process.

4.3.4 Community Acceptance

Community acceptance cannot be assessed until public comments on the PP are received. Modifying criteria (State and Community Acceptance) are considered in the remedy selection process.

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TABLE 4-2
COST COMPARISON OF REMEDIAL ACTION ALTERNATIVES FOR MC-CONTAMINATED SOIL
(NYHQ-008-R-02)

Cost	Alternative 1 No Action	Alternative 2 LUCs	Alternative 3 Target Berm - Ponded Area DU Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls	Alternative 4 All DUs: MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste
Capital	$0	$42,698	$413,082	$26,139,894
Total O&M / Periodic (6 Events)	$0	$110,260	$110,260	$0
Total	**$0**	**$152,958**	**$523,342**	**$26,139,894**
Total Present Value	$0	$128,356	$498,736	$26,139,894

Notes:
LUCs = Land Use Controls
MC = munitions constituents
O&M = operations and maintenance

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5 References

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Appendix A: XRF Data

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Table 5-1 Summary of Discrete XRF Lead Results in Surface Soil - 100 yd Firing Berm DU

Sample ID	Moisture (%)	Average Lead Result (ppm)	Max Error (+/-)*	Notes
COR01X01	15	17	3	
COR01X02	16	19	3	
COR01X03	15	15	2	
COR01X04	16	24	3	
COR01X05	15	35	3	
COR01X06	19	19	3	
COR01X07	18	18	2	
COR01X08	18	17	2	
COR01X09	17	25	3	
COR01X10	17	26	3	
COR01X11	15	20	2	
COR01X12	15	24	3	
COR01X13	15	19	3	
COR01X14	15	33	3	
COR01X15	15	17	3	
COR01X16	15	18	2	
COR01X17	16	25	3	
COR01X18	16	21	2	
COR01X19	18	29	3	
COR01X20	15	21	4	
COR01X21	15	15	2	
COR01X22	17	21	2	
COR01X23	17	20	3	
COR01X24	17	60	3	
COR01X25	17	41	3	
COR01X26	18	21	2	
COR01X27	18	30	3	
COR01X28	18	33	3	
COR01X29	18	35	3	
COR01X30	19	35	3	
COR01X31	51	18	2	
COR01X32	17	18	3	
COR01X33	15	58	3	
COR01X34	19	357	7	
COR01X35	16	40	3	
COR01X36	16	37	3	
COR01X37	19	62	4	
COR01X38	18	215	7	
COR01X39	17	293	7	
COR01X40	18	91	4	
COR01X41	19	17	3	
COR01X42	16	28	3	
COR01X43	19	46	3	
COR01X44	15	81	4	
COR01X45	15	20	3	
COR01X46	18	17	2	
COR01X47	19	19	3	
COR01X48	17	37	3	
COR01X49	15	19	3	
COR01X50	15	24	3	
COR01X51	18	21	3	
COR01X52	18	27	3	
COR01X53	18	38	3	
COR01X54	19	24	3	
COR01X55	19	13	11	

Notes
* = Error: 2-sigma, 95% confidence
Sample meets or exceeds residential soil RBSL for lead
ppm = parts per million

Table 5-2. Summary of Discrete XRF Lead Results in Surface Soil - Target Area DU

Sample ID	Moisture (%)	Average Lead Result (ppm)	Max Error (+/-)*	Notes
COR02X01	18	18	2	
COR02X02	15	20	3	
COR02X03	15	98	4	
COR02X04	15	93	4	
COR02X05	16	78	4	
COR02X06	16	64	3	
COR02X07	15	78	3	
COR02X08	15	82	3	
COR02X09	15	190	3	
COR02X10	16	250	6	
COR02X11	16	171	6	
COR02X12	17	304	6	
COR02X13	17	243	6	
COR02X14	17	373	7	
COR02X15	17	305	7	1 bullet observed
COR02X16	17	16	2	
COR02X17	18	28	3	
COR02X18	16	155	5	
COR02X19	18	103	4	
COR02X20	17	42	3	
COR02X21	15	62	3	
COR02X22	15	42	3	
COR02X23	15	33	3	
COR02X24	12	46	3	2 bullets observed
COR02X25	17	86	4	
COR02X26	15	81	4	
COR02X27	12	30	3	
COR02X28	18	113	3	
COR02X29	15	215	6	
COR02X30	18	112	5	
COR02X31	15	20	3	
COR02X32	12	39	3	
COR02X33	12	28	3	
COR02X34	12	28	3	
COR02X35	12	20	3	
COR02X36	12	14	7	
COR02X37	16	32	3	
COR02X38	15	20	3	
COR02X39	19	38	3	
COR02X40	19	62	4	
COR02X41	17	32	3	
COR02X42	16	35	3	

Notes
* = Error: 2-sigma, 95% confidence
Sample meets or exceeds residential soil RBSL for lead
ppm = parts per million

Table 5-3. Summary of Discrete XRF Lead Results in Surface Soil - Target Area Hillside DU

Sample ID	Moisture (%)	Average Lead Result (ppm)	Max Error (+/-)*	Notes
COR03X01(a)				
COR03X01(b)	13	834	14	
COR03X02				
COR03X03				
COR03X04				
COR03X05				
COR03X06	17	997	12	Sampled in First Mobilization 2019
COR03X07	17	946	12	Sampled in First Mobilization 2019
COR03X08	17	1,001	14	Sampled in First Mobilization 2019
COR03X09	18	985	13	Sampled in First Mobilization 2019
COR03X10(a)	17	969	14	Sampled in First Mobilization 2019
COR03X10(b)	13	50	4	
COR03X11(a)	16	2,708	32	Sampled in First Mobilization 2019
COR03X11(b)	13	435	10	
COR03X12	18	876	12	Sampled in First Mobilization 2019
COR03X13	15	6,051	60	Sampled in First Mobilization 2019
COR03X14	15	4,193	64	Sampled in First Mobilization 2019
COR03X15	18	862	12	Sampled in First Mobilization 2019
COR03X16	18	128	4	Sampled in First Mobilization 2019
COR03X17	18	376	8	Sampled in First Mobilization 2019
COR03X18	18	1,585	20	Sampled in First Mobilization 2019
COR03X19	15	5,286	100	Sampled in First Mobilization 2019
COR03X20(a)	15	4,979	69	Sampled in First Mobilization 2019
COR03X20(b)	13	65	5	
COR03X21(a)	15	4,197	45	Sampled in First Mobilization 2019
COR03X21(b)	13	487	5	
COR03X22	15	5,321	56	Sampled in First Mobilization 2019
COR03X23	15	1,025	14	Sampled in First Mobilization 2019
COR03X24	15	2,066		Sampled in First Mobilization 2019
COR03X25	16	2,020	23	Sampled in First Mobilization 2019
COR03X26	17	589	9	Sampled in First Mobilization 2019
COR03X27	16	514	9	Sampled in First Mobilization 2019
COR03X28	16	307	6	Sampled in First Mobilization 2019
COR03X29	17	676	12	Sampled in First Mobilization 2019
COR03X30(a)	16	2,041	22	Sampled in First Mobilization 2019
COR03X30(b)	13	111	5	
COR03X31	12	189	6	
COR03X32				
COR03X33				
COR03X34				
COR03X35				
COR03X36				
COR03X37				
COR03X38				
COR03X39				
COR03X40	12	158	6	
COR03X41	12	144	6	
COR03X42				
COR03X43				
COR03X44				
COR03X45	10	75	5	
COR03X46	10	306	8	
COR03X47	10	151	6	
COR03X48	10	399	9	
COR03X49	10	56	4	
COR03X50	11	49	3	
COR03X51	11	82	4	
COR03X52	11	116	5	
COR03X53	11	161	5	
COR03X54	11	30	3	
COR03X55	10	25	4	
COR03X56	10	24	3	
COR03X57	10	53	4	
COR03X58	10	27	3	
COR03X59	10	37	3	
COR03X60	10	41	4	
COR03X61	10	30	3	
COR03X62				Unable to Sample- Dangerous Terrain
COR03X63	10	97	6	
COR03X64	10	30	4	
COR03X65	10	24	3	
COR03X66	10	33	4	
COR03X67	12	72	4	
COR03X68	12	34	3	
COR03X69	12	179	5	
COR03X70	12	344	8	
COR03X71	12	89	4	
COR03X72	12	141	6	
COR03X73	12	62	4	
COR03X74	12	115	5	
COR03X75	12	102	7	
COR03X76	12	28	4	
COR03X77	12	26	3	
COR03X78	12	41	4	
COR03X79	12	38	5	
COR03X80	12	87	5	
COR03X81	12	47	4	
COR03X82	12	60	4	
COR03X83	12	ND	22	
COR03X84	12	ND	16	
COR03X85	12	ND	13	
COR03X86	12	31	3	

Notes

* = Error: 2-sigma, 95% confidence

Sample meets or exceeds residential soil RBSL for lead

ppm = parts per million

Area unable to be sampled due to dangerous terrain/health and safety concerns

data not recorded

(a):Belonging to the original DU of the first field mobilization effort in 2019

(b):Belonging to the updated larger DU of the second field mobilization effort in 2020

Appendix B: Munitions Response Site Prioritization Protocol

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Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Camp O'Ryan MRS 2 Rifle Range, AEDB-R # NYHQ-008-R-02

Component: Army National Guard Directorate

Installation/Property Name: JFHQ-New York

Location (City, County, State): Wethersfield, Wyoming County, New York

Site Name/Project Name (Project No.): Camp O'Ryan MRS 2 Rifle Range RI, WW9133L-14-D-0001 DO#0006

Date Information Entered/Updated: 26 May 2021

Point of Contact (Name/Phone): Mark Leeper (ARNG), (703) 607-7986

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 Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp O'Ryan MRS 2 Rifle Range is a former small arms range of approximately 42.2 acres (formerly 17.5 acres) located in Wethersfield, Wyoming County, New York. The area outside of the Camp O'Ryan MRS 2, within the former Camp O'Ryan, was used by NYARNG for both company and squad level training including maneuver practicing and camping. The MRS was operational between 1949 and 1974 and again from 1989 through 1994. The firing direction at the Camp O'Ryan MRS 2 was to the southeast. The MRS consists of a former 200-yard range with 50 targets and firing berms at distances of 100 and 200 yards, and a hillside impact berm. The MRS also includes a concrete retaining wall with target structures still intact. Small arms, including .30 caliber M1, were approved for use Camp O'Ryan MRS 2; additional potential munitions used include .22, .38, and .45 caliber, 5.56mm and 7.62mm. Additionally, two MPPEH devices, possibly C5-Tear Gas grenades were found at the base of the hillside impact berm. There is no documented history of sustained tear gas grenade use for training or any other activities at the MRS.

Description of Pathways for Human and Ecological Receptors:

MC deposited in surface soil as a result of firing activities at the MRS has limited potential to migrate from source areas (i.e., 100-yard Firing Berm, Target Area and Target Berm Hillside) to beyond the Camp O'Ryan MRS 2 Rifle Range MRS boundary. Surface water bodies present within the MRS during the field sampling events were too shallow to be sampled, so sediment from the areas was sampled and analyzed to evaluate potential historic migration of MC metals.

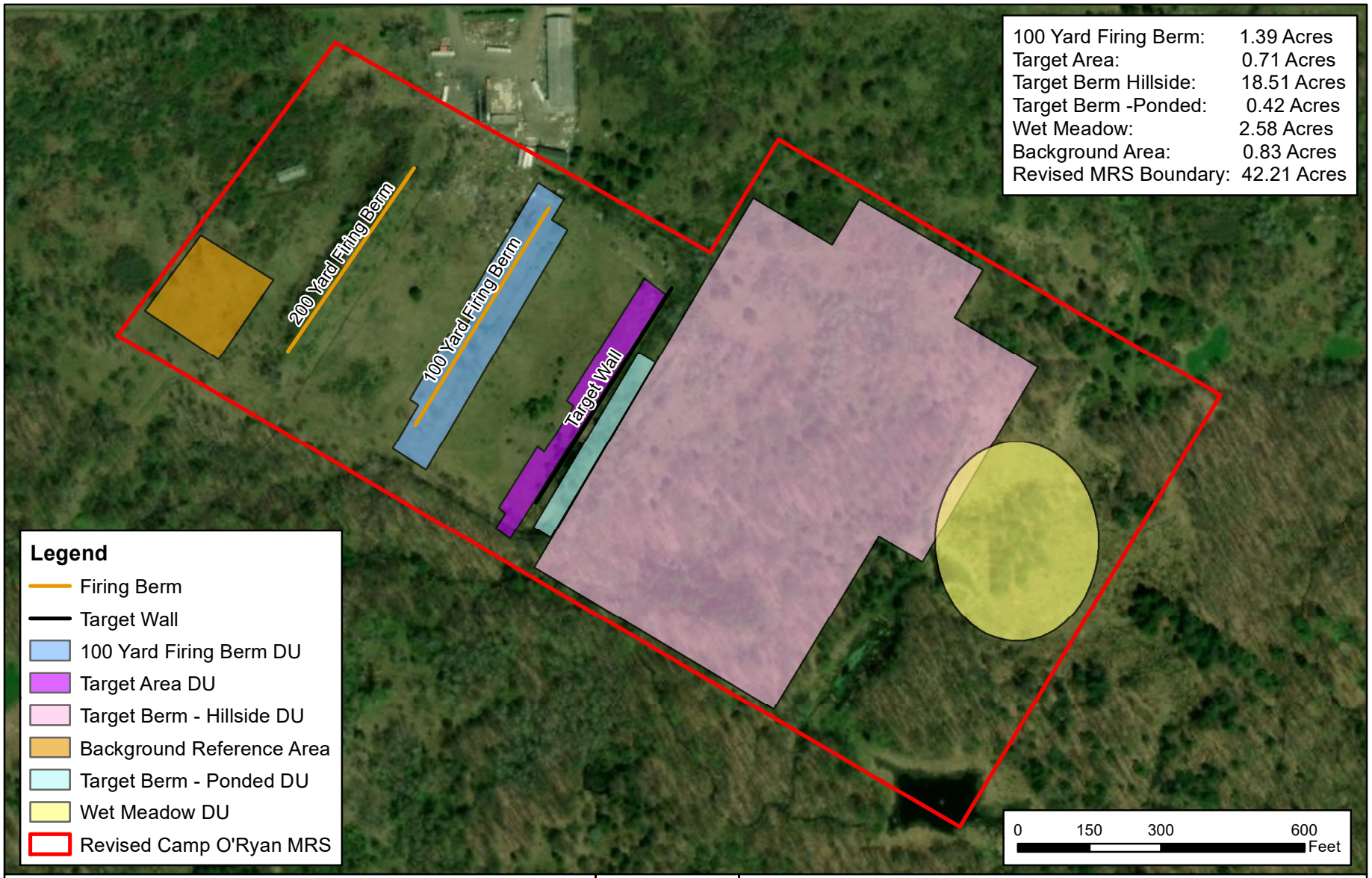
MC metals have a strong affinity to sorb to soil particles, particularly soils that are rich in organic matter or high in pH, and usually only migrate via physical transport pathways. Because of these chemical properties, they typically do not leach to groundwater except where shallow groundwater exists less than 5 feet below ground surface (bgs). Two domestic water wells exist approximately 0.25 miles from the MRS. Water depth in well number WO 430 to the southeast is 15 feet bgs (Parsons, 2012). Water depth in well number WO 868 north of the MRS is 50 feet bgs (NYSDEC, 2018). The RI conservatively uses a groundwater depth of 15 feet bgs for evaluation. Groundwater is not anticipated to be affected by munitions activities; however, groundwater depth is unclear at the MRS.

The primary exposure pathways between MC and receptors are expected to be limited to direct exposure to potentially contaminated soil at source areas. RI activities examined if soil with elevated concentrations of MC has migrated from these source areas, including an assessment of sediment in two DUs with shallow standing water.

Description of Receptors (Human and Ecological):

The MRS comprises a privately-owned parcel consisting mostly of forest land. The central portion of the MRS is densely vegetated. While the MRS sits on largely undeveloped land which contains mostly gently rolling, forested terrain comprising deciduous trees with patches of open grass fields, the USFWS National Wetland Inventory lists one potential wetland area within the MRS (USFWS, 2020). This wetland area exists east of the Target Berm Hillside DU. State and federal resources were queried to identify threatened and endangered (T&E) species within Wyoming County. The species listed include plants, invertebrates, amphibians, reptiles, birds, and mammals. Although no specific critical habitat was identified within or near the MRS, USFWS (2020c) indicated that endangered species (northern long-eared bat [Myotis septentrionalis]) and migratory birds (black-capped chickadee [Poecile atricapillus practicus] and bobolink [Dolichonyx oryzivorous]) have large ranges that may overlap the MRS. New York State also lists numerous threatened and endangered species with known ranges or locations within the vicinity of the MRS, including species of mollusks, insects, fish, amphibians, reptiles, birds, and mammals (NYSDEC, 2015). Preferential habitat quality exists at the MRS and its surrounding areas (e.g., fluvial), but ecological receptors are anticipated to be minimally exposed to MC within the MRS or in surrounding areas.

A small portion of the MRS is located on the subdivided parcel owned by King Brothers Masonry Contracting and is used primarily for debris storage; the remainder of the revised MRS is part of a larger, undeveloped and forested swath of land. Given these conditions, there is potential for the following receptors: outdoor worker, construction worker, site visitor/recreational user (child/adult), and hypothetical future resident (child/adult).



CLIENT	Army National Guard			
PROJECT	RI through DD for Camp O'Ryan, NY MRS			
REVISION NO	0	GIS BY	GC	11/20/2020
SCALE	1:3,600	CHK BY	JW	11/20/2020
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	AS	11/20/2020

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Camp O'Ryan Revised MRS 2 Boundary

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure G-1

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the scores that correspond with **all** the munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms ammunition, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	• UXO that are considered most 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). • 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)	• UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive."
	• 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)	• UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades).
	• DMM containing a pyrotechnic filler other than white phosphorus (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)	• 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	• UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor).
	• 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	• DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). • DMM that are 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)	• DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that:
	  • Have not been damaged by burning or detonation
	  • Are not deteriorated to the point of instability.
		10

Practice	• UXO that are practice munitions that are not associated with a sensitive fuze.
	• 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	• UXO or DMM containing a riot control agent filler (e.g., tear gas).	**3**
Small arms	• 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).	**3**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

The MRS was used for small arms training between 1949 and 1974 and from 1989 through 1994; Small Arms (.22, .30, .38, and .45 caliber, and 5.56mm and 7.62mm) ammunition were used (Parsons, 2012). Based on the Army Policy Memorandum dated 20 February 2009, small arms do not present a unique explosive hazard. Two MPPEH devices identified as potential C5-Tear Gas grenades were found during the RI. There is no history of sustained training with tear gas grenades at the MRS and no other items were discovered during the RI. As the only documented munitions-related activities at the MRS were small arms training and the CHE received an alternative rating of no known or suspected CWM hazard, the MRS does not present an explosive hazard. The alternate score of No Known or Suspected Explosive Hazard has been assigned to the EHE module (Table

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the scores that correspond with **all** the sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range, practice munitions, small arms range, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	• The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include impact or target areas and associated buffer and safety zones.	10
Former munitions treatment (i.e., OB/OD) unit	• The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	• The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	• The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	• The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	• The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	• The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	• The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	• The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	• The MRS is a former military range where only small arms ammunition was used. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present to place an MRS into this category.)	**1**
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

The MRS is a former small arms range that was used between 1949 and 1974 and again from 1989 through 1994; Small Arms (.22, .30, .38, and .45 caliber, and 5.56mm and 7.62mm) ammunition were used (Parsons, 2012). As a result of delineating MC in soil the MRS boundary was revised to include an area that was part of a larger training and maneuvering area. Two MPPEH devices identified by Eerie County Bomb Squad as possibly as C5-Tear Gas grenades were found at the Target Berm Hillside DU. There is no documented use of historical training with tear gas grenades at the MRS.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	• Physical evidence indicates that there are UXO or DMM on the surface of the MRS. • Historical evidence (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS, and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	• There is physical evidence (e.g., munitions debris such as fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	**10**
Suspected (historical evidence)	• There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	• There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	• The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present at the MRS to place an MRS into this category.)	**1**
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
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	**10**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

During the RI, two MPPEH items were discovered on the surface at the Target Berm Hillside DU. The Eerie County Bomb Squad identified the items as possible C5-Tear Gas grenades. Bullets and bullet fragments were also observed on the ground surface at the Target Area DU. Analytical results from the RI showed elevated levels of small arms metals MC in the 100-yard Firing Berm, Target Area, Target Berm Hillside, Target Berm Ponded and Wetland Area DUs soil and sediment compared to background and human health screening criteria (RI report, Section 5.4).

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Circle the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	• There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	**10**
Barrier to MRS access is incomplete	• There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	• There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	• There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**10**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

Access to the MRS is not restricted (RI report, Section 2.3).

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	• The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies. • The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	**5**
Scheduled for transfer from DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3
DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

The MRS is privately-owned (RI report, Section 2.2).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Score
> 500 persons per square mile	• There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5
100–500 persons per square mile	• There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3
< 100 persons per square mile	• There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	**1**
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**1**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

The MRS is located in the City of Wethersfield, which is part of Wyoming County, New York.
The population density for the Town of Windham is 71 people per square mile of land area. (AECOM [2019] WP, Table 2).

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	• There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	**5**
16 to 25 inhabited structures	• There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	• There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	• There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	• There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	• There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

Numerous residential properties and farms are located within a 2-mile radius of the MRS, and King Brothers Masonry Contractors are the commercial property owners of the land the land within the MRS. The former mess hall structure used by the MRS is now the commercial building for the King Brothers business. (AECOM [2019] WP, Chapter 1.2, and Google Earth, 2020).

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the scores that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structure* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	**5**
Parks and recreational areas	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	• There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The current land use includes both undeveloped and commercial land uses. Numerous residential and commercial properties / farms surround the MRS, and access to the MRS land itself is owned and occupied by King Brothers Masonry Contractors. (RI Report, Section 2.1).

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	• There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	• There are ecological resources present on the MRS.	**3**
Cultural resources present	• There are cultural resources present on the MRS.	3
No ecological or cultural resources present	• There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**3**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

There are no known cultural resources located within the MRS (RI Report, Section 2.3.7). Forested areas, which may provide habitat for ecological receptors, are present within the MRS. No federal critical habitats are located within the direct vicinity of the MRS. Although no specific habitat was identified within or near the MRS, USFWS indicated that endangered species (northern long-eared bat [Myotis septentrionalis]) and migratory birds (black-capped chickadee [Poecile atricapillus practicus] and bobolink [Dolichonyx oryzivorous]) have large ranges that may overlap the MRS. New York State also lists numerous threatened and endangered species with known ranges or locations within the vicinity of the MRS, including species of mollusks, insects, fish, amphibians, reptiles, birds, and mammals MRS (RI Report, Section 2.3.7)

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	3	**4**
Source of Hazard	Table 2	1	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	**25**
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	1	**14**
Population Near Hazard	Table 7	5	
Types of Activities/Structures	Table 8	5	
Ecological and/or Cultural Resources	Table 9	3	
EHE MODULE TOTAL			**43**

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**

Note: Although two MPPEH items were observed at the MRS during the RI, there is no documented history of training with tear gas grenades at the MRS and no other items were observed during subsequent field mobilizations. The MRS was only historically used for small arms training.

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: • 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: • Non-explosively configured CWM/DMM either damaged or undamaged • Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	• The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	• 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.

There is no historical evidence that CWM were used, stored, or disposed on the MRS (Parsons SIR, Chapter 4, Section 4.1.1).

Tables 12 through 19 are Intentionally Omitted According to Army Guidance

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	0	
Accessibility Factor Data Elements			
Location of CWM	Table 13	0	0
Ease of Access	Table 14	0	
Status of Property	Table 15	0	
Receptor Factor Data Elements			
Population Density	Table 16	0	0
Population Near Hazard	Table 17	0	
Types of Activities/Structures	Table 18	0	
Ecological and/or Cultural Resources	Table 19	0	
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 (∝g/L)	Comparison Value (∝g/L)	Ratios
Total Lead	18	15	1.2
Dissolved Lead	Note detected	15	NA
CHF Scale	**CHF Value**	**Sum The Ratios**	1.2
CHF > 100	**H (High)**	**CHF =** ∑ [Maximum Concentration of Contaminant] / [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 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)	**L**

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)	**M**

No Known or Suspected Groundwater MC Hazard	☐

Groundwater was not sampled as a part of the RI. The metals concentrations used in this table are from shallow groundwater samples collected from downgradient areas of adjacent MRSs as a part of the Woods Hole Group 2011 Preliminary Site Investigation Report.

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 (∝g/L)	Comparison Value (∝g/L)	Ratios
Total Lead	Not detected	15	NA
Dissolved Lead	Not detected	15	NA
CHF Scale	**CHF Value**	**Sum The Ratios**	0
CHF > 100	**H (High)**	**CHF =** ∑ [Maximum Concentration of Contaminant] / [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 groundwater 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)	**L**

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 MC Hazard	☐

Surface water was not sampled as a part of the RI. The metals concentrations used in this table are surface water samples collected from downgradient areas of adjacent MRSs as a part of the Woods Hole Group 2011 Preliminary Site Investigation Report.

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.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Antimony	19.8	31	0.638
Copper	124	3100	0.040
Lead	2780	400	6.95
Zinc	348	23000	0.015
CHF Scale	**CHF Value**	**Sum The Ratios**	7.643
CHF > 100	**H (High)**	**CHF =** ∑ [Maximum Concentration of Contaminant] / [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)	**M**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment 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)	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment 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)	**M**

No Known or Suspected Sediment (Human Endpoint) MC Hazard	☐

Sediment samples were collected at both sediment areas in evenly spaced increments which represent the scope of each DU (RI Report, Section 3.2). Antimony and lead concentrations exceeded their respective NYSDEC human health screening criterion; lead also exceeded its MRSPP comparison value.

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 (∝g/L)	Comparison Value (∝g/L)	Ratios
Total Lead	Not detected	2.5	NA
Dissolved Lead	Not detected	2.5	NA
CHF Scale	**CHF Value**	**Sum The Ratios**	0
CHF > 100	**H (High)**	**CHF =** ∑ [Maximum Concentration of Contaminant] / [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)	**L**

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 ☐

Surface water was not sampled as a part of the RI. The metals concentrations used in this table are surface water samples collected from adjacent MRSs as a part of the Woods Hole Group 2011 Preliminary Site Investigation Report.

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 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 (mg/kg)	Comparison Value (mg/kg)	Ratios
Antimony	19.8	2.00	9.9
Copper	124	31.6	3.29
Lead	2780	35.8	77.65
Zinc	348	121.0	2.87
CHF Scale	**CHF Value**	**Sum The Ratios**	93.71
CHF > 100	**H (High)**	**CHF =** $\sum$ [Maximum Concentration of Contaminant] / [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)	**M**

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment 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)	**M**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment 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)	**M**

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard	☐

Sediment samples were collected from two areas in evenly spaced increments that are representative of each decision unit (RI Report, Section 3.2). Sediment sample concentrations for each MC analyte exceed DoD ecological comparison values (RI Report, Section 5.4). The RI SLERA concluded that there is negligible risk to the benthic macroinvertebrate community and the aquatic and semiaquatic wildlife community at the Wetland Meadow DU, but there is potential risk for adverse ecological effects from direct contact based lead COCs in sediment at the Target Berm Ponded DU (RI Report, Appendix F).

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)	Ratios
Antimony	328 (2009 NYSDEC Data)	31	10.58
Copper	5,530 (2009 NYSDEC Data)	3100	1.78
Lead	50,900 (2009 NYSDEC Data)	400	127.25
Zinc	119 (2020 AECOM Data)	23000	0.005
CHF Scale	**CHF Value**	**Sum The Ratios**	139.615
CHF > 100	**H (High)**	**CHF =** $\sum$ [Maximum Concentration of Contaminant] / [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)	**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)	**M**

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)	**M**

No Known or Suspected Surface Soil MC Hazard	☐

Surface soil samples were analyzed for MC metals (antimony, copper, zinc and lead). Although no surface soil samples collected during the 2020 RI exhibited MC concentrations that exceeded DoD comparison values, discrete surface soil samples collected during the 2009 NYSDEC investigation did. MC deposited in surface soil as a result of firing activities at the MRS has limited potential to migrate from source areas (i.e., subsurface soil, adjacent sediment). Given the MRS topography, range orientation, and heavy vegetation, stormwater runoff from significant rain events is unlikely to transport suspended MC off site.

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 in any given medium 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 of the Primer) 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: Do not 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
Groundwater (Table 21)	**L**	**L**	**M**	**L-L-M**	**F**
Surface Water/Human Endpoint (Table 22)	**L**	**L**	**M**	**L-L-M**	**F**
Sediment/Human Endpoint (Table 23)	**M**	**L**	**M**	**M-L-M**	**E**
Surface Water/Ecological Endpoint (Table 24)	**L**	**L**	**M**	**L-L-M**	**F**
Sediment/Ecological Endpoint (Table 25)	**M**	**M**	**M**	**M-M-M**	**D**
Surface Soil (Table 26)	**H**	**M**	**M**	**H-M-M**	**C**

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	**C**

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 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				**4**	

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Appendix C: Cost Estimates for Remedial Action Alternatives

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TABLE C-1
COST COMPARISON OF REMEDIAL ACTION ALTERNATIVES FOR MC

Site:	**Camp O'Ryan Rifle Range (NYHQ-008-R-02)**	**2021**
Installation:	**NDNODS, New York**	**09/02/2021**
Phase:	**Feasibility Study (-30% to +50%)**	

	Alternative 1 No Action	**Alternative 2 Land Use Controls**	**Alternative 3 Target Berm-Ponded Area DU Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls**	**Alternative 4 MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste**
Description				
Total Project Duration (Years)	0	30	30	1
Capital Cost	$0	$42,698	$413,082	$26,139,894
Total O&M/Periodic Cost	$0	$110,260	$110,260	$0
Total Cost of Alternative[1]	**$0**	**$152,958**	**$523,342**	**$26,139,894**
Total Present Value of Alternative	$0	$128,356	$498,736	$26,139,894

Notes

[1]Cost estimates are developed in the FS primarily for the purpose of comparing remedial action alternatives, not for establishing project budgets.

TABLE C-2
ALTERNATIVE 2 - LAND USE CONTROLS

Alternative 2 - Land Use Controls

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York
Phase: Feasibility Study (-30% to +50%)
Base Year 2021

Description: Includes the implementation of an environmental covenant (e.g., deed restriction) and the installation of warning signs at NYHQ-008-R-02 to reduce the risk of MC-contaminated soil. Periodic costs include site inspections and Five-Year Review reports. Capital costs occur in Year 0 and periodic costs occur in Years 5,10,15,20,25, and 30.

CAPITAL COSTS

Description	QTY	U/M	Unit Cost	Cost	Notes
Land Use Controls					
Environmental Easement	1	LS	$25,000	$25,000	See Table UCW-2
Warning Signs	30	EACH	$292	$8,753	See Table UCW-7
SUBTOTAL 1				$33,753	
Contingency	15%			$5,063	5% scope + 10% bid
SUBTOTAL 2				$38,816	
Project Management	10%			$3,882	
SUBTOTAL 3				$42,698	
TOTAL CAPITAL COST				**$42,698**	

PERIODIC COSTS

Description	QTY	U/M	Unit Cost	Cost Cost	Notes
Site Insepction for Five-Year Review	1	LS	$4,527	$4,527	See Table UCW-1
Five-Year Review Report	1	LS	$10,000	$10,000	
SUBTOTAL 1				$14,527	
Contingency	15%			$2,179	5% scope + 10% bid
SUBTOTAL 2				$16,706	
Project Management	10%			$1,671	
SUBTOTAL 3				$18,377	
TOTAL PERIODIC COST (6 Events)				**$110,260**	

PRESENT VALUE ANALYSIS

Description	Year	Cost	Cost/Year	DF (1.5%)	Present Value	Notes
Capital Cost	0	$42,698	$42,698	1.000	$42,698.19	
Periodic Costs	5	$18,377	$18,377	0.928	$17,058.32	
Periodic Costs	10	$18,377	$18,377	0.862	$15,834.56	
Periodic Costs	15	$18,377	$18,377	0.800	$14,698.60	
Periodic Costs	20	$18,377	$18,377	0.742	$13,644.12	
Periodic Costs	25	$18,377	$18,377	0.689	$12,665.30	
Periodic Costs	30	$18,377	$18,377	0.640	$11,756.69	
		$152,958			$128,355.78	

TOTAL COST OF ALTERNATIVE **$152,958**

TOTAL PRESENT VALUE OF ALTERNATIVE (ROUNDED TO NEAREST WHOLE DOLLAR) **$128,356**

TABLE C-3
ALTERNATIVE 3 - Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls

Alternative 3 - Target Berm-Ponded Area DU Soil Stabilization, Excavation and Off-Site Disposal as Non-Hazardous Waste with additional Land Use Controls

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York
Phase: Feasibility Study (-30% to +50%)
Base Year 2021

Description: Includes completion of Soil Removal Work Plan and Site-Specific Final Report for NYHQ-008-R-02. Includes excavation, stabilization, transportation, and disposal of an estimated 678 BCY of lead-contaminated soil. This is based on excavation over 0.42-acre to a depth of 1 foot. We assume that the excavated soil will require stabilization and will be done in one 12 inch deep pass. Includes the required field quality and safety equipment, including personal and area air monitors and an XRF for field screening. Includes transportation and disposal of the stabilized soil at a RCRA Subtitle D permitted landfill. Includes subcontractor oversight. Includes vegetation removal. Includes additional physical and legal Land Use Controls. Periodic costs include Site Inspections and Five-Year Review Reports. Capital costs occur in Year 0 and periodic costs occur in Years 5,10,15,20,25, and 30.

CAPITAL COSTS

Description	QTY	U/M	Unit Cost	Cost	Notes
Field Activities					
Soil Stabilization (One 12" deep passes)	2,033	Sq Yd	$17.95	$36,489	RS Means
Sediment Removal including T&D	1	LS	$161,182	$161,182	See Table UCW-3
Vegetation Removal	1	LS	$4,492	$4,492	See Table UCW-4
Pre, Post and Final Topographic Surveys	3	Each	$2,585	$7,755	Recent Sub Pricing
Reporting					
Site-Specific Final Report	1	LS	$25,000	$25,000	
Land Use Controls					
Environmental Easement Implementation	1	LS	$25,000	$25,000	See Table UCW-2
Warning Signs	30	EACH	$292	$8,753	See Table UCW-7
SUBTOTAL 1				$268,671	
Contingency	25%			$67,168	15% scope + 10% bid
SUBTOTAL 2				$335,839	
Project Management	8%			$26,867	
Remedial Design	15%			$50,376	
SUBTOTAL 3				$413,082	
TOTAL CAPITAL COST				**$413,082**	

PERIODIC COSTS

Description	QTY	U/M	Unit Cost	Cost	Notes
Site Inspection for Five-Year Review	1	LS	$4,527	$4,527	See Table UCW-1
Five-Year Review Report	1	LS	$10,000	$10,000	
SUBTOTAL 1				$14,527	
Contingency	15%			$2,179	5% scope + 10% bid
SUBTOTAL 2				$16,706	
Project Management	10%			$1,671	
SUBTOTAL 3				$18,377	
TOTAL PERIODIC COST (6 Events)				**$110,260**	

PRESENT VALUE ANALYSIS

Description	Year	Cost	Cost/Year	DF (1.5%)	Present Value	Notes
Capital Cost	0	$413,082	$413,082	1.000	$413,082.42	
Periodic Costs	5	$18,377	$18,377	0.928	$17,053.54	
Periodic Costs	10	$18,377	$18,377	0.862	$15,840.68	
Periodic Costs	15	$18,377	$18,377	0.800	$14,701.32	
Periodic Costs	20	$18,377	$18,377	0.742	$13,635.48	
Periodic Costs	25	$18,377	$18,377	0.689	$12,661.52	
Periodic Costs	30	$18,377	$18,377	0.640	$11,761.06	
		$523,342			$498,736.00	

TOTAL COST OF ALTERNATIVE **$523,342**

TOTAL PRESENT VALUE OF ALTERNATIVE (ROUNDED TO NEAREST WHOLE DOLLAR) **$498,736**

TABLE C-4
ALTERNATIVE 4 - MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste

Alternative 4 - MC-Contaminated Soil Stabilization and Off-Site Disposal as Non-Hazardous Waste

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York
Phase: Feasibility Study (-30% to +50%)
Base Year 2021

Description: Includes completion of a Soil Removal Work Plan and Site-Specific Final Report for NYHQ-008-R-02. Includes excavation, stabilization, transportation, and disposal of an estimated 66,276 BCY of lead-contaminated soil and 4,840 BCY of lead-contaminated soil at the Targte Berm-Ponded DU. This is based on excavation over a 20.54-acre area to a depth of 2 feet for soil, and over a 3 acre depth to a depth of 1 foot for soil at the Target Berm-Ponded DU. We assume that the excavated soil will require stabilization and will be done in two 12 inch deep passes. At the Target Berm-Ponded DU, stabilization will be done in one 12 inch deep pass. Includes the required field quality and safety equipment, including personal and area air monitors and an XRF for field screening. Includes transportation and disposal of the stabilized soil at a RCRA Subtitle D permitted landfill. Includes subcontractor oversight. Includes vegetation removal. Capital costs occur in Year 0 and there are no annual or periodic costs.

CAPITAL COSTS

Description	QTY	U/M	Unit Cost	Cost	Notes
Field Activities					
Soil Stabilization (Three 12" deep passes)	99,752	Sq Yd	$53.85	$5,371,667	RS Means
Soil Stabilization (One 12" deep pass)	14,520	Sq Yd	$17.95	$260,634	RS Means
Soil Removal including T&D	1	LS	$13,016,242	$13,016,242	See Table UCW-5
Vegetation Removal	1	LS	$158,265	$158,265	See Table UCW-6
Pre, Post and Final Topographic Surveys	3	Each	$2,585	$7,755	Recent Sub Pricing
Reporting					
Site-Specific Final Report	1	LS	$25,000	$25,000	
SUBTOTAL 1				$18,839,563	
Contingency	25%			$4,709,891	15% scope + 10% bid
SUBTOTAL 2				$23,549,454	
Project Management	5%			$1,177,473	
Remedial Design	6%			$1,412,967	
SUBTOTAL 3				$26,139,894	
TOTAL CAPITAL COST				**$26,139,894**	

PERIODIC COSTS

Description	QTY	U/M		Cost	Notes
				Cost	
Site Visit for 5 Year Review	0	LS	$1,667	$0	
Five Year Review Report	0	LS	$10,000	$0	
SUBTOTAL 1				$0	
Contingency	15%			$0	5% scope + 10% bid
SUBTOTAL 2				$0	
Project Management	10%			$0	
SUBTOTAL 3				$0	
TOTAL PERIODIC COST				**$0**	

PRESENT VALUE ANALYSIS

Description	Year	Cost	Cost/Year	DF (1.5%)	Present Value	Notes
Capital Cost	0	$26,139,894	$26,139,894	1.000	$26,139,893.98	
TOTAL COST OF ALTERNATIVE					**$26,139,894**	
TOTAL PRESENT VALUE OF ALTERNATIVE (ROUNDED TO NEAREST WHOLE DOLLAR)					**$26,139,894**	

TABLE UCW-1
FIVE-YEAR REVIEW SITE INSPECTION

Periodic Cost Sub-Element
Site Inspection for Five-Year Review

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Site inspection for Five-Year Review. Assumes site inspection involves 2-person team (Geologists). Includes completing an inspection of the site and photographing current site conditions.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
2x Geologist	32	Hour	$117.40	$3,757	Hourly Rates Derivation
Subtotal Labor Cost				**$3,757**	
ODCs/Subs					
Rental Vehicle	1	Week	$60.00	$60	Recent Vendor Pricing
Gasoline	1	Week	$15.00	$15	Recent Vendor Pricing
Level D PPE	1	Day	$5.00	$5	Recent Vendor Pricing
Subtotal ODC/Subs Costs				**$80**	
Prime Contractor Overhead and Profit	18%			**$691**	10% overhead + 8% profit
Lump Sum Price				**$4,527**	

Source of Cost Data:

Costs based on previous experience and recent vendor pricing

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rates Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-2
ADDITIONAL ENVIRONMENTAL EASEMENTS

Capital Cost Sub-Element
Environmental Easements

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for the costs associated with the implementation of an environmental easement (e.g. deed restriction) at NYHQ-008-R-02 to reduce the risk of MC-contaminated soil.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Environmental Easement Implementation	1	LS	$20,000.00	$20,000	
Subtotal Labor Cost				**$20,000**	
Contingency and Project Management	25%			**$5,000**	15% contingency + 10% project management
Lump Sum Price				**$25,000**	

Source of Cost Data:

Costs based on previous experience.

Cost Adjustment Checklist:

	FACTOR:	
		NOTES: The break down of the hourly rate is included on the Hourly Rate Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	Costs are based on local quotes, historical data, and RS Means.
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-3
SEDIMENT REMOVAL, TRANSPORTATION, AND DISPOSAL

Capital Cost Sub-Element
Soil Removal, Transportation, and Disposal - Target Berm-Ponded I

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for soil removal of an estimated 678 BCY (0.42 acres x 1 feet deep) of contaminated soil. Assumes soil removal involves a subcontractor, a Geologist, and an Environmental Scientist for oversight/support. The soil will be transported and disposed of at a Subtitle D Landfill. Includes an estimated 250 BCY per day for excavation and stockpile and 250 BCY per day for backfill and compaction. Assumes three days awaiting results of the quick turn confirmation sampling.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
Geologist	70	Hour	$117.40	$8,218	Five 10-hr days, +2 travel days
Environmental Scientist	70	Hour	$94.73	$6,631	Five 10-hr days, +2 travel days
Subtotal Labor Cost				**$14,848**	
ODCs/Subs					
XRF Confirmation Sampling	1	Week	$1,575.00	$1,575	Recent Sub Pricing
Air Monitoring / Dust Control	1	Week	$2,925.00	$2,925	Recent Sub Pricing
Rental Pickup	2	Week	$335.00	$670	
Mobilization	1	LS	$20,000.00	$20,000	Recent Sub Pricing
Erosion Controls	0.50	Acre	$3,500.00	$1,750	Recent Sub Pricing
Excavate and Load Soil	678	BCY	$10.45	$7,085	Recent Sub Pricing
Backfill, Compaction, and Grading	678	BCY	$20.00	$13,560	Recent Sub Pricing
Transport and Dispose Stabilized Soil	1,627	Ton	$42.50	$69,156	Recent Sub Pricing
Analytical Laboratory Sampling	1	LS	$5,000.00	$5,000	Recent Sub Pricing
Level D PPE	5	Day	$5.00	$25	
Subtotal ODC/Subs Costs				**$121,746**	
Prime Contractor Overhead and Profit	18%			**$24,587**	10% overhead + 8% profit
Lump Sum Price				**$161,182**	

Source of Cost Data:
Costs based on previous experience.

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rate Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	Costs are based on local quotes, historical data, and RS Means.
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-4
VEGETATION REMOVAL

Capital Cost Sub-Element
Vegetation Removal

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for a vegetation removal. Assumes vegetation removal involves a subcontractor and a Geologist for support. Assumed approximately 0.42-acres will need vegetation removal of the sage and other scrub brush. This team is anticipated to clear the MRS in one 10-hour day.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
Geologist	10	Hour	$117.40	$1,174	Hourly Rates Derivation
Subtotal Labor Cost				**$1,174**	
ODCs/Subs					
Vegetation Removal Sub	0.4	Acre	$6,079.18	$2,553	RS Means 2020
Rental Vehicle	1	Day	$60.00	$60	
Gasoline	1	Day	$15.00	$15	
Level D PPE	1	Day	$5.00	$5	
Subtotal ODC/Subs Costs				**$2,633**	
Prime Contractor Overhead and Profit	18%			**$685**	10% overhead + 8% profit
UNIT COST PER DAY				**$4,492**	

Source of Cost Data:

Costs based on previous experience and RS Means.

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rates Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-5
SOIL AND SEDIMENT REMOVAL, TRANSPORTATION, AND DISPOSAL

Capital Cost Sub-Element
Soil Removal, Transportation, and Disposal

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for soil and sediment removal of an estimated 71,116 BCY of contaminated soil . Assumes soil removal involves a subcontractor, a Geologist, and an Environmental Scientist for oversight/support. The soil will be transported and disposed of at a Subtitle D Landfill. Includes an estimated 250 BCY per day for excavation and stockpiling and 250 BCY per day for backfill and compaction. Assumes three days awaiting results of the quick turn confirmation sampling.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
Geologist	5716	Hour	$117.40	$671,030	570 10-hr days, +2 travel days
Environmental Scientist	5716	Hour	$94.73	$541,448	570 10-hr days, +2 travel days
Subtotal Labor Cost				**$1,212,478**	
ODCs/Subs					
XRF Confirmation Sampling	57	Week	$1,575.00	$89,775	Recent Vendor Pricing
Air Monitoring / Dust Control	57	Week	$2,925.00	$166,725	Recent Vendor Pricing
Rental Pickup	57	Week	$335.00	$19,095	
Mobilization	1	LS	$20,000.00	$20,000	Recent Sub Pricing
Erosion Controls	22.00	Acre	$3,500.00	$77,000	Recent Sub Pricing
Excavate and Load Soil	71,115	BCY	$10.45	$743,152	Recent Sub Pricing
Backfill, Compaction, and Grading	71,115	BCY	$20.00	$1,422,300	Recent Sub Pricing
Transport and Dispose Stabilized Soil	170,677	Ton	$42.50	$7,253,764	Recent Sub Pricing
Analytical Laboratory Sampling	1	LS	$25,000.00	$25,000	Recent Sub Pricing
Level D PPE	285	Day	$5.00	$1,425	
Subtotal ODC/Subs Costs				**$9,818,236**	
Prime Contractor Overhead and Profit	18%			**$1,985,529**	10% overhead + 8% profit
Lump Sum Price				**$13,016,242**	

Source of Cost Data:

Costs based on previous experience, and recent subcontractor pricing.

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rates Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	Costs are based on local quotes, historical data, and RS Means.
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-6
VEGETATION REMOVAL

Capital Cost Sub-Element
Vegetation Removal

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for a vegetation removal. Assumes vegetation removal involves a subcontractor and a Geologist for support. Assumed approximately 20 of the 42.21 acres will need vegetation removal of the sage and other scrub brush. This team is anticipated to clear the MRS in ten 10-hour days.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
Geologist	100	Hour	$117.40	$11,740	Hourly Rates Derivation
Subtotal Labor Cost				**$11,740**	
ODCs/Subs					
Vegetation Removal Sub	20.0	Acre	$6,079.18	$121,584	RS Means 2020
Rental Vehicle	10	Day	$60.00	$600	
Gasoline	10	Day	$15.00	$150	
Level D PPE	10	Day	$5.00	$50	
Subtotal ODC/Subs Costs				**$122,384**	
Prime Contractor Overhead and Profit	18%			**$24,142**	10% overhead + 8% profit
UNIT COST PER DAY				**$158,265**	

Source of Cost Data:

Costs based on previous experience and RS Means.

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rates Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
✓	Area Cost Factor	
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

TABLE UCW-7
WARNING SIGN INSTALLATION

Capital Cost Sub-Element
Warning Signs

UNIT COST WORKSHEET

Site: Camp O'Ryan Rifle Range (NYHQ-008-R-02)
Installation: NDNODS, New York

Work Statement:

Unit cost is for installation of warning signs. Assumes signs are installed by a 3-person field team. Assumes 10 signs installed per day.

Cost Analysis:

DESCRIPTION	QTY	U/M	UNIT COST	COST	NOTES
Labor					
Environmental Scientist	30	Hour	$94.73	$2,842	Hourly Rates Derivation
Field Technician	60	Hour	$79.81	$4,788	Hourly Rates Derivation
Subtotal Labor Cost				**$2,842**	
Equipment/Subs					
Truck Mounted Earth Auger	3.0	Day	$417.20	$1,252	RS Means
Rental Vehicle	3	Day	$60.00	$180	
Gasoline	3	Day	$15.00	$45	
GPS	3	Day	$100.00	$300	
Steel Post	30	EACH	$34.95	$1,049	
Warning Sign	30	EACH	$49.07	$1,472	
Concrete (Premixed Bag)	30	EACH	$3.80	$114	
Misc. Field Supplies	3	EACH	$50.00	$150	
Level D PPE	3	Day	$5.00	$15	
Subtotal ODC/Subs Costs				**$4,576**	
Prime Contractor Overhead and Profit	18%			**$1,335**	10% overhead + 8% profit
UNIT COST PER DAY				**$8,753**	
UNIT COST PER SIGN				**$292**	

Source of Cost Data:

Costs based on wage determinations, available pricing, and RS Means.

Cost Adjustment Checklist:

	FACTOR:	**NOTES:** The break down of the hourly rate is included on the Hourly Rates Derivation sheet.
✓	H&S Productivity (labor & equip only)	
✓	Escalation to Base Year	2021 is base year.
	Area Cost Factor	
✓	Subcontractor Overhead and Profit	Included in cost.
✓	Prime Contractor Overhead and Profit	Included in cost.

HOURLY RATES DERIVATION

FIELD CREW HOURLY RATES — COST BACKUP SHEET 1

Geologist			Environmental Scientist		
Hourly Rate	$	90.97	Hourly Rate	$	68.30
Wyoming Co. Per Diem Per Day	$	151.00	Wyoming Co. Per Diem Per Day	$	151.00
40 HR Week	$	3,638.80	40 HR Week	$	2,732.00
Per Diem 7 Days	$	1,057.00	Per Diem 7 Days	$	1,057.00
Weekly Total	$	4,695.80	Weekly Total	$	3,789.00
Hourly rate (including Per Diem)	$	117.40	Hourly rate (including Per Diem)	$	94.73