FINAL

Proposed Plan

Walker Lake Land Test Range Munitions Response Site

(Sites HWAAP-008-R-01)

Hawthorne Army Depot
Mineral County, Nevada

Contract No. W912DY-09-D-0062
Delivery Order No. CM01

Prepared For:

Hawthorne Army Depot,
U.S. Army Environmental Command,

and

U. S. Army Corps of Engineers,
Sacramento District

Prepared By:

PARSONS

Revision No. 2

December 2014

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CHAPTER 1 INTRODUCTION

PURPOSE

The 10,269-acre Walker Lake Land Test Range MRS is referred to as the "project site" and is the subject of this Proposed Plan. The MRS is further divided into the "Land Area" and "Water Area". Other munitions response sites at the HWAD are not addressed by this document.

This ***Proposed Plan***[1] is being presented by the United States Army (the Army)[2] to allow the public to review and comment on the recommended cleanup of potential remaining ***munitions and explosives of concern*** (MEC) at a ***munitions response site*** (MRS) at the Hawthorne Army Depot (HWAD), Mineral County, Nevada.

The focus of this Proposed Plan is the Walker Lake Land Test Range MRS, an approximately 10,269-acre area owned by HWAD, the Bureau of Land Management (BLM), and the State of Nevada adjacent to and within Walker Lake at the northern boundary of HWAD (Figure 1). The Walker Lake Land Test Range MRS is hereafter referred to as the ***project site***. The project site is further divided into the portion within Walker Lake, hereafter referred to as the Water Area, and the area on land adjacent to Walker Lake, hereafter referred to as the Land Area. Each subarea of the MRS is then further divided, based on the potential MEC density, into high-density and low-density areas. The High-Density Area includes all areas within project site where a high concentration of MEC or ***munitions debris*** (MD) was identified. The Low-Density Area contains a low concentration of identified MD and provides a buffer around the High-Density Area. Table 1 shows the subareas discussed in this proposed plan. This Proposed Plan does not address other MRSs at the HWAD, which will be presented in separate Proposed Plan documents.

A ***remedial investigation*** (RI) and ***feasibility study*** (FS) were completed for the project site, and the information and recommendations contained in this Proposed Plan are the result of the findings. The Nevada Division of Environmental Protection (NDEP) and the current land owners reviewed the RI and FS and agreed with the conclusions and recommendations. The Final RI Reports (Parsons, 2013a and 2013b) and Final FS Report (Parsons, 2014) for the range are part of the ***Administrative Record*** File that contains the documents used in making decisions on remedial projects at the HWAD.

This Proposed Plan provides basic background information on the project site, identifies the ***Preferred Alternative*** for remedial action (i.e., cleanup), explains why this alternative is preferred, and describes the other alternatives that were considered. Because of the different site conditions and available remedial technologies, the FS assessed the Land Area and Water Area separately. Because the water levels in Walker Lake have been dropping over time, the boundary

PUBLIC COMMENT PERIOD:

January 7, 2015 –

February 6, 2015

PUBLIC MEETING:

A public meeting will be held to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study Report.

Date: February 3, 2015

Time: 7:00 PM

Location:

High Desert Special Operations Center, Training Building
410 E Street
Hawthorne, Nevada 89415

ADMINISTRATIVE RECORD:

For more information, see the Administrative Record at the following location:

Environmental Office
Hawthorne Army Depot
1 South Maine Ave.
Hawthorne, NV 89415

[1] The terms used in this Proposed Plan are defined in the glossary at the back of this document and presented in bold italic font at first use.

[2] A list of acronyms and abbreviations used in this document follows the glossary at the back of this document.

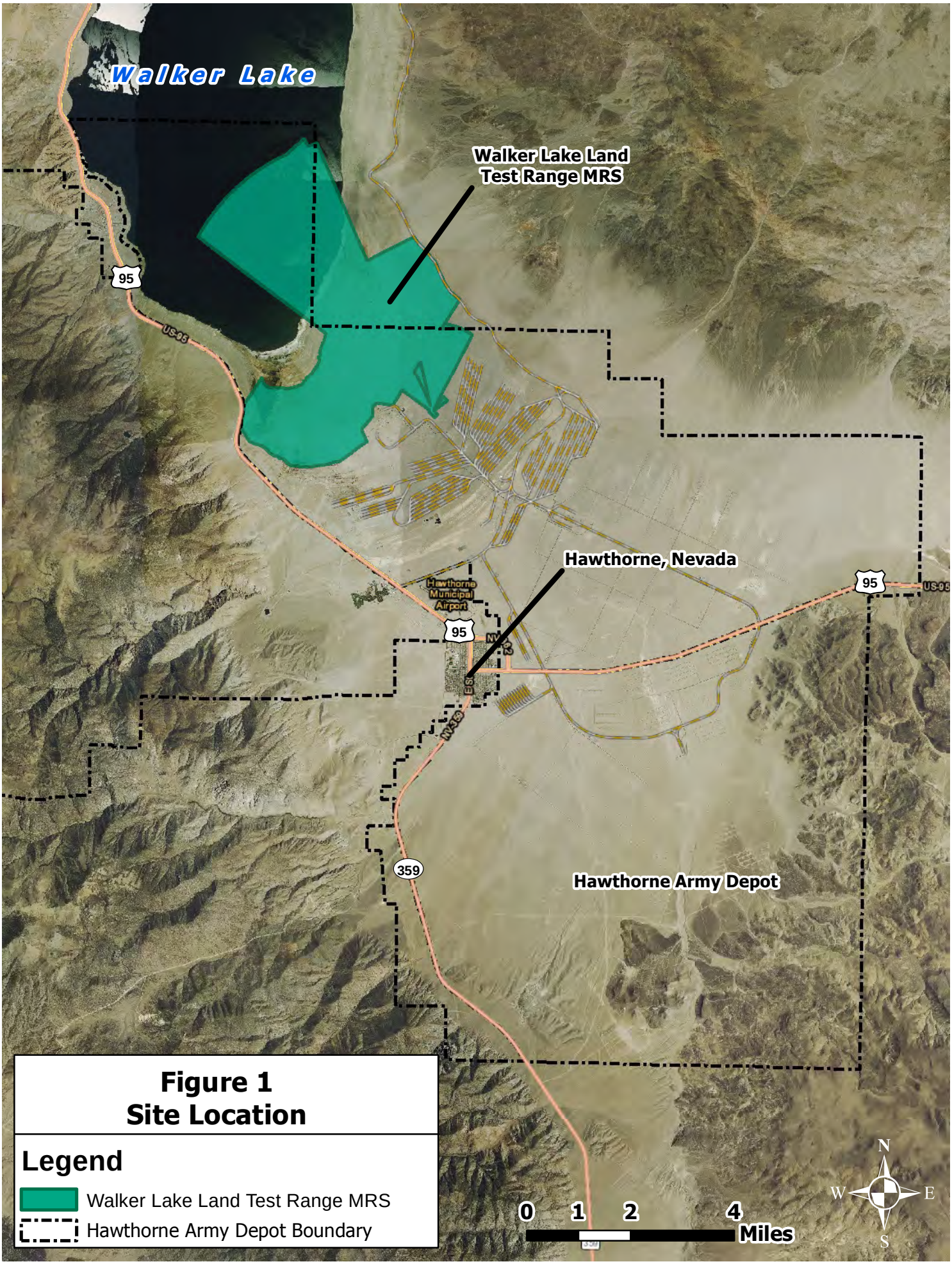


Figure 1
Site Location

Legend

Walker Lake Land Test Range MRS

Hawthorne Army Depot Boundary

between land and water is moving; therefore, the Water Area alternatives include remedial actions for the shoreline area as it becomes land over time. This document also provides an opportunity for the public to participate in the decision process, and it provides information on how the public can get involved.

Table 1
Summary of MRS Subareas

MRS	Assessment Areas	Subarea Used in Alternative Development
Walker Lake Land Test Range MRS 10,269 Acres	Land Area 6,803 Acres	High-Density Land Area – 1,975 Acres
		Low-Density Land Area – 4,828 Acres
	Water Area 3,466 Acres	High-Density Water Area – 1,038 Acres
		Low-Density Water Area – 2,428 Acres

PUBLIC INVOLVEMENT PROCESS

This Proposed Plan is part of the Army's community relations program, which is a component of the requirements of Section 117(a) of the ***Comprehensive Environmental Response, Compensation and Liability Act*** (CERCLA), also known as ***Superfund***, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the RI and FS reports and other documents contained in the Administrative Record File for this site. The Army encourages the public to review these documents to gain a more comprehensive understanding of the site and activities conducted at the site.

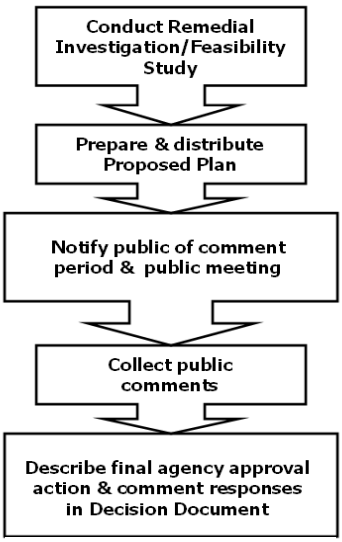


Figure 2
Decision Document Process

Local community members and other interested parties are encouraged to review this Proposed Plan and submit comments. Public comments on all alternatives are considered before any action is selected and approved. The Army, the lead agency for site activities, in consultation with the NDEP, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. The Army, in consultation with NDEP, may modify the Preferred Alternative or select another response action presented in this plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan. Public comments on the Proposed Plan will be accepted during a 30-day public review and comment period (January 7, 2015 – February 6, 2015). In addition, a public meeting will be held to explain this Proposed Plan. Comments from the public will be considered before the final selection and approval of any action. Information on how to comment on this document and the location of the Administrative Record File is provided in Chapter 10.

The Army, in consultation with the NDEP, will consider public comments received during the public meeting and comment period and make a final decision concerning future action to be taken at the project site. This decision will be presented in a ***Remedial Action Decision Document*** (RA DD). The Army's responses to public comments on this Proposed Plan will be contained in the

Responsiveness Summary section of the RA DD. The current schedule calls for completion of the RA DD by May 2015.

The flow chart shown in Figure 2 summarizes the various steps in the development and approval process of the project site RA DD.

CHAPTER 2 SITE BACKGROUND

POTENTIALLY CONTAMINATED MEDIA

Surface and subsurface soil and sediment at the project site are potentially contaminated with intact munitions (e.g., MEC).

SITE HISTORY AND CAUSES OF CONTAMINATION

Site History of the Walker Lake Land Test Range Munitions Response Site

The Walker Lake Test Range has been used since World War II for testing various rockets, involving the firing of thousands of rounds at the range. Documentation of the firing at this range is only available since 1970; however, interviewed personnel have verified that the ranges in this area were used during World War II, the Korean War, and the post-Korean War periods (URS Group, Inc. [URS], 2008). The Walker Lake Land Test Range was also used from 1942 to around 1954 to test Hedgehog depth charges. Although depth charges were tested at these ranges, only the firing capabilities were tested, and thus they were not fired toward Walker Lake. A part of the range was also reported to have been used by personnel from the Naval Weapons Center China Lake in the 1950s. Interviews have indicated that this range may have been used for firing incendiary material into Walker Lake. According to site interviews conducted during the preliminary assessment, surface sweeps for ***unexploded ordnance*** (UXO) have been conducted in the past at the Walker Lake Land Test Range MRS. Clearance activities on the Walker Lake Ranges in 1974 removed more than 6,000 pieces of munitions and MD weighing more than 75 tons (URS, 2008).

Three prior MEC-related investigations were conducted by the Army at the Walker Lake Land Test Range MRS, including a closed, transferring, and transferred site inventory (TechLaw, 2003), historical records review (URS, 2008), and a site inspection (URS, 2009). In addition, a time-critical removal action (TCRA) was conducted to remove MEC from the southeast shoreline of Walker Lake between October 2011 and April 2012 (North Wind, Inc., 2012). In addition to the shoreline removal, any rockets/munitions located in the water up to 2 feet deep were removed. The TCRA was deemed necessary because the receding water level in Walker Lake exposes rockets/munitions on the new shoreline, presenting a potential explosive hazard. The TCRA identified and removed military munitions and associated debris along the shoreline of Walker Lake; 29 MEC items and 130,870 pounds of MD were removed from the land area and lake shoreline.

Results of these investigations were used during the development of the technical approach for the RI and were also used to supplement the RI data.

An RI was completed at the project site in 2013. The objective and purpose of the RI was to confirm whether MEC or ***munitions constituents*** (MC) contamination is present and, if present, to characterize the nature and extent. Prior to and during the RI, the 10,269-acre Walker Lake Land Test Range MRS consisted of four individual MRSs. The four MRS included the 9,210-acre Walker Lake Land Test Range MRS, 796-acre Walker Lake Water Test Range MRS, 208-acre Walker Lake Water Test Range (Transferred [TD]) MRS, and 14-acre Walker Lake Land Test Range (TD) MRS. At the conclusion of RI, all of the Walker Lake Land Test Range MRSs and Walker Lake Water Test Range MRSs, and a small triangle of land near the firing point of the Walker Lake Land Test Range MRS, were combined into one MRS (project site). Figure 3 shows the remedial investigation MRS boundaries as well as the current Walker Lake Land Test Range MRS boundary (project site). At the conclusion of the RI, the total area of the Walker Lake Land Test Range expanded from 9,210 acres to 10,269 acres.

The final RI reports for the Walker Lake Land Test Range MRSs and the Walker Lake Water Test Range MRSs were issued in July 2013 and January 2013, respectively (Parsons, 2013a and 2013b). The RI determined that there are no unacceptable MC risks; therefore, an FS was recommended to evaluate remedial action alternatives to address MEC hazards only.

REMEDIAL INVESTIGATION RESULTS

The RI was conducted to confirm whether MEC or MC contamination were present within the Walker Lake Land Test Range MRS. The results and conclusions of the RI are presented in two separate RI reports (Parsons, 2013a and 2013b) and summarized in Chapter 2 of the FS report (Parsons, 2014). The RI assessed whether MEC or MC contamination was present and, if so, characterized the nature and extent of the contamination and evaluated associated hazards or risks.

Data collection activities conducted during the RI included bathymetry and side-scan sonar; light detection and ranging imaging (LiDAR); orthophotography data acquisition; ground-based and underwater qualitative reconnaissance (magnetometer-assisted visual inspections); airborne, ground-based, and underwater digital geophysical mapping (DGM); ground-based and underwater intrusive ***anomaly*** investigation; and surface soil, subsurface soil, sediment, and surface water sampling for MC. Table 2 and Figure 4 summarize the findings of the RI at the Walker Lake Land Test Range MRS.

Using a conservative approach and combining the results of the DGM and qualitative reconnaissance findings, the Walker Lake Land Test Range MRS was divided into the High-Density Area and the Low-Density Area within both the land and water portions of the MRS. The High-Density Area includes all areas within Walker Lake Land Test Range MRS where a high concentration of MD was identified. The Low-Density Area contains a low concentration of identified MD and provides a buffer around the High-Density Area. While the High-Density Area has the highest potential for MEC hazards, there is also some potential for MEC to be present on the surface and in the subsurface within the Low-Density Area.

The Walker Lake Land Test Range MRS includes areas on land adjacent to Walker Lake and within Walker Lake. Because of the different site conditions and remedial technologies available for land and water, this Proposed Plan will assess the Land Area and Water Area separately. The water levels in Walker Lake are receding and have dropped by an average of 1.9 feet per year in the past 10 years (United States Geological Survey, 2014). As a result, new land area along the shoreline is exposed over time. The Land Area and Water Area alternatives developed for this Proposed Plan are based on the January 2014 water levels. Remedial action for future exposure of land along the shoreline is covered under the Water Area alternatives.

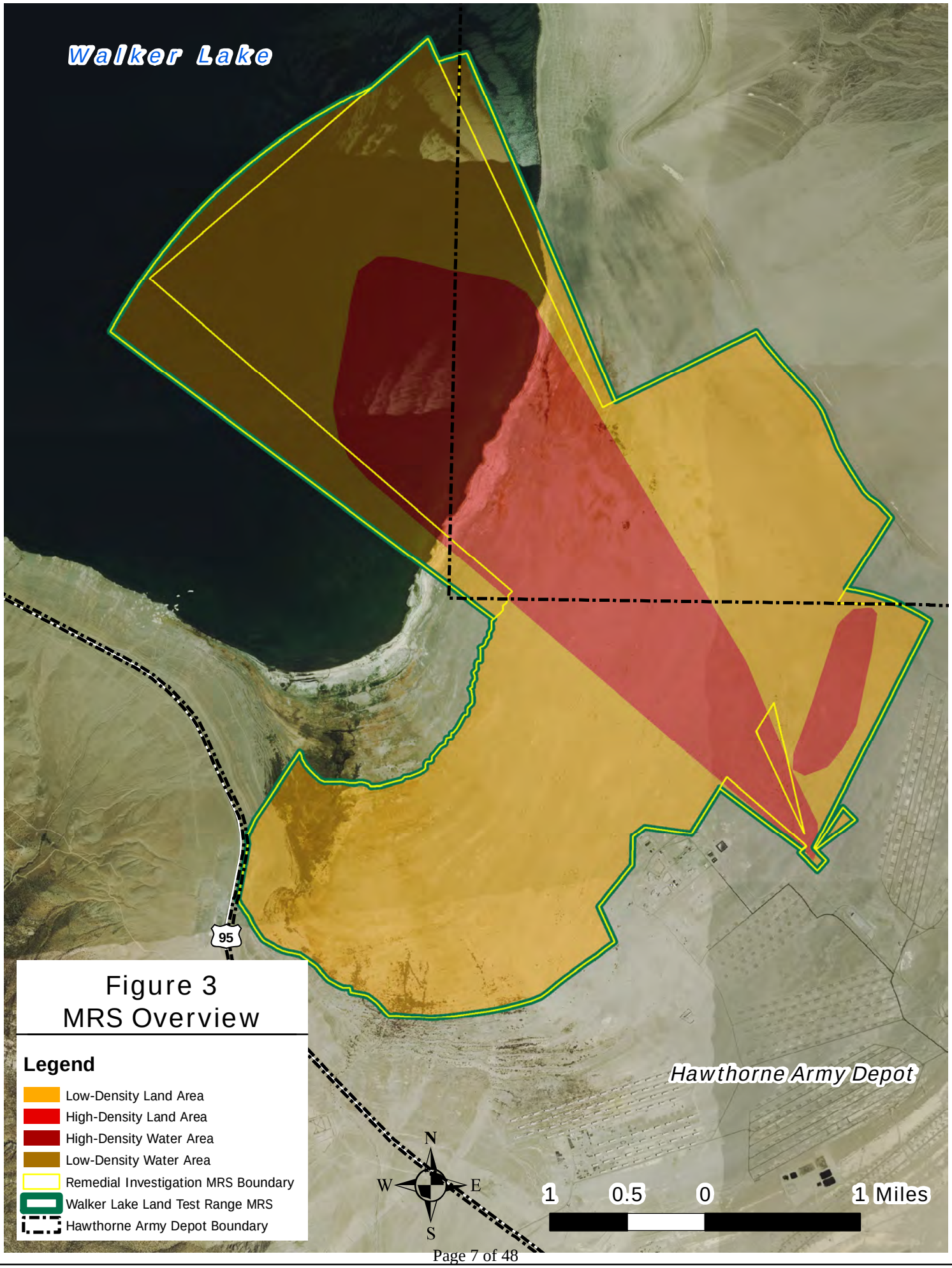


Figure 3
MRS Overview

Table 2
Remedial Investigation Findings

Walker Lake Land Test Range MRS	
Qualitative Reconnaissance - Ground-based qualitative reconnaissance was collected over 39.4 miles covering 78.4 acres. - Underwater qualitative reconnaissance covered about 0.33 miles.	During ground-based qualitative reconnaissance at the Walker Lake Land Test Range MRS, three MEC items were identified and MD was found at 109 locations. In addition, seven suspected burial pits locations were identified in the Walker Lake Land Test Range MRS.
Digital Geophysical Mapping - Collected 519.4 acres of airborne DGM, 67.3 acres of ground-based DGM, and 53.1 acres of underwater DGM transects within the MRS.	A total of 867 DGM-identified anomalies were selected for intrusive investigation (82 airborne anomalies, 33 underwater anomalies, and 752 ground-based anomalies). During the intrusive investigation, 11 MEC items were found and MD was found at 301 locations.
Munitions Constituents Sampling - Collected and analyzed 16 surface soil samples, six subsurface soil samples, eight sediment samples, eight surface water, and two incremental surface soil samples.	No MC were present at sufficient concentration to pose a risk to human health; however, aluminum and zinc exceeded ecological screening levels. The maximum detected concentrations of aluminum and zinc were more than 24 inches below the surface of the lake bottom, where sediment is not likely to be accessible to ecological receptors. Therefore, aluminum and zinc are not expected to pose a risk to ecological receptors exposed to sediment at the Walker Lake Land Test Range MRS. A risk assessment, conducted to evaluate potential risk to ecological receptors, concluded that **no unacceptable MC risks are expected in the Walker Lake Land Test Range MRS**.

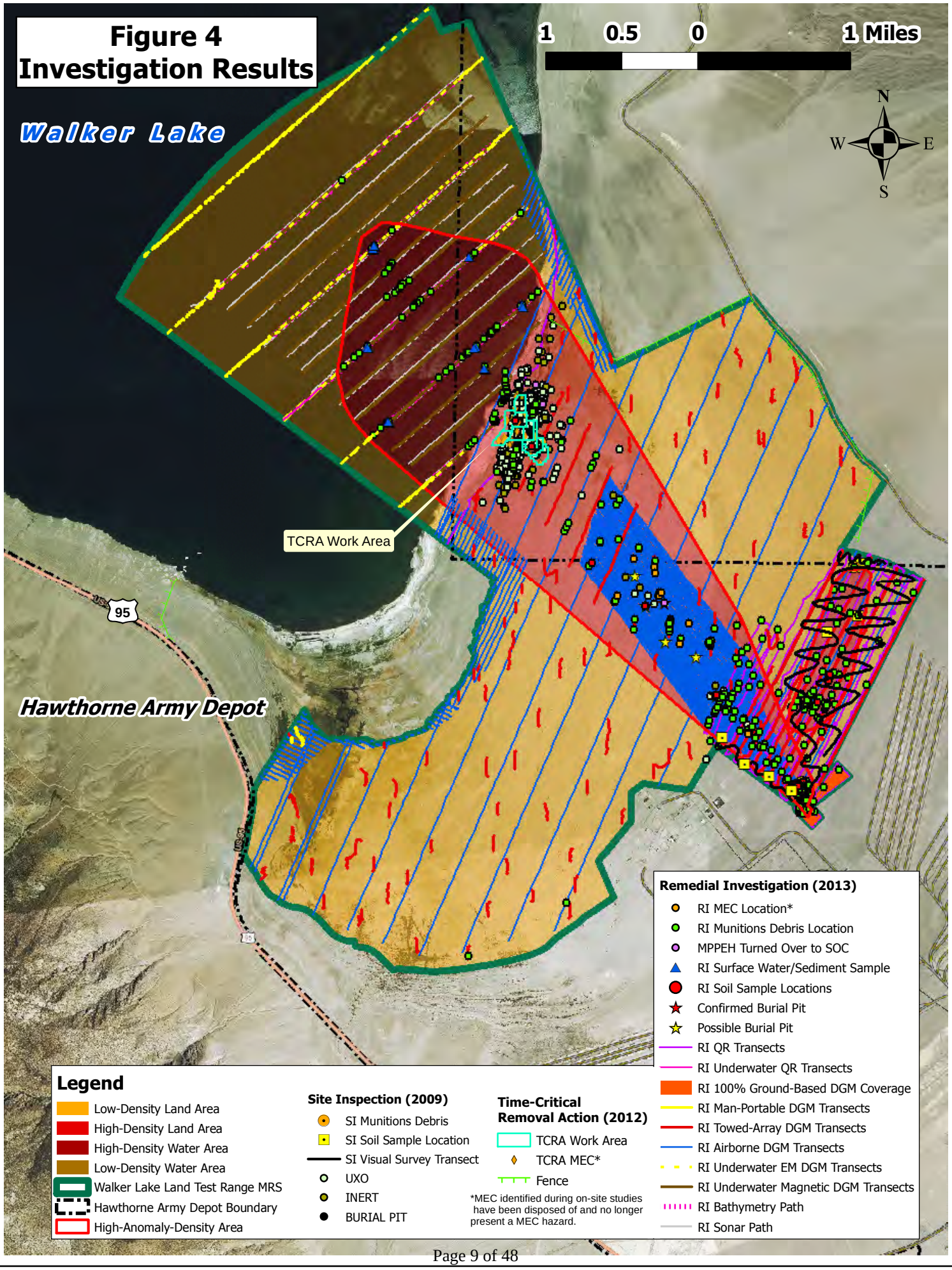


Figure 4
Investigation Results
Walker Lake
Hawthorne Army Depot
TCRA Work Area
1 0.5 0 1 Miles
N
W
E
S
95
Legend
Low-Density Land Area
High-Density Land Area
High-Density Water Area
Low-Density Water Area
Walker Lake Land Test Range MRS
Hawthorne Army Depot Boundary
High-Anomaly-Density Area
Site Inspection (2009)
SI Munitions Debris
SI Soil Sample Location
SI Visual Survey Transect
UXO
INERT
BURIAL PIT
Time-Critical Removal Action (2012)
TCRA Work Area
TCRA MEC*
Fence
*MEC identified during on-site studies have been disposed of and no longer present a MEC hazard.
Remedial Investigation (2013)
RI MEC Location*
RI Munitions Debris Location
MPPEH Turned Over to SOC
RI Surface Water/Sediment Sample
RI Soil Sample Locations
Confirmed Burial Pit
Possible Burial Pit
RI QR Transects
RI Underwater QR Transects
RI 100% Ground-Based DGM Coverage
RI Man-Portable DGM Transects
RI Towed-Array DGM Transects
RI Airborne DGM Transects
RI Underwater EM DGM Transects
RI Underwater Magnetic DGM Transects
RI Bathymetry Path
RI Sonar Path

CHAPTER 3 SITE CHARACTERISTICS

PHYSICAL CHARACTERISTICS AND LAND USE

The project site lies within the Great Basin Section of the Basin and Range Geomorphic Province, which consists of discontinuous, roughly parallel, north-oriented mountain ranges separated by broad intermontane alluvial valleys. The project site is within the Walker Lake Valley (flat alluvial plain).

The Walker Lake Land Test Range MRS is at the boundary of the HWAD, with part of the MRS on HWAD property and the remaining portions owned by the BLM and State of Nevada. The project site is currently undeveloped, and the BLM and State of Nevada portions are used for recreation, including hunting. There are currently no structures on the project site, and only a few dirt roads provide access to parts of the site. Parts of the project site are open to the public; however, the site is not heavily used. Persons entering the project site are expected to include BLM workers, HWAD workers, hunters, and recreational users, and it is estimated that persons spend fewer than 4,000 hours per year within the project site. Current land use is not anticipated to change.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Response actions under the Military Munitions Response Program must identify and attain or formally waive ***applicable or relevant and appropriate requirements*** (ARARs) under federal and state laws. Other criteria, advisories, and guidance to be considered (to be considered [TBC] information) are also useful in designing and selecting a remedial alternative. The FS identified three ARARs for the remedial action at the project site, which are summarized in Table 3. TBC information used to evaluate post-demolition samples in accordance with the identified ARAR is also shown in Table 3.

NATURE AND EXTENT OF CONTAMINATION

The potential sources of MEC within the project site result from rocket testing involving live fire of thousands of rounds at the range. The RI and supplemental MC sampling completed during the FS determined that there are no unacceptable MC risks at the Walker Lake Land Test Range MRS; therefore, this document only evaluates remedial actions to address MEC hazards. The potential exists for UXO to be present from munitions that did not function as designed (e.g., did not detonate). The RI identified 14 MEC items that were found in the Walker Lake Land Test Range MRS (all land-based). In addition to the MEC items, MD was found at 410 locations during the intrusive anomaly investigation and qualitative reconnaissance; therefore, it is reasonable to conclude that MEC is present within the project site. Figure 4 displays high- and low-density areas identified during the RI as well as the MEC and MD distribution across the MRS.

Table 3
Applicable or Relevant and Appropriate Requirements

ARAR	Description
RCRA, 40 Code of Federal Regulations 262.11 (Hazardous Waste Identification), 264 Subparts I (Container Management) and X (Miscellaneous Units – OB/OD), and 266.202 Subpart M – Military Munitions (Solid Waste Identification)	Remedial actions must appropriately identify and manage investigation-derived wastes and remedial wastes (that are hazardous wastes) stored onsite. If consolidated shots are performed, this can include measures such as post-demolition samples to document lack of, or measure the amount of, MC released.
Protection of Wetlands Executive Order No. 11990 [40 CFR Part 6, App. A]	Regulate federal actions that involve potential impacts on, or take place within, wetlands. Requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction, to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this executive order.
Fish and Wildlife Coordination Act [16 Unites States Code (United States Code) 661 et seq.; 40 CFR Section 6.302(g); 33 CFR Part 320]	Requires federal agencies involved in actions that will result in the control of structural modification of any stream or body of water for any purpose to take action to protect the fish and wildlife resources that may be affected by the action. Must consult with the Fish and Wildlife Service and the appropriate state agency to ascertain the means and measures necessary to mitigate, prevent, and compensate for project-related losses of wildlife resources and to enhance the resources.
TBC Information	
Toxicological profiles from the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.	
USEPA RSLs (USEPA, 2013b) for residential soil.	
USEPA ecological soil screening levels (EcoSSL; USEPA, 2013a), or if no EcoSSL is available, the ecological screening value from the EcoRisk Database (Los Alamos National Laboratory, 2012).	

EcoSSL = ecological soil screening level; MC = munitions constituents; OB/OD = open burn / open detonation; RCRA = Resource Conservation and Recovery Act; RSL = regional screening level; TBC = to be considered; U.S. = United States; USEPA = United States Environmental Protection Agency

The deepest single munitions-related item found during the RI at Walker Lake Land Test Range MRS was 4 feet below ground surface (bgs) within the High-Density Land Area; however, seven suspected burial pits were identified that may contain MEC at deeper depths. It is estimated that the maximum depth of the MEC hazard in the burial pit is 72 inches bgs. The deepest MEC item found at the Walker Lake Land Test Range MRS was 2 feet bgs. During the intrusive investigation within the Walker Lake Land Test Range MRS during the RI, 96% of all munitions-related items were found within the top 2 feet of soil.

CHAPTER 4 SCOPE AND ROLE OF RESPONSE ACTION

The overall remedial strategy for the Walker Lake Land Test Range MRS where MEC hazards were identified reflects the Army's desire to mitigate those hazards.

Consequently, the Preferred Alternative is designed to reduce the potential for munitions-related accidents through a combination of surface and subsurface MEC removal, land use controls, and educational awareness. The overall remedial strategy for the project site also reflects the BLM's desire to keep the project site open to the public.

CHAPTER 5 SUMMARY OF SITE HAZARDS AND RISKS

Site hazards and risks were evaluated in terms of an exposure model that consists of a source of contamination, a receptor, and interaction at the exposure point. The RI at the project site evaluated possible hazards associated with MEC and risks associated with constituents related to munitions. Based on the findings of the RI, the project site was determined to contain a source of MEC. Soil samples were collected and evaluated during the RI and during supplemental sampling conducted during the FS. Based on these samples, it was concluded that no unacceptable munitions constituent risk is present in the Walker Lake Land Test Range MRS.

At this project site, the source of contamination consists of surface and subsurface MEC. Potential receptors are BLM workers, HWAD workers, hunters, and recreational users. MEC has been found on the ground surface and in the subsurface. Recreational users (e.g., hunters, hikers) and site visitors could interact with surface MEC, whereas MEC in the subsurface is more likely to be encountered by BLM workers or HWAD workers performing intrusive activities (e.g., digging fence posts, replacing culverts, grading roads). The potential for being exposed to MEC varies according to the nature of the work/activity, ranging from contact with surface MEC to contacting MEC in the subsurface. MEC do not typically pose an appreciable threat to ecological receptors and DoD/USEPA MEC hazard assessment methodology does not assess potential MEC hazard for ecological receptors; therefore, ecological receptors are not included as a potentially exposed population at the project site.

MEC/MD densities in different areas of the project site are also important when evaluating the potential for exposure to MEC. Areas of relative MEC/MD density are presented in Figure 4; in areas with a higher relative MEC/MD density, a receptor (human) may have a greater chance of encountering MEC.

MUNITIONS AND EXPLOSIVES OF CONCERN HAZARD ASSESSMENT

A qualitative MEC hazard assessment (HA) was conducted using information from investigations completed at the project site to provide a baseline condition for comparison of response alternatives. The MEC HA considers the following factors:

- Presence and nature of MEC sources
- Site characteristics that affect potential pathways between the MEC source and human receptors

- Types of activities that may result in exposure

The MEC HA analysis is not designed to include underwater sites; therefore, the Water Area was not evaluated using the MEC HA method. The Low-Density Land Area and High-Density Land Area were evaluated separately using the MEC HA analysis. The MEC HA concluded that based on current conditions, the High-Density Land Area has a hazard level of "Highest Potential Explosive Hazard Conditions," while the Low-Density Land Area has a hazard level of "Moderate Potential Explosive Hazard Conditions." These two levels are the first- and third-highest of the four categories defined by the MEC HA. While the MEC HA is used to support the FS evaluation and remedy selection, it is not the decision tool for remedy selection. Also, as with the baseline scores, these total MEC HA scores and the associated hazard levels generated for each remedial alternative are *qualitative references only* and should ***not*** be interpreted as quantitative measures of explosive hazard. Results of the MEC HA are discussed in detail in the RI Reports and FS Report (Parsons, 2013a, 2013b, and 2014), which are each available in the Administrative Record File in the HWAD Environmental Office. The hazard level ratings determined for each alternative evaluated during the FS are included in Chapter 8 of this proposed plan.

CHAPTER 6 REMEDIAL ACTION OBJECTIVES

The overall remedial action objective (RAO) is to reduce the potential explosive hazards to ensure protection of human health and safety. Due to slight variations across the MRS with regard to potential MEC hazard, site conditions, and current/future use, specific RAOs have been developed for each area, described in Table 4. These RAOs define the measures for the success of the adopted remedial actions. The means for how the actions are implemented will be established during the future remedial design phase. The development of the RAOs is discussed in the FS Report (Parsons, 2014), which is available in the Administrative Record File in the HWAD Environmental Office.

Table 4
Remedial Action Objectives

Area	Media	Receptor	Objective
Land Area	Soil	Commercial/industrial workers	Zero accidents resulting from commercial/ industrial worker interaction with surface and subsurface MEC to 3 feet bgs
		Recreational users/site visitors	Zero accidents resulting from recreational user and site visitor interaction with surface and subsurface MEC to 1 foot bgs
Water Area	Soil (as it is exposed on the shoreline)	Commercial/industrial workers	Zero accidents resulting from commercial/ industrial worker interaction with surface and subsurface MEC to 3 feet bgs
		Recreational users/site visitors	Zero accidents resulting from recreational user and site visitor interaction with surface and subsurface MEC to 1 foot bgs
	Sediment	Commercial/industrial workers/recreational users/site visitors	Zero accidents resulting from commercial/ industrial worker, recreational user, and site visitor interaction with surface MEC

CHAPTER 7 SUMMARY OF REMEDIAL ALTERNATIVES

Because of the different site conditions and available remedial technologies, the FS assessed the Land Area and Water Area separately. Eleven Land Area remedial alternatives and six Water Area remedial alternatives were developed and evaluated during the FS for the project site. The Preferred Alternatives were identified as Land Alternative 8 for the Land Area (Land Use Controls [LUCs], Surface MEC Removal in the Low-Density Land Area, and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area) and Water Alternative 3 for the Water Area (LUCs with Shallow-Water Surface MEC Removal). The identified remedial alternatives use a combination of MEC removal and administrative procedures to develop remedial alternatives that will protect human health and reduce potential explosive hazards posed by MEC at the project site. Common elements used in development of the several remedial alternatives include:

- **Digital Geophysical Mapping:** DGM consists primarily of using geophysical instruments such as metal detectors and magnetometers to collect measurements and identify metal objects in the subsurface. Time-domain electromagnetic induction metal detectors (i.e., Geonics EM61-MK2) were successfully used for detection of subsurface metal during the RI at the project site. A high degree of confidence can be expected for successful

detection of munitions-related items with this method. Although these detection instruments can successfully find MEC, only a percentage of the anomalies identified result in MEC items being found. Various advanced electromagnetic induction (EMI) technologies (i.e., advanced classification) have been developed to differentiate better between buried MEC and anomalies that are caused by other metal debris or munitions debris not representing MEC. MetalMapper, an advanced classification EMI instrument, was used successfully during the treatability study for detection of MEC at the Walker Lake Land Test Range MRS. Currently, advanced classification technologies have not been developed for underwater use; therefore, advanced classification was not included for the Water Area. More detail on the differences between DGM using traditional and advanced classification EMI methods is in the Final FS Report (Parsons, 2014) for the project site.

- **Surface MEC Removal**: Surface MEC removal would include metal-detector-assisted visual inspection by UXO technicians of the surface of MRS for potential MEC. Suspected MEC identified on the surface would be removed and disposed of using demolition procedures, and other debris (including MD) would be inspected, certified, and shipped offsite for disposal. Typically, a surface MEC removal would only involve removing MEC found exposed, at least partially, on the surface. Using this method, it is likely that high winds would quickly expose MEC in the shallow subsurface. Therefore, for this project site, all surface MEC removal options include analog detection and removal of MEC to a depth of 1 foot bgs.

- **Subsurface MEC Removal**: Subsurface MEC removal involves using analog or digital instruments to identify possible MEC in the subsurface followed by digging to remove the suspected item from the ground. Analog surveys involve the detection of subsurface metallic anomalies using analog geophysical sensors. The anomalies detected using analog methods are generally either excavated immediately (the mag-and-dig method) or marked with pin flags for possible excavation later (the mag-and-flag method). Digital surveys involve the detection and mapping of anomalies using digital instruments (DGM). The data collected are then used to identify locations in which to return and excavate possible MEC items. UXO technicians, trained in the identification of munitions, would excavate each suspected MEC item and would identify and destroy any MEC items. As with surface MEC removal, other debris (including MD) would be inspected, certified as safe, and shipped offsite for disposal. For this project site, all subsurface MEC removal options include removal of MEC to a depth of 2 foot bgs, with the exception of the burial pits which will include removal to the vertical extent of the burial pits. A 2 foot removal depth was selected for protection of recreational users and site visitors. As indicated in the RAO (Table 4) the anticipated intrusive depth for this receptor group is 1 foot bgs. In addition, 96% of all munitions-related items were found during the RI were within the top 2 feet of soil. The MEC support provided under each alternative provides the protections necessary to meet the RAOs for the commercial/industrial worker with potential intrusive activities to 3 feet bgs.

- **LUCs, including MEC support**: LUCs can include administrative and legal controls as well as engineering and physical barriers that help minimize the potential for exposure to contamination. MEC support is an example of an activity and use restriction that falls under the administrative controls category

of LUCs. Onsite or on-call MEC support can be used during intrusive activities to protect workers from potentially contacting MEC in the subsurface. Onsite MEC support would include UXO technicians working onsite to conduct sweeps to detect MEC before any planned construction and before or during any intrusive activities, whereas on-call MEC support involves support from UXO technicians who are available to respond if site personnel encounter a possible munitions-related hazard. With on-call support, the personnel conducting intrusive activities require UXO recognition training before initiating operations. Signs and buoys can be used to remind visitors of access restrictions or the requirement to use MEC support.

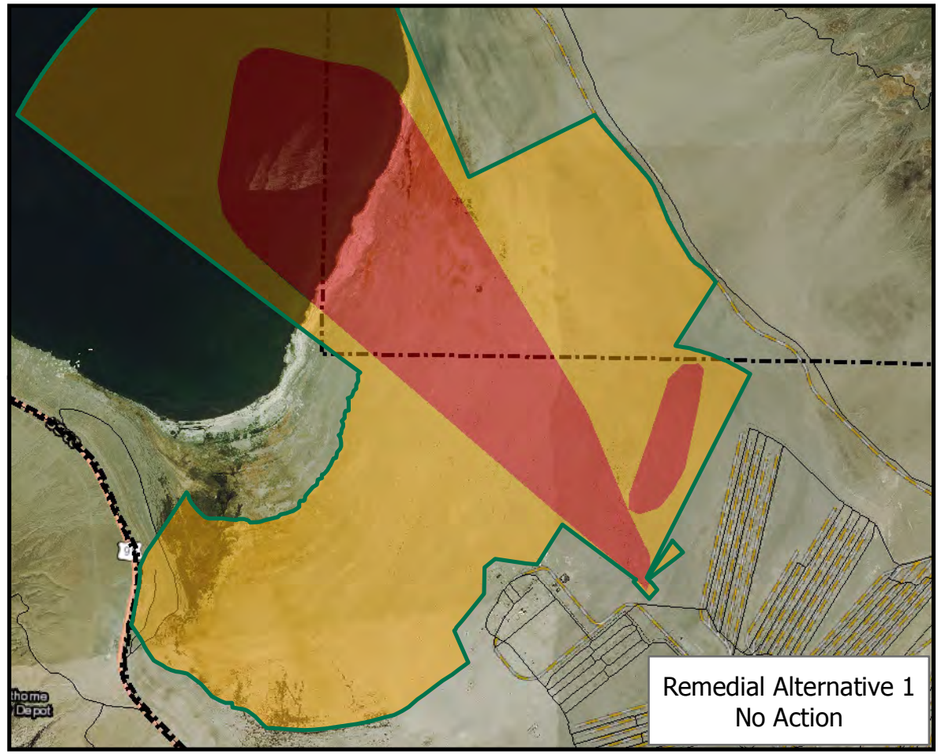
- **Educational Awareness**: Educational awareness programs are implemented with the goal of influencing behavior to reduce the risk of exposure and reduce the impact if exposure occurs. The educational awareness program included in the remedial alternatives outlined for this project site would consist of developing educational tools and materials (e.g., pamphlets).

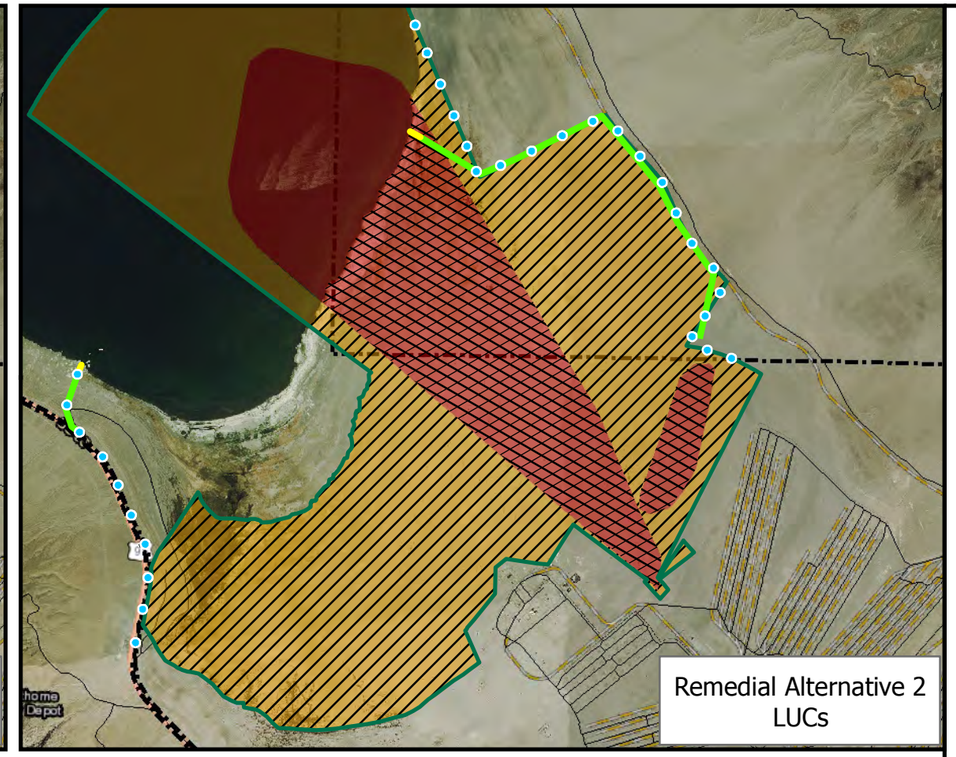
- **Five-Year Reviews**: Though not a remedial alternative, five-year reviews are included with some of the remedial alternatives. Five-year reviews are required for sites where hazardous substances, pollutants, or contaminants remain at a site above levels that allow unlimited use and unrestricted exposure following the completion of remedy. Five-year reviews would be conducted to determine if the selected response action continues to minimize human health risks and continues to be protective of human health, safety, and the environment. If new information arises concerning contamination conditions at the site or if land uses change beyond what has been assumed, the evaluation of remedial alternatives may need to be revisited.

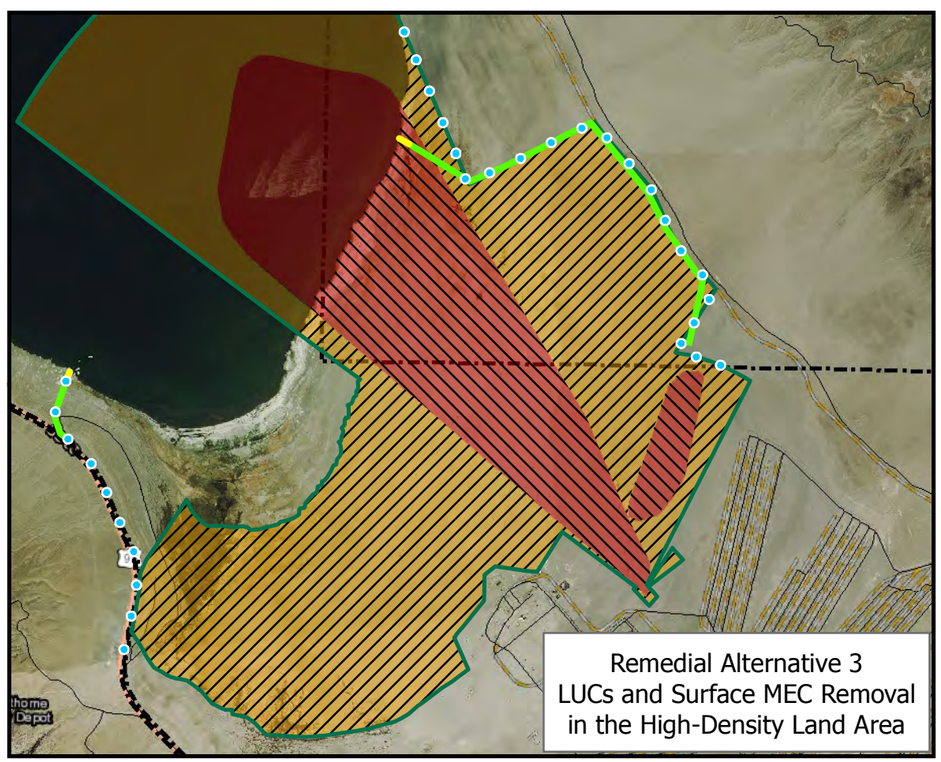
Figures 5a and 5b shows the major components of the 11 remedial alternatives developed for the Land Area of the Walker Lake Land Test Range MRS. Figure 6 shows the major components of the six remedial alternatives developed for the Water Area of the Walker Lake Land Test Range MRS. Descriptions of the remedial alternatives developed for consideration are presented below.

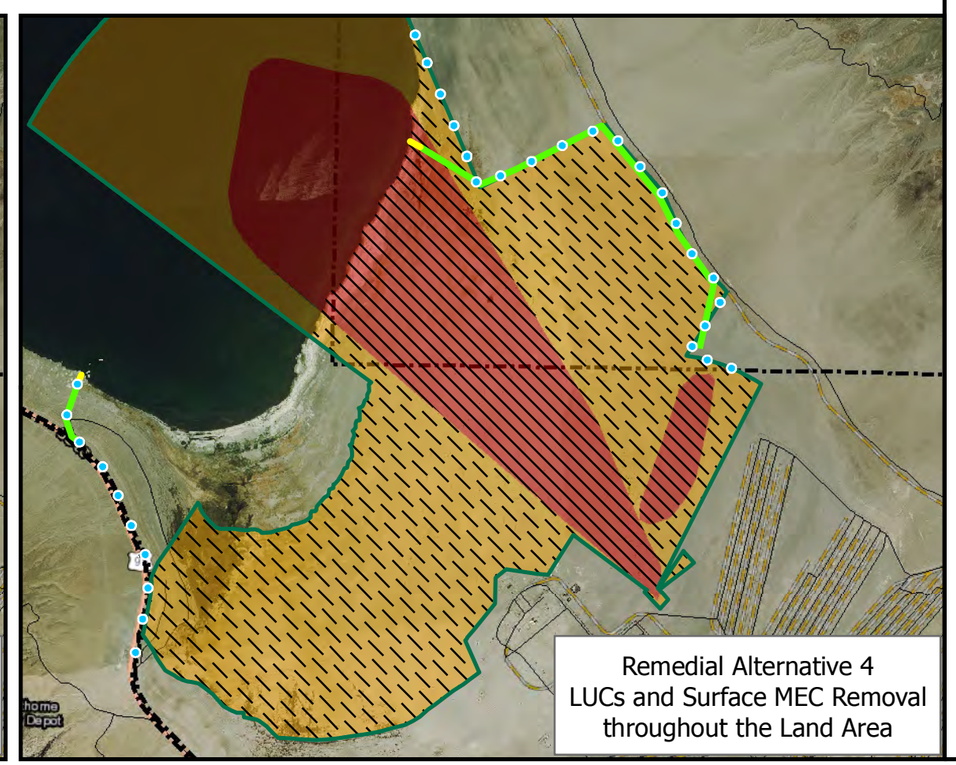
Figure 5a

Land Area Remedial Alternatives









Legend

- Signs*
- New Fence**
- Existing Fence
- On-Call MEC Support
- Onsite MEC Support
- Surface MEC Removal (1 foot bgs) Using Analog Detection Methods; On-Call MEC Support
- Surface MEC Removal (1 foot bgs) Using Analog Detection Methods; Onsite MEC Support
- Low-Density Area
- High-Density Area
- Walker Lake Land Test Range MRS
- HWAD Boundary

*Signs will be placed along the areas indicated at a spacing of 200 feet.

**The existing fence will be extended to the shoreline.

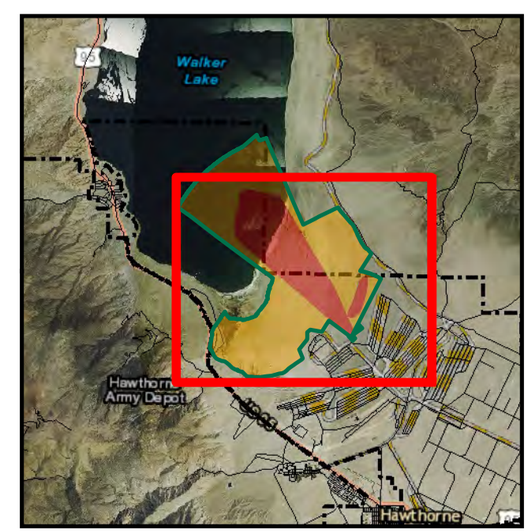


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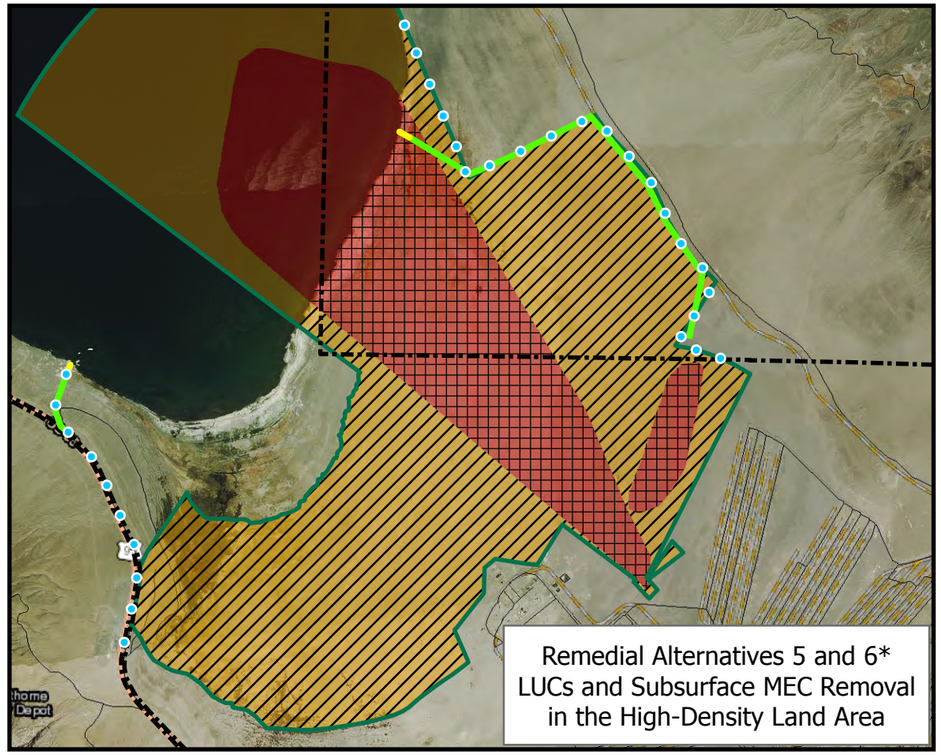
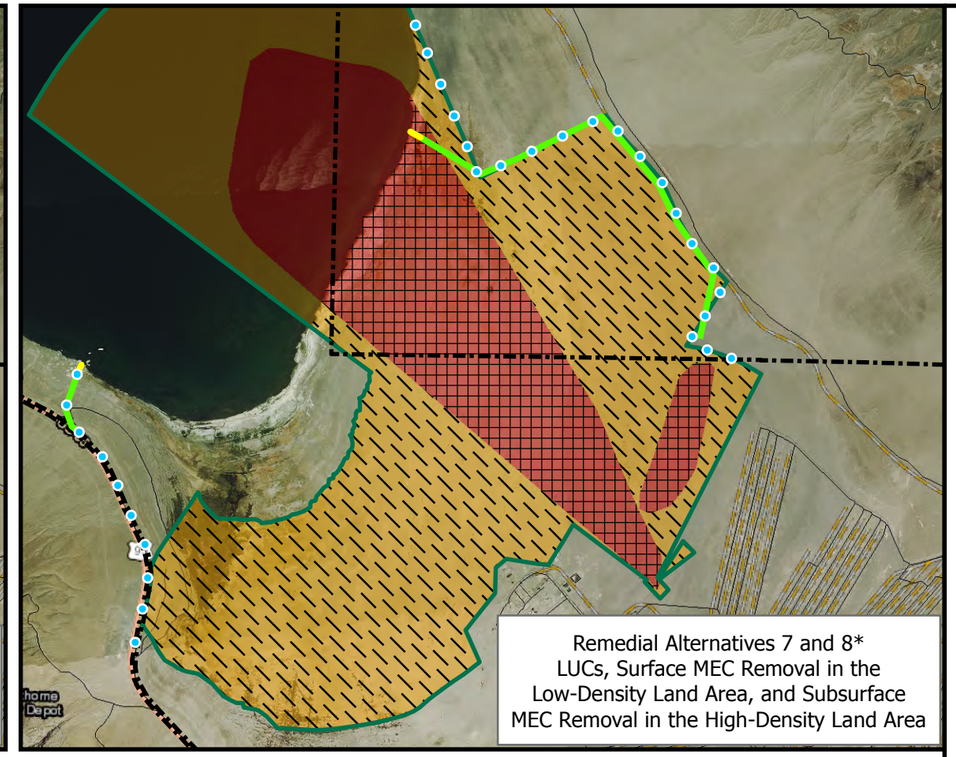
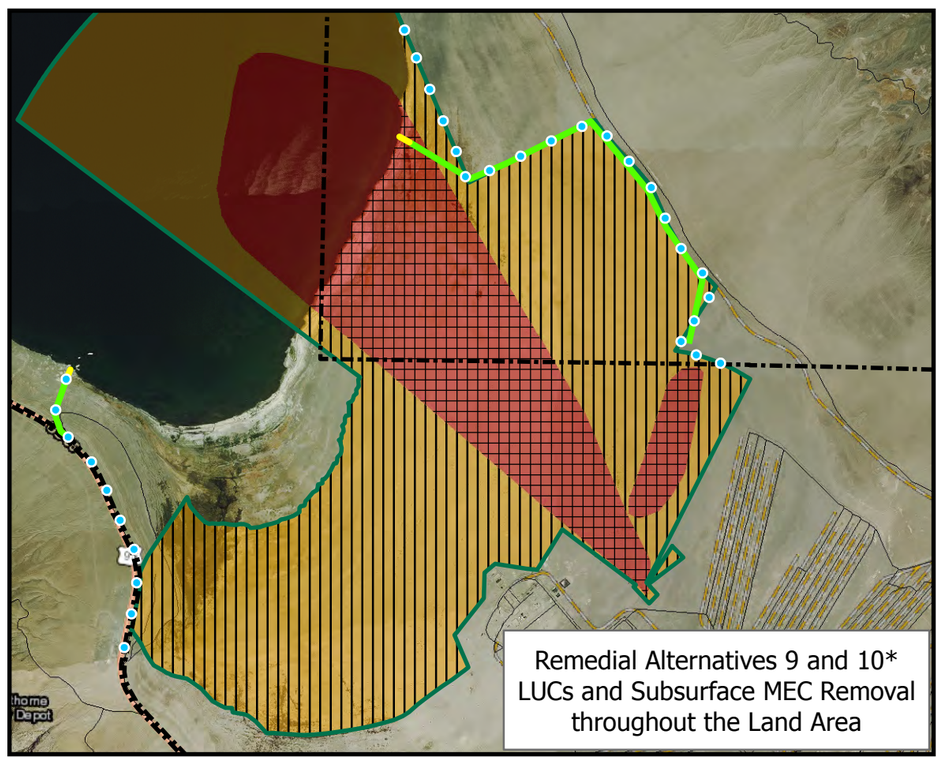
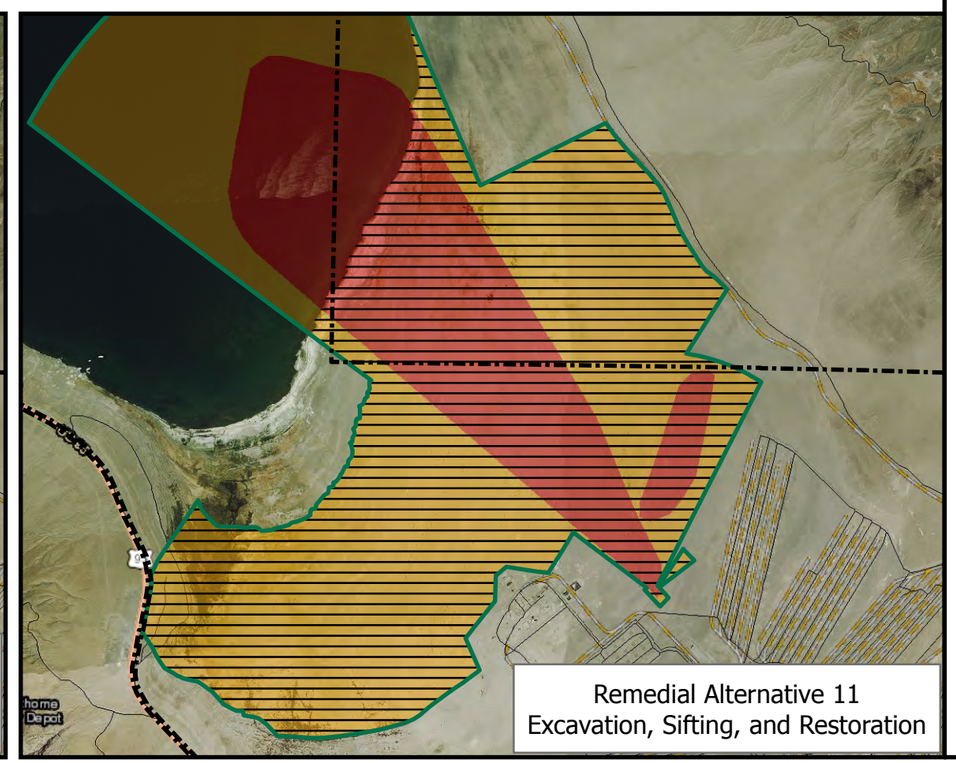
Figure 5b

Land Area Remedial Alternatives









Legend

- Signs**
- New Fence***
- Existing Fence
- On-Call MEC Support
- Surface MEC Removal (1 foot bgs) Using Analog Detection Methods; On-Call MEC Support
- Subsurface MEC Removal (2 feet bgs); Onsite MEC Support
- Subsurface MEC Removal (2 feet bgs); On-Call MEC Support
- Excavate, Sift, and Restore
- Low-Density
- High-Density
- Walker Lake Land Test Range MRS
- HWAD Boundary

*For Alternatives 6, 8, and 10, subsurface MEC removal includes the use of advanced classification DGM methods.
**Signs will be placed along the areas indicated at a spacing of 200 feet.
***The existing fence will be extended to the shoreline.

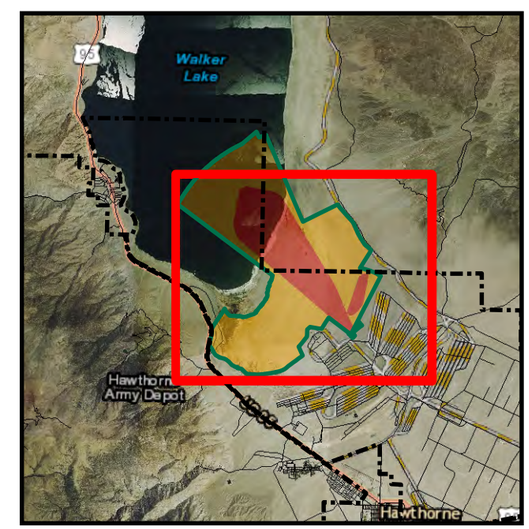


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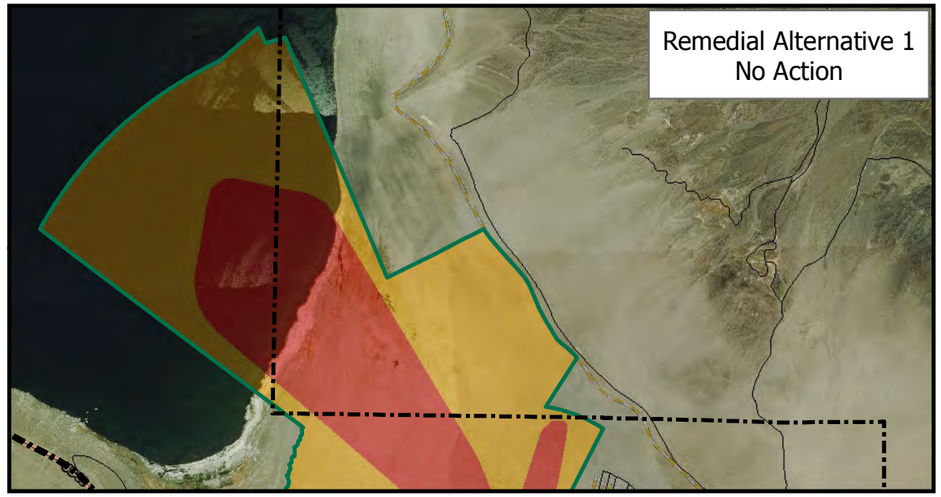
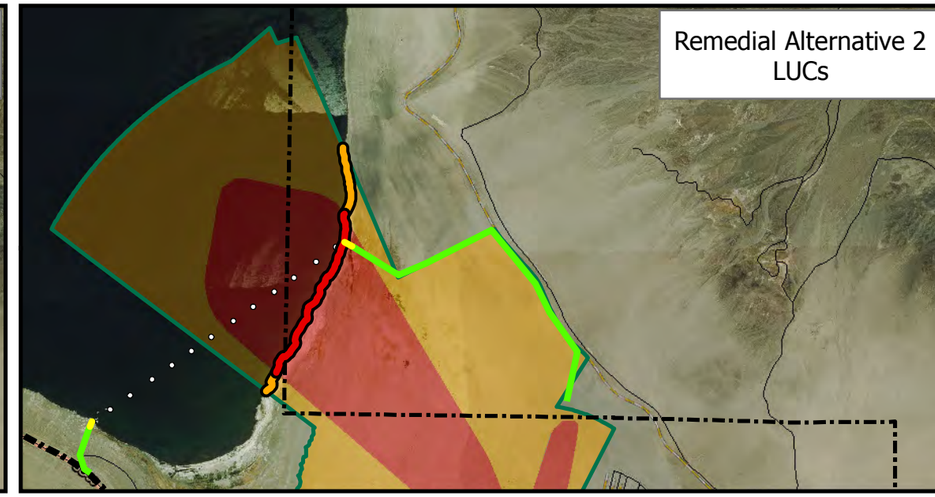
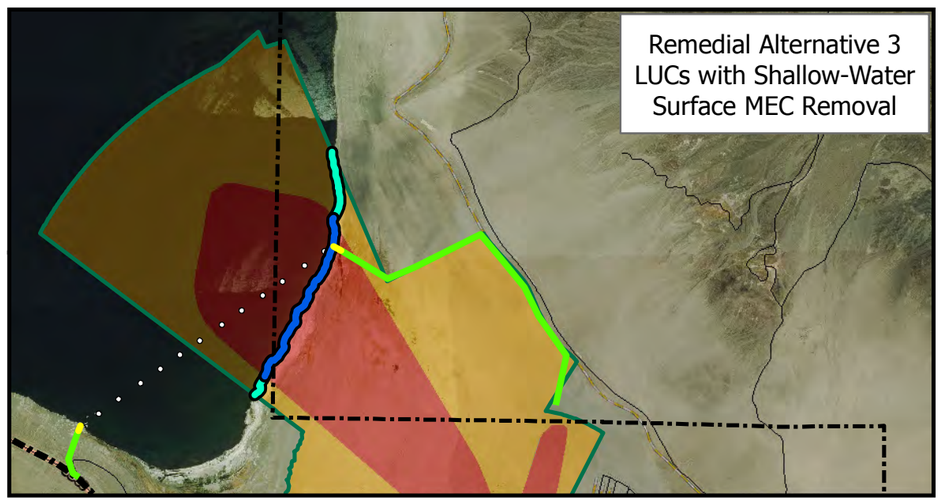
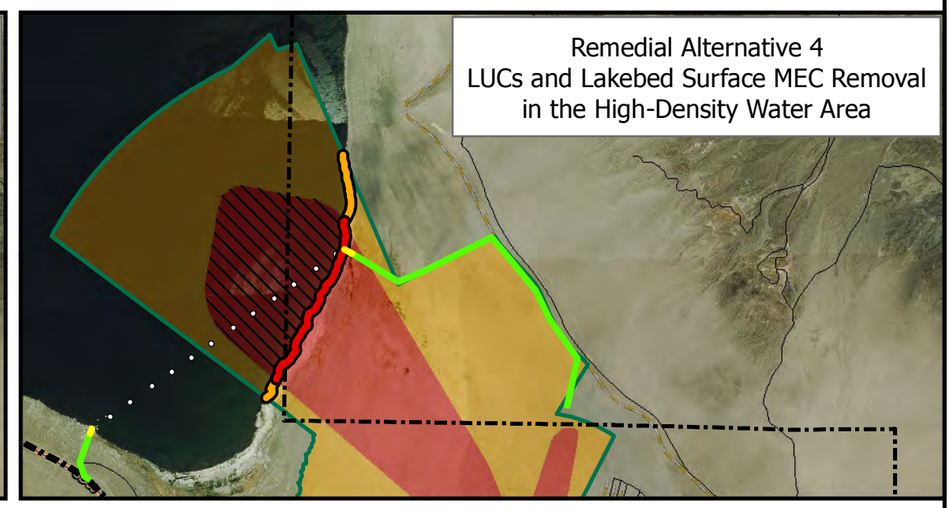
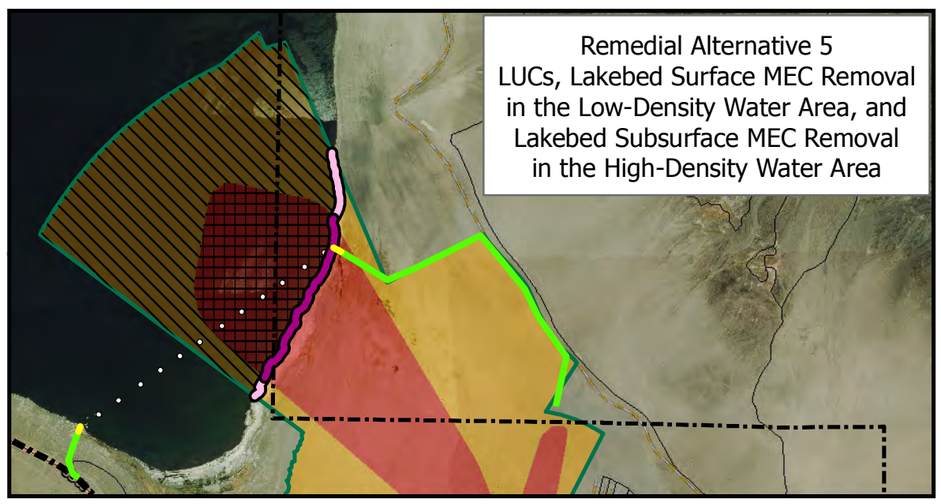
Figure 6
Water Area Remedial Alternatives

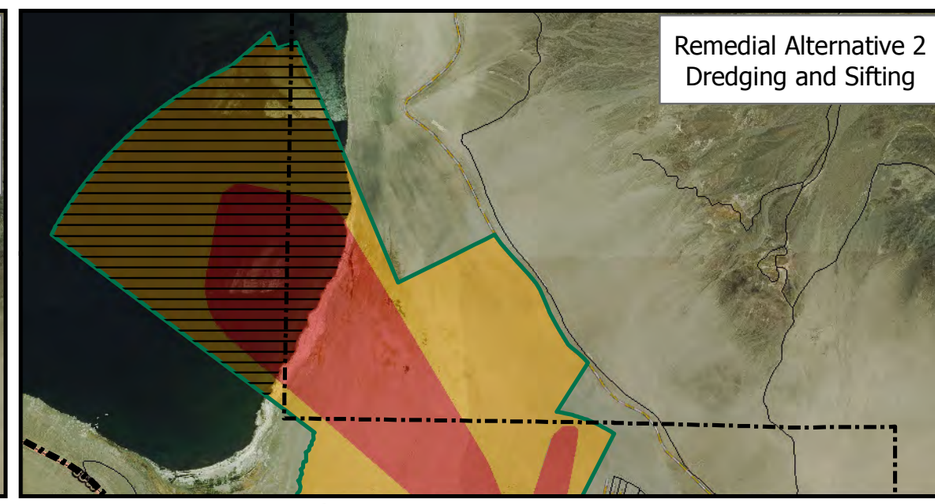








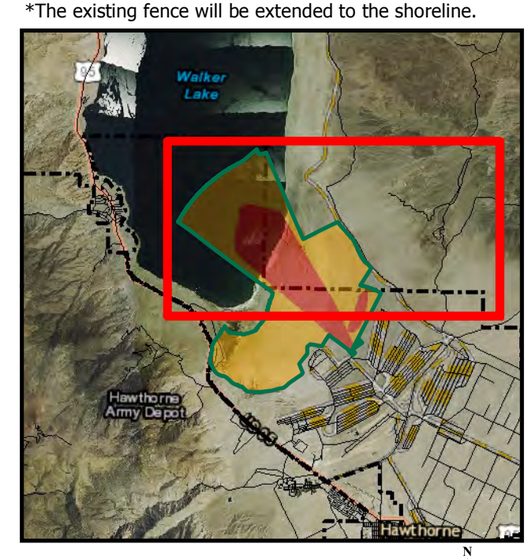




Legend

- Buoys
- New Fence*
- Existing Fence
- Onsite MEC Support; Periodic Surface Sweep (1 foot bgs)
- On-Call MEC Support; Periodic Surface Sweep (1 foot bgs)
- Onsite MEC Support; Shallow-Water Surface Sweep (1 foot bgs); Periodic Shoreline Surface Sweep (1 foot bgs)
- On-Call MEC Support; Shallow-Water Surface Sweep (1 foot bgs); Periodic Shoreline Surface Sweep (1 foot bgs)
- Onsite MEC Support
- On-Call MEC Support
- Surface MEC Removal (1 foot bgs)
- Surface and Subsurface MEC Removal (2 feet bgs)
- Dredge and Sift
- Low-Density
- High-Density
- Walker Lake Land Test Range MRS
- HWAD Boundary

*The existing fence will be extended to the shoreline.



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LAND ALTERNATIVE 1: NO ACTION

The No Action alternative means that remedial action would not be implemented to reduce the potential explosive safety hazards posed by MEC. This alternative, if implemented, would involve continued use of the site in its current condition.

Estimated capital cost: $0
Estimated operations and maintenance (O&M) cost for 30 years: $0
Estimated periodic costs for 30 years: $0
Estimated present worth cost: $0
Estimated construction timeframe: Not applicable

LAND ALTERNATIVE 2: LUCS

Under this alternative, administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment. Before the detailed analysis of the remedial alternatives, each was screened to identify any alternatives that should be eliminated for consideration due to effectiveness, implementability, or cost. Land Alternative 2 was screened out because this alternative would not be effective at protecting human health; therefore, cost estimates were not produced for this alternative. For more information on the alternative screen process, see Section 4.4 in the FS report for the Walker Lake Land Test Range MRS (Parsons, 2014).

Estimated capital cost: Not applicable
Estimated O&M cost for 30 years: Not applicable
Estimated periodic costs for 30 years: Not applicable
Estimated present worth cost: Not applicable
Estimated construction timeframe: Not applicable

LAND ALTERNATIVE 3: LUCS AND SURFACE MEC REMOVAL IN THE HIGH-DENSITY LAND AREA

Under this alternative, surface MEC removal would be conducted in the High-Density Land Area. Due to the potential for movement of site soils from wind and water, the surface MEC removal would be conducted to a depth of 1 foot bgs. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $11,567,000
Estimated O&M cost for 30 years: $1,974,000

Estimated periodic costs for 30 years: $288,000
Estimated present worth: $13,180,000
Estimated construction timeframe: 2 years

LAND ALTERNATIVE 4: LUCS AND SURFACE MEC REMOVAL THROUGHOUT THE LAND AREA

Under this alternative, surface MEC removal to 1 foot bgs would be conducted within the entire Land Area. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $31,701,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $32,560,000
Estimated construction timeframe: 4 years

LAND ALTERNATIVE 5: LUCS AND SUBSURFACE MEC REMOVAL IN THE HIGH-DENSITY LAND AREA

Under this alternative, subsurface MEC removal would be conducted in the High-Density Land Area to a depth of 2 feet bgs. In addition, subsurface MEC removal would be conducted at each of the seven suspected burial pits to a depth necessary to reach the full extent of the pit and collect confirmation MC samples below each pit. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $36,670,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $37,470,000
Estimated construction timeframe: 4 years

LAND ALTERNATIVE 6: LUCS AND SUBSURFACE MEC REMOVAL USING ADVANCED CLASSIFICATION DGM IN THE HIGH-DENSITY LAND AREA

Land Alternative 6 would involve all components of Land Alternative 5 and also include the use of advanced classification DGM methods during the subsurface

MEC removal to 2 feet bgs. The use of advanced classification DGM should reduce the number of anomalies excavated by identifying those that resemble MEC items. It is estimated that the dig list would be reduced by 78% using advanced classification DGM, leading to significantly less intrusive work. Based on these assumptions, this technology could significantly reduce MEC removal cost and provide more cost-effective hazard reduction. Because the advanced classification method focuses on removing MEC items rather than all metal debris, Land Alternative 6 should achieve the same level of protection of human health as Land Alternative 5, at a better value.

Estimated capital cost: $29,309,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $30,510,000
Estimated construction timeframe: 3 years

LAND ALTERNATIVE 7: LUCS, SURFACE MEC REMOVAL IN THE LOW-DENSITY LAND AREA, AND SUBSURFACE MEC REMOVAL IN THE HIGH-DENSITY LAND AREA

Under this alternative, subsurface MEC removal would be conducted in the High-Density Land Area to a depth of 2 feet bgs and surface MEC removal would be conducted in the Low-Density Area to a depth of 1 foot bgs. In addition, subsurface MEC removal would be conducted at each of the seven identified burial pits to a depth necessary to reach the full extent of the pit and collect confirmation MC samples below each pit. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $55,826,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $55,180,000
Estimated construction timeframe: 6 years

LAND ALTERNATIVE 8: LUCS, SURFACE MEC REMOVAL IN THE LOW-DENSITY LAND AREA, AND SUBSURFACE MEC REMOVAL USING ADVANCED CLASSIFICATION DGM IN THE HIGH-DENSITY LAND AREA

Land Alternative 8 would involve all components of Land Alternative 7 and also include the use of advanced classification DGM methods during the subsurface MEC removal to 2 feet bgs. The use of advanced classification DGM should reduce the number of anomalies excavated by identifying those that resemble MEC items. It is estimated that the dig list would be reduced by 78% using advanced classification DGM, leading to significantly less intrusive work. Based on these

assumptions, this technology could significantly reduce MEC removal cost and provide more cost-effective hazard reduction. Because the advanced classification method focuses on removing MEC items rather than all metal debris, Land Alternative 8 should achieve the same level of protection of human health as Land Alternative 7, at a better value.

Estimated capital cost: $48,466,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $48,560,000
Estimated construction timeframe: 5 years

LAND ALTERNATIVE 9: LUCS AND SUBSURFACE MEC REMOVAL THROUGHOUT THE LAND AREA

Under this alternative, subsurface MEC removal would be conducted throughout the Land Area to a depth of 2 feet bgs. In addition, subsurface MEC removal would be conducted at each of the seven identified burial pits to a depth necessary to reach the full extent of the pit and collect confirmation MC samples below each pit. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the High-Density Land Area and on-call MEC support for intrusive activities in the Low-Density Land Area. Existing fences would be extended and maintained, signs would be installed around the Land Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $65,030,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000
Estimated present worth: $63,970,000
Estimated construction timeframe: 6 years

LAND ALTERNATIVE 10: LUCS AND SUBSURFACE MEC REMOVAL USING ADVANCED CLASSIFICATION DGM THROUGHOUT THE LAND AREA

Land Alternative 10 would involve all components of Land Alternative 9 and also include the use of advanced classification DGM methods during the subsurface MEC removal to 2 feet bgs. The use of advanced classification DGM should reduce the number of anomalies excavated by identifying those that resemble MEC items. It is estimated that the dig list would be reduced by 78% using advanced classification DGM, leading to significantly less intrusive work. Based on these assumptions, this technology could significantly reduce MEC removal cost and provide more cost-effective hazard reduction. Because the advanced classification method focuses on removing MEC items rather than all metal debris, Land Alternative 10 should achieve the same level of protection of human health as Land Alternative 9, at a better value.

Estimated capital cost: $56,287,000
Estimated O&M cost for 30 years: $1,974,000
Estimated periodic costs for 30 years: $288,000

Estimated present worth: $56,100,000
Estimated construction timeframe: 5 years

LAND ALTERNATIVE 11: EXCAVATION, SIFTING, AND RESTORATION

This alternative would use excavation and sifting of soil to remove MEC from the entire project site. Rather than use metal detectors to identify specific subsurface metallic items and excavate them, this alternative would use armored heavy equipment to remove all soil within the area and process the soil through a mechanical sifter to remove MEC and other debris. The excavation would go to a depth necessary to reach to bedrock or a maximum of 6 feet bgs. Land Alternative 11 would also include removal to the full extent of each of the seven suspected burial pits. Under this alternative, all existing vegetation would be cleared during excavation of site soils.

All excavated soils would be processed through a mechanical sifter by trained UXO technicians to segregate large items from the soil and screen them for MEC. Engineering controls or evacuation may be needed when working close to roads. After soil is screened and all munitions-related debris and MEC are removed, the areas would be backfilled. Upon completion of backfilling, these areas would be restored as close as practicable to their original condition.

Estimated capital cost: $3,321,476,000
Estimated O&M cost for 34 years: $0
Estimated periodic costs for 35 years: $0
Estimated present worth: $2,477,000,000
Estimated construction timeframe: 34 years

WATER ALTERNATIVE 1: NO ACTION

The No Action alternative means that remedial action would not be implemented to reduce the potential explosive safety hazards posed by MEC. This alternative, if implemented, would involve continued use of the site in its current condition.

Estimated capital cost: $0
Estimated operations and maintenance (O&M) cost for 30 years: $0
Estimated periodic costs for 30 years: $0
Estimated present worth cost: $0
Estimated construction timeframe: Not applicable

WATER ALTERNATIVE 2: LUCS

Under this alternative, administrative procedures and policies would be used to restrict intrusive activities, including boating, within the Water Area and require onsite MEC support during all intrusive activities in the shoreline High-Density Area and on-call MEC support for intrusive activities in the shoreline Low-Density Area. Existing fences would be extended and maintained, signs and buoys would be installed around the Water Area, and an educational awareness campaign would be implemented. Periodic shoreline sweeps would be conducted to a depth of 1 foot bgs to clear MEC from the surface as the shoreline is exposed by retreating water levels. Five-year reviews would be conducted to determine if the response

action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $126,000
Estimated O&M cost for 30 years: $23,261,000
Estimated periodic costs for 30 years: $446,000
Estimated present worth: $18,400,000
Estimated construction timeframe: 0 years

WATER ALTERNATIVE 3: LUCS WITH SHALLOW-WATER SURFACE MEC REMOVAL

Under this alternative, surface MEC removal would be conducted from the surface of the lakebed to 1 foot bgs in the Water Area from the edge of the shoreline to a depth of 2 feet of water within the Water Area, including any rockets protruding from deeper water. Administrative procedures and policies would be used to restrict intrusive activities, including boating, within the Water Area and require onsite MEC support during all intrusive activities in the shoreline High-Density Area and on-call MEC support for intrusive activities in the shoreline Low-Density Area. Existing fences would be extended and maintained, signs and buoys would be installed around the Water Area, and an educational awareness campaign would be implemented. During the long term management phase, beginning after the initial MEC removal, periodic shoreline sweeps would be conducted to a depth of 1 foot bgs to clear MEC from the surface as the shoreline is exposed by retreating water levels. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $126,000
Estimated O&M cost for 30 years: $24,139,000
Estimated periodic costs for 30 years: $446,000
Estimated present worth: $19,270,000
Estimated construction timeframe: 1 year

WATER ALTERNATIVE 4: LUCS AND LAKEBED SURFACE MEC REMOVAL IN THE HIGH-DENSITY WATER AREA

Under this alternative, surface MEC removal would be conducted from the surface of the lakebed to 1 foot bgs within the High-Density Water Area. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the shoreline High-Density Area and on-call MEC support for intrusive activities in the shoreline Low-Density Area. Existing fences would be extended and maintained, signs and buoys would be installed around the Water Area, and an educational awareness campaign would be implemented. Periodic shoreline sweeps would be conducted to a depth of 1 foot bgs in the Low-Density Water Area to clear MEC from the surface as the shoreline is exposed by retreating water levels. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $733,807,000
Estimated O&M cost for 30 years: $7,365,000

Estimated periodic costs for 30 years: $446,000
Estimated present worth: $639,700,000
Estimated construction timeframe: 17 years

WATER ALTERNATIVE 5: LUCS, LAKEBED SURFACE MEC REMOVAL IN THE LOW-DENSITY WATER AREA, AND LAKEBED SUBSURFACE MEC REMOVAL IN THE HIGH-DENSITY WATER AREA

Under this alternative, subsurface MEC removal would be conducted from the surface of the lakebed to 2 feet bgs within the High-Density Water Area and surface MEC removal would be conducted from the surface of the lakebed to 1 foot bgs in the Low-Density Water Area. Administrative procedures and policies would be used to restrict intrusive activity and require onsite MEC support during all intrusive activities in the shoreline High-Density Area and on-call MEC support for intrusive activities in the shoreline Low-Density Area. Existing fences would be extended and maintained, signs and buoys would be installed around the Water Area, and an educational awareness campaign would be implemented. Five-year reviews would be conducted to determine if the response action continues to minimize potential explosive safety hazards and continues to be protective of human health, safety, and the environment.

Estimated capital cost: $1,852,114,000
Estimated O&M cost for 47 years: $834,000
Estimated periodic costs for 47 years: $669,000
Estimated present worth: $1,243,000,000
Estimated construction timeframe: 47 years

WATER ALTERNATIVE 6: DREDGING AND SIFTING

This alternative would use dredging and sifting of lakebed sediment to remove MEC from the entire Water Area to a depth of 6 feet bgs. Rather than use metal detectors to identify specific subsurface metallic items and excavate them, this alternative would use dredging to remove all sediment within the area and process it through a mechanical sifter to remove MEC and other debris. The dredging would go to a depth necessary to reach bedrock or a maximum of 6 feet bgs. All excavated sediment would be processed through a mechanical sifter by trained UXO technicians to segregate large items from the sediment and screen them for MEC. Engineering controls or evacuation may be needed when working close to roads. After sediment is screened and all munitions-related debris and MEC are removed, the areas would be backfilled. Upon completion of backfilling, these areas would be restored as close as practicable to their original condition.

Estimated capital cost: $2,854,718,000
Estimated O&M cost for 18 years: $0
Estimated periodic costs for 18 years: $0
Estimated present worth: $2,444,000,000
Estimated construction timeframe: 18 years

CHAPTER 8 EVALUATION OF ALTERNATIVES

The rationale for selecting the Preferred Alternatives was based on nine criteria used to compare alternatives to one another in a detailed analysis (Table 5). The nine criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria:

- Threshold criteria are requirements that each alternative must meet to be eligible for selection.
- Primary balancing criteria are used to weigh major tradeoffs among alternatives.
- Modifying criteria may be considered to the extent that information is available during the FS, but they can be fully considered only after public comment is received on the Proposed Plan. In the final balancing of tradeoffs between alternatives upon which the final remedy selection is based, modifying criteria are of equal importance to the balancing criteria.

Tables 6 and 7 evaluate the threshold criteria and primary balancing criteria. In addition, the MEC HA hazard level ratings determined for each of the land alternative are in Tables 6. The MEC HA method is not appropriate for evaluating hazards associated with underwater MEC; therefore, the Water Area of the project site is not evaluated using the MEC HA method.

Table 5
Evaluation Criteria for Superfund Remedial Alternatives

Criteria	Threshold	**Overall protectiveness of human health and the environment** determines if an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
		Compliance with applicable or relevant and appropriate requirements evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
	Primary Balancing	**Long-term effectiveness and permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
		Reduction of toxicity, mobility, or volume of contaminants through treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
		Short-term effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
		Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
		Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
	Modifying	**State/support agency acceptance** considers whether the state agrees with the Army's analyses and recommendations, as described in the RI/FS and Proposed Plan.
		Community acceptance considers whether the local community agrees with the Army's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

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Table 6
Evaluation of Land Area Alternatives Using Threshold and Primary Balancing Criteria

	Criteria	Land Alternative 1 (1)	Land Alternative 3	Land Alternative 4	Land Alternative 5	Land Alternative 6
		No Action	**LUCs and Surface MEC Removal in the High-Density Land Area**	**LUCs and Surface MEC Removal throughout the Land Area**	**LUCs and Subsurface MEC Removal in the High-Density Land Area**	**LUCs and Subsurface MEC Removal Using Advanced Classification Digital Geophysical Mapping (DGM) in the High-Density Land Area**
Supporting Information	**MEC Hazard Assessment Hazard Level – High-Density Land Area**	Highest potential explosive hazard conditions.	Moderate potential explosive hazard conditions.	Moderate potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.
	MEC Hazard Assessment Hazard Level – Low-Density Land Area	Moderate potential explosive hazard conditions.	Moderate potential explosive hazard conditions.	Low potential explosive hazard conditions.	Moderate potential explosive hazard conditions.	Moderate potential explosive hazard conditions.
Threshold Criteria	**Protectiveness**	Not protective of human health or environment; does not achieve RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.
	ARARs Compliance and To Be Considered Criteria	Identified ARAR does not apply.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.
Primary Balancing Criteria	**Effectiveness and Permanence**	Not effective over long term.	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs.
	Reduction of Toxicity, Mobility, or Volume	No reduction in source of wastes.	Some reduction in TMV of wastes (surface MEC removal to 1 foot bgs in High-Density Area only).	Partial reduction in TMV of wastes (surface MEC removal to 1 foot bgs in the entire MRS).	Substantial reduction in TMV of wastes (subsurface removal and surface removal in High-Density Area only).	Substantial reduction in TMV of wastes (subsurface removal and surface removal in High-Density Area only).
	Short-Term Effectiveness	No short-term hazards to workers or the surrounding area.	Short-term hazards to workers and the surrounding area (associated with surface MEC removal and LUC installation).	Short-term hazards to workers and the surrounding area (associated with surface MEC removal and LUC installation).	Short-term hazards to workers and the surrounding area (associated with subsurface MEC removal and LUC installation).	Short-term hazards to workers and the surrounding area (associated with subsurface MEC removal and LUC installation).
	Implementability	Readily implementable (no actions required).	Readily implementable (uses well-established technologies); subsurface removal in High-Density Area more likely to gain approval than surface removal and LUCs only; however, less likely to gain approval than subsurface removal throughout MRS.	Readily implementable (uses well-established technologies).	Readily implementable (uses well-established technologies); subsurface removal within the High-Density Area is likely to gain approval; however, less likely than alternatives that include MEC removal in the Low-Density Area.	Readily implementable (uses established technologies); subsurface removal within the High-Density Area is likely to gain approval; however, less likely than alternatives that include MEC removal in the Low-Density Area.
	Total Present Value Cost	$0	$13,180,000	$32,560,000	$37,470,000	$30,510,000

(1) Alternative 2 was screened out during the screening of individual alternatives (Section 4.4; Parsons, 2014) because LUCs alone would not be protective of human health.

ARAR = applicable or relevant and appropriate requirement; LUC = land use control; MEC = munitions and explosives of concern; MRS = munitions response site; RAO = remedial action objective; TBC = to be considered; TMV = toxicity, mobility, or volume

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Table 6 (continued)
Evaluation of Land Area Alternatives Using Threshold and Primary Balancing Criteria

	Criteria	Land Alternative 7	Land Alternative 8 (2)	Land Alternative 9	Land Alternative 10	Land Alternative 11
		LUCs, Surface MEC Removal in the Low-Density Land Area, and Subsurface MEC Removal in the High-Density Land Area	LUCs, Surface MEC Removal in the Low-Density Land Area, and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area	LUCs and Subsurface MEC Removal throughout the Land Area	LUCs and Subsurface MEC Removal Using Advanced Classification DGM throughout the Land Area	Excavation, Sifting, and Restoration
Supporting Information	**MEC Hazard Assessment Hazard Level – High-Density Land Area**	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.
Supporting Information	**MEC Hazard Assessment Hazard Level – Low-Density Land Area**	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.	Low potential explosive hazard conditions.
Threshold Criteria	**Protectiveness**	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO and allows unrestricted land use.
Threshold Criteria	**ARARs Compliance and To Be Considered Criteria**	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.
Primary Balancing Criteria	**Effectiveness and Permanence**	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs.	Highly effective over long term	Highly effective over long term	Highly effective over long term.
Primary Balancing Criteria	**Reduction of Toxicity, Mobility, or Volume**	Substantial reduction in TMV of wastes (surface and subsurface MEC removal to 2 feet bgs in High-Density Area and surface MEC removal to 1 foot bgs in Low-Density Area).	Substantial reduction in TMV of wastes (surface and subsurface MEC removal to 2 feet bgs in High-Density Area and surface MEC removal to 1 foot bgs in Low-Density Area).	Achieves nearly complete reduction in TMV of wastes (surface and subsurface removal in entire MRS).	Achieves nearly complete reduction in TMV of wastes (surface and subsurface removal in entire MRS).	Provides complete reduction in TMV of wastes (surface and subsurface removal in entire MRS).
Primary Balancing Criteria	**Short-Term Effectiveness**	Short-term hazards to workers and the surrounding area (associated with surface and subsurface MEC removal and LUC installation).	Short-term hazards to workers and the surrounding area (associated with surface and subsurface MEC removal and LUC installation).	Short-term hazards to workers and the surrounding area (associated with subsurface MEC removal).	Short-term hazards to workers and the surrounding area (associated with subsurface MEC removal).	High short-term hazards to workers and the surrounding area (associated heavy excavation and sifting of soils containing MEC).
Primary Balancing Criteria	**Implementability**	Readily implementable (uses well-established technologies); subsurface removal to 2 feet bgs in High-Density Area and surface MEC removal to 1 foot bgs in the Low-Density Area is more likely to gain approval than surface MEC removal to 1 foot bgs in the High-Density Area and LUCs only in the Low-Density Area.	Readily implementable (uses established technologies); subsurface removal to 2 feet bgs in High-Density Area and surface MEC removal to 1 foot bgs in the Low-Density Area is more likely to gain approval than surface MEC removal to 1 foot bgs in the High-Density Area and LUCs only in the Low-Density Area.	Readily implementable (uses well-established technologies); likely to gain approval.	Readily implementable (uses established technologies); likely to gain approval.	Implementable (uses well-established technologies); subsurface removal throughout MRS. Less likely to gain approval due to negative impact on site conditions.
Primary Balancing Criteria	**Total Present Value Cost**	$55,180,000	$48,560,000	$63,970,000	$56,100,000	$2,477,000,000

(2) Shaded column indicates the most practicable solution for reducing the MEC hazard at the site.

ARAR = applicable or relevant and appropriate requirement; LUC = land use control; MEC = munitions and explosives of concern; MRS = munitions response site; RAO = remedial action objective; TBC = to be considered; TMV = toxicity, mobility, or volume

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Table 7
Evaluation of Water Area Alternatives Using Threshold and Primary Balancing Criteria

	Criteria	Water Alternative 1	Water Alternative 2	Water Alternative 3	Water Alternative 4	Water Alternative 5	Water Alternative 6
		No Action Alternative	LUCs	LUCs with Shallow-Water Surface MEC Removal	LUCs and Lakebed Surface MEC Removal in the High-Density Water Area	LUCs, Lakebed Surface MEC Removal in the Low-Density Water Area, and Lakebed Subsurface MEC Removal in the High-Density Water Area	Dredging and Sifting
Threshold Criteria	**Protectiveness**	Not protective of human health or environment; does not achieve RAO	Protective of human health and environment; achieves RAO	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO.	Protective of human health and environment; achieves RAO and allows unrestricted land use.
Threshold Criteria	**ARARs Compliance and To Be Considered Criteria**	Identified ARAR does not apply.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.	Complies with identified ARAR.	ARARs would not be met by implementing this alternative because it would disrupt and destroy the wetland habitat and totally disturb Walker Lake from its natural state.
Primary Balancing Criteria	**Effectiveness and Permanence**	Not effective over long term.	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs.	Effective over long term with annual maintenance and continually implemented LUCs	Highly effective over long term	Highly effective over long term.
Primary Balancing Criteria	**Reduction of Toxicity, Mobility, or Volume**	No reduction of TMV of wastes	Minimal reduction in TMV of wastes (shoreline sweeps) for this MRS.	Minimal reduction in TMV of wastes (shoreline and shallow-water surface MEC removal) for this MRS	Partial reduction in TMV of wastes (surface removal).	Substantial reduction in TMV of wastes (subsurface removal and surface removal in MRS).	Provides most complete reduction in TMV of wastes (subsurface removal and surface removal in MRS).
Primary Balancing Criteria	**Short-Term Effectiveness**	No short-term hazards to workers or the surrounding area.	Possible short-term hazards to workers and the surrounding area during implementation (LUC installation and shoreline sweeps).	Possible short-term hazards to workers and the surrounding area during implementation (LUC installation and shoreline and shallow-water surface MEC removal).	High short-term hazards to workers and the surrounding area (associated with surface MEC removal underwater).	High short-term hazards to workers and the surrounding area (associated with subsurface MEC removal underwater).	High short-term hazards to workers and the surrounding area due to the use of heavy equipment and sifting of soils potentially containing MEC while working with underwater MEC.
Primary Balancing Criteria	**Implementability**	Readily implementable (no actions required).	Readily implementable (uses well established technologies); less likely to gain approval than surface or subsurface MEC removal.	Readily implementable (uses well established technologies); less likely to gain approval than surface or subsurface MEC removal.	Implementable (uses established technologies); specialized equipment and personnel would be required but are available.	Implementable (uses established technologies); specialized equipment and personnel would be required but are available.	Difficult to implement due to size of site. Less likely to gain approval due to negative impact on site conditions.
Primary Balancing Criteria	**Total Present Value Cost**	$0	$18,400,000	$19,270,000	$639,700,000	$1,243,000,000	$2,444,000,000

Shaded column indicates the most practicable solution for reducing the MEC hazard at the site.

ARAR = applicable or relevant and appropriate requirement; LUC = land use control; MEC = munitions and explosives of concern; MRS = munitions response site; RAO = remedial action objective; TBC = to be considered; TMV = toxicity, mobility, or volume

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DISCUSSION OF MODIFYING CRITERIA

State Acceptance

The NDEP supports the Preferred Alternatives.

Community Acceptance

Community acceptance of the Preferred Alternatives will be evaluated after the public comment period ends and will be described in the RA DD for the site.

EVALUATION SUMMARY

Land Alternative 1: No Action

Land Alternative 1 would not reduce the potential MEC exposure hazards, nor would it provide overall protection of human health. Current land use (i.e., open to the public) is not expected to change, and there are potential hazards to current and future human receptors under the current land use. Land Alternative 1 would not reduce toxicity, mobility, or volume (TMV) of contamination, nor would there be any new short-term hazards associated with implementation of this alternative. There would be no implementability concerns posed by this remedy because no action would be taken. Uncertainty exists about the long-term effectiveness of this approach for hazard management. No costs are associated with this alternative. Implementation of Land Alternative 1 would not change the MEC HA hazard level from that of the baseline conditions, indicating highest potential explosive hazard conditions in the High-Density Land Area and moderate potential explosive hazard conditions in the Low-Density Land Area. There are no ARARs associated with Land Alternative 1 that would restrict or modify its implementation.

Land Alternative 2: LUCs

Prior to the detailed analysis of the remedial alternatives, each was screened to identify any alternatives that should be eliminated for consideration due to effectiveness, implementability, or cost. Land Alternative 2, which includes LUCs only, was screened out because this alternative would not be effective at protecting human health. For more information on the alternative screen process, see Section 4.4 in the FS report for the Walker Lake Land Test Range MRS (Parsons, 2014).

Land Alternative 3: LUCs and Surface MEC Removal in the High-Density Land Area

Land Alternative 3 would achieve the RAO, would provide overall protection of human health and the environment; and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. Land Alternative 3 would provide less protection than alternatives that involve MEC removal in both the High- and Low-Density Land Areas. The balancing factors of long-term

effectiveness and permanence would be achieved primarily through surface removal of MEC in the High-Density Land Area. Land Alternative 3 would not completely eliminate hazards because MEC could remain in the subsurface within the High- and Low-Density Land Areas and on the surface within the Low-Density Land Area. However, the implementation of LUCs would further reduce the potential for human interaction with any remaining MEC in the future. For the short-term effectiveness criterion, MEC removal activities and the installation of signs and maintenance of fences would pose some hazards to field personnel, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 3 (surface MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. Land Alternative 3 has an estimated 30-year nondiscounted constant dollar cost of $13,860,000 and a total present value (TPV) of $13,180,000. Implementation of Land Alternative 3 in the High-Density Land Area would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions to moderate potential explosive hazard conditions. Implementation of Land Alternative 3 in the Low-Density Land Area would not change the corresponding hazard level of moderate potential explosive hazard conditions.

Land Alternative 4: LUCs and Surface MEC Removal throughout the Land Area

Land Alternative 4 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness and permanence would be achieved primarily through MEC surface removal in the entire Land Area. Land Alternative 4 would not completely eliminate hazards because MEC could remain in the subsurface within the MRS. However, the implementation of LUCs would further reduce the potential for human interaction with any remaining MEC in the future. For the short-term effectiveness criterion, MEC removal activities and the installation of signs would pose some hazards to field personnel, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 4 (surface MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. Land Alternative 4 has an estimated 30-year nondiscounted constant dollar cost of $34,010,000 and a TPV of $32,560,000. Implementation of Land Alternative 4 in the High-Density Land Area would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions to moderate potential explosive hazard conditions. Implementation of Land Alternative 4 in the Low-Density Land Area would reduce the MEC HA hazard level from the baseline of moderate potential explosive hazard conditions to low potential explosive hazard conditions.

Land Alternative 5: LUCs and Subsurface MEC Removal in the High-Density Land Area

Land Alternative 5 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-

term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from the High-Density Land Area, where the vast majority of the MEC contamination is anticipated. Additional long-term effectiveness would be achieved through the implementation of LUCs (MEC support, signs, and fences). For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities and the installation of signs and fences, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 5 (MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. Land Alternative 5 has an estimated 30-year nondiscounted constant dollar cost of $38,990,000 and a TPV of $37,470,000. Implementation of Land Alternative 5 in the High-Density Land Area would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions to low potential explosive hazard conditions. Implementation of Land Alternative 5 in the Low-Density Land Area would not change the corresponding hazard level of moderate potential explosive hazard conditions.

Land Alternative 6: LUCs and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area

Land Alternative 6 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from the High-Density Land Area, where the vast majority of the MEC contamination is anticipated. Additional long-term effectiveness would be achieved through the implementation of LUCs (MEC support, signs, and fences). For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities and the installation of signs and fences; although the operations would be performed by qualified UXO technicians, there would be some potential for an accidental detonation during remedy implementation. All components of Land Alternative 6 (MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. The advanced classification DGM method included in Land Alternative 6 is newer than the methods in Land Alternative 5; however, testing has proven this method effective. Land Alternative 6 has an estimated 30-year nondiscounted constant dollar cost of $31,620,000 and a TPV of $30,510,000. Implementation of Land Alternative 6 in the High-Density Land Area would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions to low potential explosive hazard conditions. Implementation of Land Alternative 6 in the Low-Density Land Area would not change the corresponding hazard level of moderate potential explosive hazard conditions.

Land Alternative 7: LUCs, Surface MEC Removal in Low-Density Land Area, and Subsurface MEC Removal in the High-Density Land Area

Land Alternative 7 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using

consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from the surface throughout the MRS and from the subsurface of the High-Density Land Area, where most of the MEC contamination is anticipated. Additional long-term effectiveness would be achieved through the implementation of LUCs (MEC support, signs, and fences). For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities and the installation of signs and fences, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 7 (MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. Land Alternative 7 has an estimated 30-year nondiscounted constant dollar cost of $58,150,000 and a TPV of $55,180,000. Implementation of Land Alternative 7 in both the High- and Low-Density Land Areas would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions and moderate potential explosive hazard conditions, respectively, to low potential explosive hazard conditions.

Land Alternative 8: LUCs, Surface MEC Removal in Low-Density Land Area, and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area

Land Alternative 8 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from the surface throughout the MRS and from the subsurface of the High-Density Land Area, where most of the MEC contamination is anticipated. Additional long-term effectiveness would be achieved through the implementation of LUCs (MEC support, signs, and fences). For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities and the installation of signs and fences, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 8 (MEC removal, LUCs, and educational awareness) are proven methods that are well established and readily implementable. The advanced classification DGM method included in Land Alternative 8 is newer than traditional DGM methods; however, testing has proven this method effective. Land Alternative 8 has an estimated 30-year nondiscounted constant dollar cost of $50,790,000 and a TPV of $48,560,000. The cost calculations for the use of advanced classification DGM under Land Alternative 8 assume a 78% reduction in the number of intrusive investigations when applying advanced classification techniques. The difference in cost when compared to that of Land Alternative 7 is due to the lower costs for the MEC removal when applying advanced classification techniques. Implementation of Land Alternative 8 in both the High- and Low-Density Land Areas would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions and moderate potential explosive hazard conditions, respectively, to low potential explosive hazard conditions.

Land Alternative 9: LUCs and Subsurface MEC Removal throughout the Land Area

Land Alternative 9 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from both the surface and subsurface of the Land Area. Additional long-term effectiveness would be achieved by performing five-year reviews. For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities, although the operations would be performed by qualified UXO technicians. All components of Land Alternative 9 (MEC removal, DGM, and LUCs) are proven methods that are well established and readily implementable. Land Alternative 9 has an estimated 30-year nondiscounted constant dollar cost of $67,340,000 and a TPV of $63,970,000. Implementation of Land Alternative 9 in both the High- and Low-Density Land Areas would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions and moderate potential explosive hazard conditions, respectively, to low potential explosive hazard conditions.

Land Alternative 10: LUCs and Subsurface MEC Removal Using Advanced Classification DGM throughout the Land Area

Land Alternative 10 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through source removal (i.e., MEC removal) from both the surface and subsurface of the Land Area. Additional long-term effectiveness would be achieved by performing five-year reviews. For the short-term effectiveness criterion, there would be some hazards posed to field personnel during MEC removal activities and the installation of signs and fences; although the operations would be performed by qualified UXO technicians, there would be some potential for an accidental detonation during remedy implementation. All components of Land Alternative 10 (MEC removal, DGM, and LUCs) are proven methods that are well established and readily implementable. The advanced classification DGM method included in Land Alternative 10 is newer than traditional DGM methods; however, testing has proven this method effective. Land Alternative 10 has an estimated 30-year nondiscounted constant dollar cost of $58,610,000 and a TPV of $56,100,000. Implementation of Land Alternative 10 in both the High- and Low-Density Land Areas would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions and moderate potential explosive hazard conditions, respectively, to low potential explosive hazard conditions.

Land Alternative 11: Excavation, Sifting, and Restoration

Land Alternative 11 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through complete MEC source removal. Land

Alternative 11 is implementable from a technical perspective; however, it is much more difficult to implement than other MEC removal alternatives and would have a negative impact on site conditions. Land Alternative 11 would take approximately 34 years to implement and has an estimated 34-year nondiscounted constant dollar cost of $3,324,000,000 and a TPV of $2,477,000,000. Implementation of Land Alternative 11 in both the High- and Low-Density Land Areas would reduce the MEC HA hazard level from the baseline of highest potential explosive hazard conditions and moderate potential explosive hazard conditions, respectively, to low potential explosive hazard conditions.

Water Alternative 1: No Action

Water Alternative 1 would not reduce the potential MEC exposure hazards, nor would it provide overall protection of human health. Current land use (i.e., open to the public for boating and recreation) is not expected to change, and there are potential hazards to current and future human receptors under the current land use. Water Alternative 1 would not reduce TMV of contamination, nor would there be any new short-term hazards associated with implementation of this alternative. There would be no implementability concerns posed by this remedy because no action would be taken. Uncertainty exists about the long-term effectiveness of this approach for hazard management. No costs are associated with this alternative. There are no ARARs associated with Water Alternative 1 that would restrict or modify its implementation.

Water Alternative 2: LUCs

Water Alternative 2 would achieve the RAO, would provide overall protection of human health and the environment; and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness and permanence would be achieved if all components of the alternative were maintained into the future. However, the long-term effectiveness of this alternative is less than that of alternatives involving surface or subsurface underwater MEC removal because of the potential that the lake water levels will continue to recede and expose more land along the shoreline. For the short-term effectiveness criterion, installation of LUCs and periodic shoreline sweeps would pose some hazards to field personnel, although the operations would be performed by qualified UXO technicians. All components of Water Alternative 2 (LUCs, educational awareness, and shoreline sweeps) are proven methods that are well established and readily implementable. Water Alternative 2 has an estimated 30-year nondiscounted constant dollar cost of $23,880,000 and a TPV of $18,400,000. This alternative does not significantly reduce TMV, and this alternative would limit the potential for development or use of the land in the future. Because there are no plans to develop the MRS in the foreseeable future, this alternative is considered for the Water Area.

Water Alternative 3: LUCs with Shallow-Water Surface MEC Removal

Water Alternative 3 would achieve the RAO, would provide overall protection of human health and the environment, and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness and permanence would be achieved if all components of the alternative were maintained into the future. Water Alternative 3 would improve the long-term effectiveness and permanence criterion through some hazard reduction (i.e., decreased exposure) and some reduction of TMV. The TMV is reduced through the shallow-water surface MEC removal during the remedial action phase and periodic shoreline sweeps that take place during the long term management phase. MEC hazards would be managed through controls to limit interaction with MEC (i.e., activity restrictions and installation of signs). However, the long-term effectiveness of this alternative is less than that of alternatives involving MEC removal over larger areas because of the potential that the lake water levels will continue to recede and expose more land along the shoreline. For the short-term effectiveness criterion, installation of LUCs, shallow-water surface MEC removal, and periodic shoreline sweeps would pose some hazards to field personnel, although the operations would be performed by qualified UXO technicians. All components of Water Alternative 3 (LUCs, educational awareness, shallow-water surface MEC removal, and shoreline sweeps) are proven methods that are well established and readily implementable. Water Alternative 3 has an estimated 30-year nondiscounted constant dollar cost of $24,760,000 and a TPV of $19,270,000. This alternative does not significantly reduce TMV, and this alternative would limit the potential for development or use of the land in the future. Because there are no plans to develop the MRS in the foreseeable future, this alternative is considered for the Water Area.

Water Alternative 4: LUCs and Lakebed Surface MEC Removal in the High-Density Water Area

Water Alternative 4 would achieve the RAO, would provide overall protection of human health and the environment; and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness and permanence would be achieved if all components of the alternative were maintained into the future. Water Alternative 4 would improve the long-term effectiveness and permanence criterion through source removal (i.e., MEC removal) from the surface of the High-Density Water Area, where most of the MEC contamination is anticipated. Residual hazards would be managed through controls to limit interaction with MEC (i.e., installation of signs). For the short-term effectiveness criterion, this alternative would pose high hazards to field personnel during surface MEC removal activities due to the difficulty of removing MEC underwater, although the operations would be performed by qualified UXO technicians. All components of Water Alternative 4 (LUCs, educational awareness, underwater MEC removal, and shoreline sweeps) are proven methods that are established and implementable; however, specialized equipment and personnel would be required but are available. Water Alternative 4 has an estimated 30-year nondiscounted constant dollar cost of $741,700,000 and a TPV of $639,700,000.

This alternative reduces TMV to some extent; however, this alternative would limit the potential for development or use of the land in the future. Because there are no plans to develop the MRS in the foreseeable future, this alternative is considered for the Walker Lake Land Test Range MRS–Water Area.

Water Alternative 5: LUCs and Lakebed Surface MEC Removal in the Low-Density Water Area, and Lakebed Subsurface MEC Removal in the High-Density Water Area

Water Alternative 5 would achieve the RAO, would provide overall protection of human health and the environment; and would comply with the identified ARAR by collecting post-detonation samples if any MEC found were destroyed using consolidated shots rather than being blown in place. The balancing factors of long-term effectiveness and permanence would be achieved if all components of the alternative were maintained into the future. Water Alternative 5 would meet the long-term effectiveness and permanence criterion through source removal (i.e., MEC removal) in the MRS. Additional long-term effectiveness would be achieved through the installation of signs and LUCs. For the short-term effectiveness criterion, significant hazards would be posed to field personnel during MEC removal activities due to the risk of diving and removal of underwater MEC; although the operations would be performed by qualified UXO technicians, there would be some potential for an accidental detonation during remedy implementation. All components of Water Alternative 5 are proven methods that are established and implementable; however, specialized equipment and personnel would be required but are available. Water Alternative 5 has an estimated duration of 47 years and a nondiscounted constant dollar cost of $1,854,000,000 and a TPV of $1,243,000,000. This alternative reduces TMV to some extent; however, this alternative would limit the potential for development or use of the land in the future. Because there are no plans to develop the MRS in the foreseeable future, this alternative is considered for the Walker Lake Land Test Range MRS–Water Area.

Water Alternative 6: Dredging and Sifting

Water Alternative 6 would achieve the RAO and would provide overall protection of human health and the environment; however, it would not comply with the identified ARARs because it would disrupt and destroy the wetland habitat and totally disturb Walker Lake from its natural state. The balancing factors of long-term effectiveness, permanence, and reduction of TMV would be achieved through complete MEC source removal. Water Alternative 6 is implementable from a technical perspective; however, it is much more difficult to implement than other MEC removal alternatives and would have a negative impact on site conditions. Water Alternative 6 has an estimated duration of 18 years and a nondiscounted constant dollar cost of $2,855,000,000 and a TPV of $2,444,000,000.

Summary

Ten of the 11 Land Area alternatives considered for the Walker Lake Land Test Range MRS were evaluated in terms of the seven criteria (Land Alternative 2, which includes LUCs only, was not considered because it would not effectively

protect human health). Land Alternative 1 must be ruled out because it provides neither long-term effectiveness nor permanence, and Land Alternative 11 must be ruled out because of extraordinary costs and the adverse effects it would have on the sites. Land Alternatives 3 and 4 reduce the TMV of MEC at the site due to surface MEC removal, and they reduce the likelihood of persons coming into contact with MEC by providing LUCs and a barrier to entry. Land Alternatives 5, 6, 7, 8, 9, and 10 reduce the TMV by including subsurface MEC removal over at least a portion of the MRS; however, implementation of Land Alternative 8 would provide both a cost-effective reduction in TMV and protection of human health with long-term effectiveness. While Land Alternatives 9 and 10 would include more area, because the vast majority of the MEC within the MRS is expected to be within the High-Density Area, the extra cost of implementing Land Alternatives 9 and 10 would not make a large difference in the reduction in TMV for the Land Area of the Walker Lake Land Test Range MRS.

All six of the Water Area alternatives considered for the Walker Lake Land Test Range MRS were evaluated in terms of the seven criteria. Water Alternative 1 must be ruled out because it provides neither long-term effectiveness nor permanence, and Water Alternative 6 must be ruled out because of its inability to comply with the ARARs due to the adverse effects it would have on the sites and due to the extraordinary costs. Water Alternative 2 would provide minimal reduction in TMV but it would reduce the likelihood of persons being exposed to MEC that may be present by providing LUCs and periodic shoreline sweeps. Water Alternative 3 would reduce the TMV more than Water Alternative 2 due to the addition of shallow-water surface MEC removal. Water Alternatives 4 and 5 are very effective at reducing the potential explosive hazards at the MRSs; however, both would involve very high short-term hazards due to the safety concerns associated with underwater MEC removal using divers. While MEC are expected on the lakebed and subsurface of the lakebed within the Water Area, they are not readily accessible; therefore, the completion of underwater MEC removal under Water Alternatives 4, 5, and 6 may not substantially increase protection of human health when compared to the potential risks associated with underwater MEC removal and the very high cost of these three alternatives.

Based on the comparative analysis of identified alternatives, the Army recommends Land Alternative 8 for the Land Area (LUCs, Surface MEC Removal in the Low-Density Land Area, and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area) and Water Alternative 3 for the Water Area (LUCs with Shallow-Water Surface MEC Removal). Based on the current land use and anticipated land use at the Walker Lake Land Test Range MRS, Land Alternative 8 and Water Alternative 3 both would meet the RAOs and provide the most cost-effective reduction in hazard.

CHAPTER 9 PREFERRED ALTERNATIVES

The Preferred Alternatives were identified as Land Alternative 8 for the Land Area (LUCs, Surface MEC Removal in the Low-Density Land Area, and Subsurface MEC Removal Using Advanced Classification DGM in the High-Density Land Area) and Water Alternative 3 for the Water Area (LUCs with Shallow-Water Surface MEC

Removal). The Preferred Alternatives may change in response to public comments or new information. These alternatives are recommended because they will achieve a substantial reduction in the hazards posed by MEC at the project site by conducting both surface and subsurface MEC removal in areas where the largest quantity of MEC is expected. These alternatives are the most cost effective because they focus MEC removal on the areas that pose the greatest hazard and they use LUCs and educational awareness to further reduce residual hazards from any MEC that might remain following remedial activities. Land Alternative 8 includes MEC removal to a depth of 2 feet bgs within the High-Density Land Area. A 2 foot removal depth will provided protection of recreational users and site visitors who have an anticipated intrusive depth of 1 foot bgs (Table 4). In addition, 96% of all munitions-related items were found during the RI were within the top 2 feet of soil; therefore, a MEC removal to a depth of 2 feet bgs will remove the majority of potential MEC within the MRS. In addition, MEC support provided under this alternative provides the protections necessary to meet the RAOs for the commercial/industrial worker with potential intrusive activities to 3 feet bgs.

Implementation of Land Alternative 8 would reduce the MEC HA score from that of the baseline conditions (highest potential explosive hazard conditions) to low potential explosive hazard conditions within the project site. Figure 7 outlines the elements of the preferred alternatives.

Based on the information currently available, the Army believes that Land Alternative 8 for the Land Area and Water Alternative 3 for the Water Area will meet the threshold criteria and provide the most effective tradeoffs among the alternatives for the balancing and modifying criteria. The Army expects the Preferred Alternatives to satisfy the statutory requirements of CERCLA §121(b):

1) Be protective of human health and the environment.
2) Comply with ARARs (or justify a waiver).
3) Be cost-effective.
4) Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
5) Satisfy the preference for treatment as a principle element (or justify not meeting the preference).

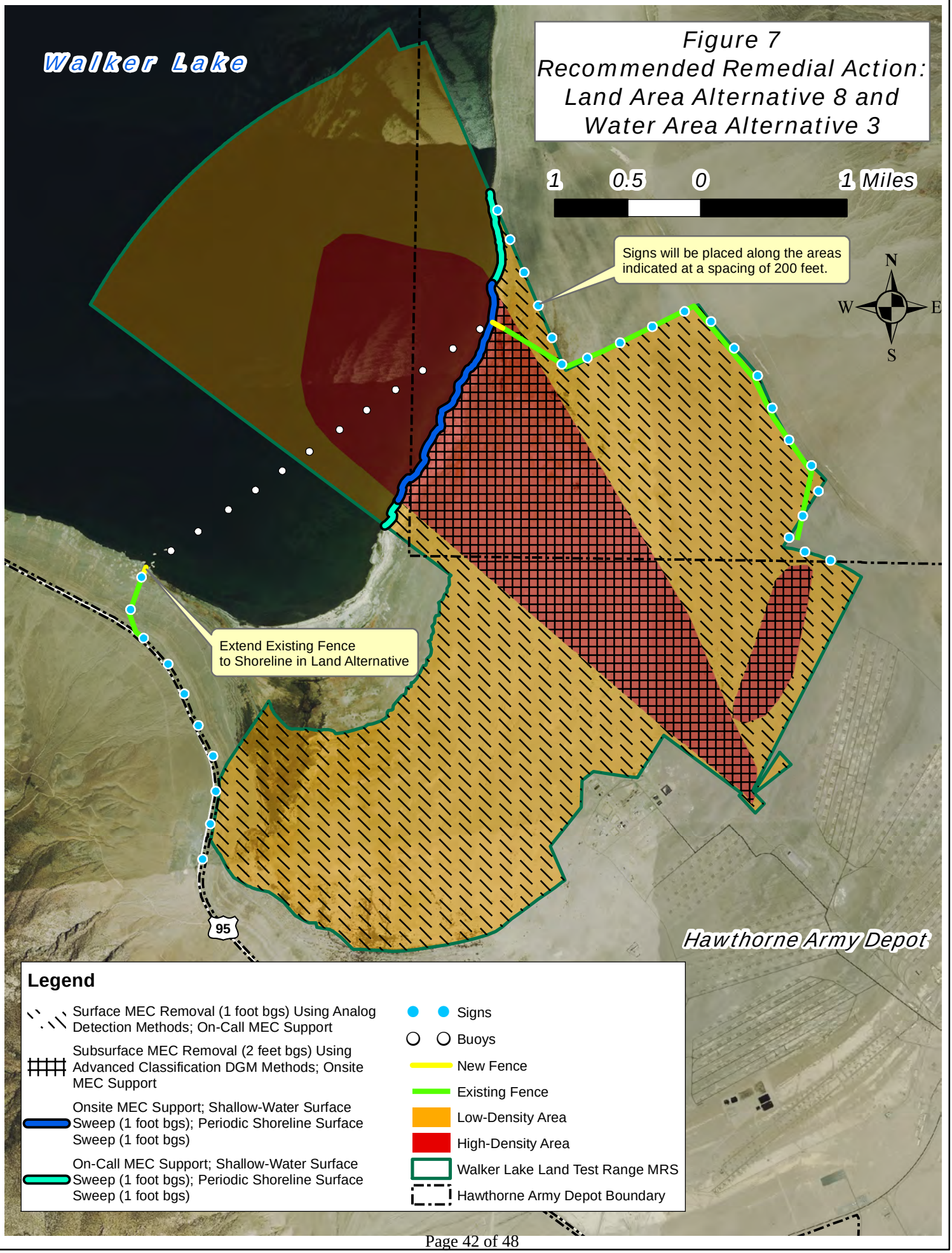
Figure 7
Recommended Remedial Action:
Land Area Alternative 8 and
Water Area Alternative 3
Walker Lake
1 0.5 0 1 Miles
Signs will be placed along the areas indicated at a spacing of 200 feet.
N
W
E
S
Extend Existing Fence to Shoreline in Land Alternative
95
Hawthorne Army Depot
Legend
Surface MEC Removal (1 foot bgs) Using Analog Detection Methods; On-Call MEC Support
Subsurface MEC Removal (2 feet bgs) Using Advanced Classification DGM Methods; Onsite MEC Support
Onsite MEC Support; Shallow-Water Surface Sweep (1 foot bgs); Periodic Shoreline Surface Sweep (1 foot bgs)
On-Call MEC Support; Shallow-Water Surface Sweep (1 foot bgs); Periodic Shoreline Surface Sweep (1 foot bgs)
Signs
Buoys
New Fence
Existing Fence
Low-Density Area
High-Density Area
Walker Lake Land Test Range MRS
Hawthorne Army Depot Boundary

CHAPTER 10 COMMUNITY PARTICIPATION

PUBLIC COMMENTS

The public is encouraged to comment on this proposed plan.

In January 2013 and July 2013, the *Final Remedial Investigation Reports* (Parsons, 2013a and 2013b) for the areas associated with the Walker Lake Land Test Range MRS were placed in the Administrative Record. The RI Reports are comprehensive documents that describe the history of the MRS, the details of the RI, the associated risk and hazard assessments, and the conclusions for the site. The *Final Feasibility Study Report* (Parsons, 2014) was placed in the Administrative Record File in October 2014 and provides a detailed description of the remedial alternative selection process summarized in this Proposed Plan. These documents and other information on this project site are available for review in the Administrative Record:

Information Repository/Administrative Record File
Environmental Office
Hawthorne Army Depot
1 South Maine Ave.
Hawthorne, NV 89415

Written and oral comments on this Proposed Plan will be accepted during a 30-day public comment period between **January 7, 2015,** and **February 6, 2015.**

The Army is the lead agency for investigating, reporting, making remedial decisions, and conducting remedial actions at the project site. As lead agency, the Army is soliciting public review and comments on all alternatives identified for this project site. Public comments are considered before any action is selected and approved. A public meeting will take place on **February 3, 2015, at 7:00 PM**, at the **High Desert Special Operations Center, Training Building**, 410 E Street, Hawthorne, Nevada. The Army and NDEP will be present at the meeting to explain this Proposed Plan, listen to concerns raised, answer questions, and accept public comments.

Written comments will be accepted throughout a 30-day public comment period from January 7, 2015, to February 6, 2015. Please submit written comments to Chuck King (information provided below). For further information on the project site, please contact the following representatives.

INFORMATION ACCESS

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Information Repository

Copies of the *Final Remedial Investigation Reports* (Parsons, 2013a and 2013b) and *Final Feasibility Study Report* (Parsons, 2014) and the Administrative Record File for this project site can be found at the following location:

Environmental Office
Hawthorne Army Depot
1 South Maine Ave.
Hawthorne, NV 89415

RECOGNIZE — *when you may have encountered a munition.*
RETREAT — *do not touch, move, or disturb it, but carefully leave the area.*
REPORT — *call 911!*

Visit the 3Rs Explosives Safety Education Website: *www.denix.osd.mil/uxosafety*

REFERENCES

Los Alamos National Laboratory, 2012. EcoRisk Database (Release 3.1). LA-UR-11-5460. Los Alamos National Laboratory, Los Alamos, New Mexico. October.

North Wind, Inc., 2012. *Final Time-Critical Removal Action, Walker Lake Land Test Range Munitions Response Site (HWAAP-008-R-01), Military Munitions Response Program, Hawthorne Army Depot, Nevada.* July.

Parsons, 2013a. *Final Remedial Investigation Report: Hawthorne Army Depot, Walker Lake Water Munitions Response Sites, Mineral County, Nevada.* January.

Parsons, 2013b. *Final Remedial Investigation Report: Hawthorne Army Depot, Walker Lake Land Test Range Munitions Response Sites, Mineral County, Nevada.* July.

Parsons, 2014. *Final Feasibility Study Report: Walker Lake Land Test Range Munitions Response Site, Hawthorne Army Depot, Mineral County, Nevada*. October.

TechLaw, Inc., 2003. *Final U.S. Army Closed, Transferring, and Transferred Range/Site Inventory for Hawthorne AD, NV.* March.

United States Environmental Protection Agency (USEPA), 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*.

USEPA, 2013a. ECOTOX Database. Ecological Soil Screening Levels. http://cfpub.epa.gov/ecotox/.

USEPA, 2013b. Regional Screening Level (RSL) Summary Table May 2013. Resident Soil.

United States Geological Survey, 2014. USGS 10288500 Walker Lake NR Hawthorne, NV. Provisional Data Subject to Revision. http://waterdata.usgs.gov/nwis/dv?cb_00062=on&format=html&period=&begin_date=1900-01-01&end_date=2014-02-07&site_no=10288500&referred_module=sw.

URS Group, Inc. (URS), 2008. *Final Historical Records Review, Hawthorne Army Depot, Hawthorne, Nevada, Military Munitions Response Program.* July.

URS, 2009. *Final Site Inspection Report, Hawthorne Army Depot, Hawthorne, Nevada, Military Munitions Response Program.* September.

GLOSSARY OF TERMS

Administrative Record File – A compilation of all documents relied upon to select a remedial action pertaining to the investigation and remediation of the project site.

Anomaly – Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and nonferrous material at a site (e.g., pipes, power lines).

Applicable or Relevant and Appropriate Requirements (ARARs) – Section 121(d)(2)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act incorporates into law the Compliance Policy, which specifies that Superfund remedial actions must meet federal standards, requirements, criteria, or limitations that are determined to be ARARs.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, otherwise known as Superfund) – A federal law that addresses the funding for and remediation of abandoned or uncontrolled hazardous waste sites. This law also establishes criteria for creating key documents such as the remedial investigation, feasibility study, Proposed Plan, and Decision Document.

Feasibility Study (FS) – A study that evaluates possible remedies using the information generated from the remedial investigation. The FS becomes the basis for selecting a remedy that effectively eliminates the threat posed by contaminants at the site.

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety hazards, means (a) unexploded ordnance, (b) discarded military munitions, or (c) explosive munitions constituents present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) – Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, as well as emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris (MD) – Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal. Munitions debris is confirmed inert and free of explosive hazards by technically qualified personnel.

Munitions Response Site (MRS) – A discrete location within a defense site that is known to require a munitions response (investigation, removal action, or remedial action).

Preferred Alternative – The alternative that, when compared to other potential alternatives, was determined to best meet the Comprehensive Environmental

Response, Compensation, and Liability Act evaluation criteria and is proposed for implementation at a site.

Project Site – For this Proposed Plan, the project site is the 10,269-acre Walker Lake Land Test Range munitions response site. Other munitions response sites at the Hawthorne Army Depot are not addressed by this document.

Proposed Plan – A plan that identifies the preferred remedial alternative for a site and is made available to the public for comment.

Remedial Action Decision Document (RA DD) – A report, required at Comprehensive Environmental Response, Compensation, and Liability Act sites, that documents the final selected remedial action.

Remedial Investigation (RI) – Exploratory inspection conducted at a site to define the nature and extent of contamination present.

Superfund – See Comprehensive Environmental Response, Compensation, and Liability Act, above.

Total Present Value (TPV) – The present value of a future investment or payment that is calculated using a particular discount or interest rate. Total present value is the amount of money, which, if invested in the current year, would be sufficient to cover all the costs over time associated with a project.

Unexploded Ordnance (UXO) – Military munitions that (a) have been primed, fuzed, armed, or otherwise prepared for action; (b) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (c) remain unexploded whether by malfunction, design, or any other cause.

ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DGM	digital geophysical mapping
EMI	advanced electromagnetic induction
FS	feasibility study
HA	hazard assessment
HWAD	Hawthorne Army Depot
LiDAR	light detection and ranging
LUC	land use control

MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MRS	munitions response site
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDEP	Nevada Division of Environmental Protection
O&M	operations and maintenance
RA DD	Remedial Action Decision Document
RAO	remedial action objective
RI	remedial investigation
TBC	to be considered
TCRA	time-critical removal action
TD	transferred
TMV	toxicity, mobility, or volume
TPV	total present value
URS	URS Group, Inc.
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance

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