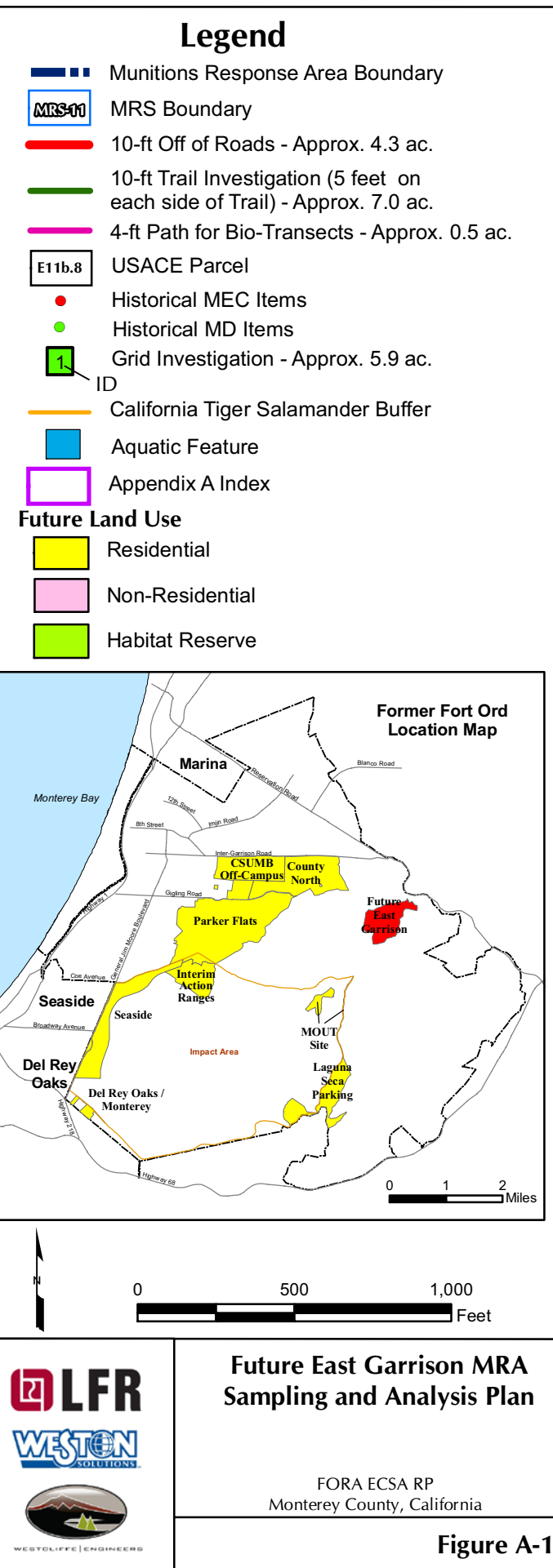
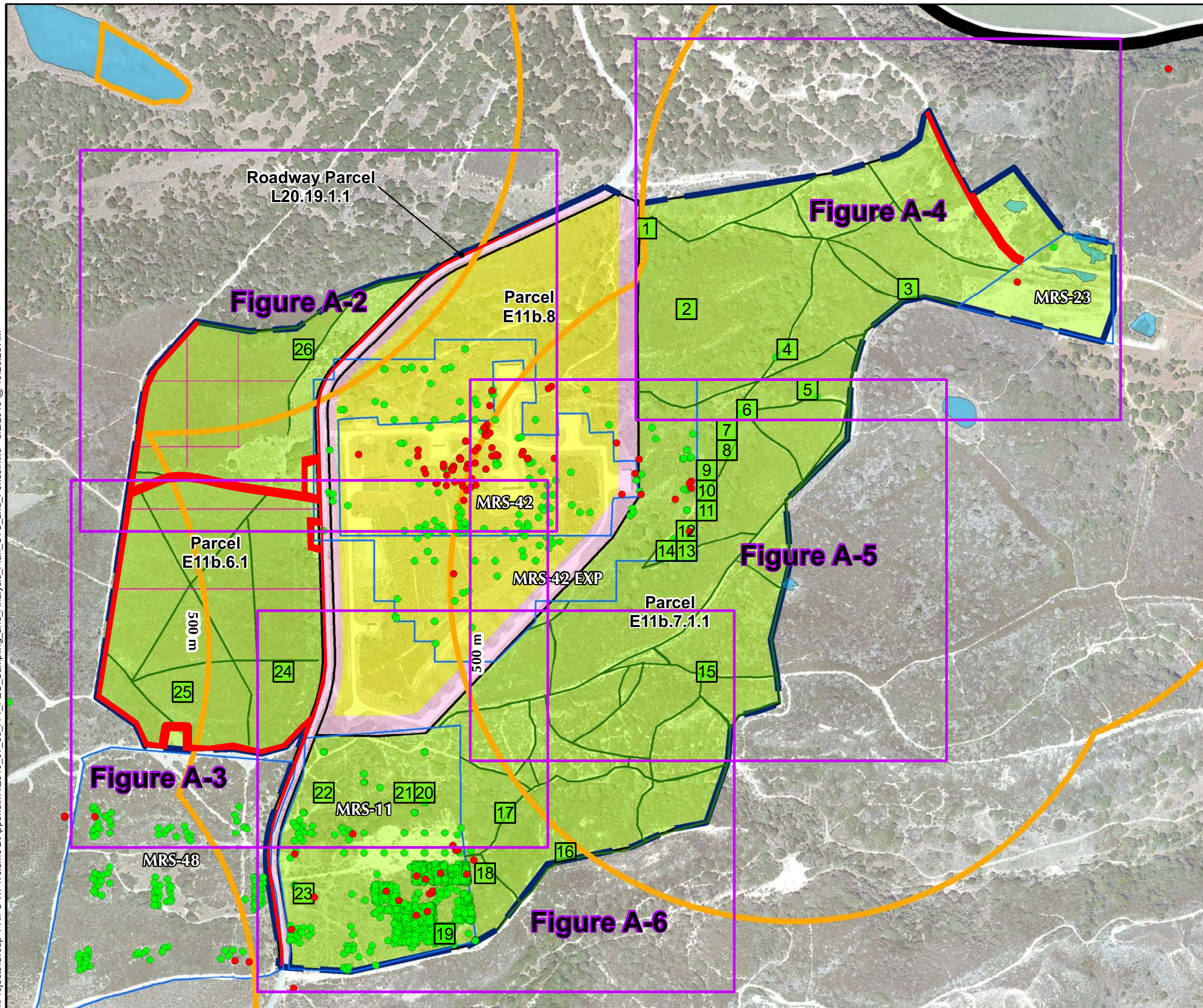
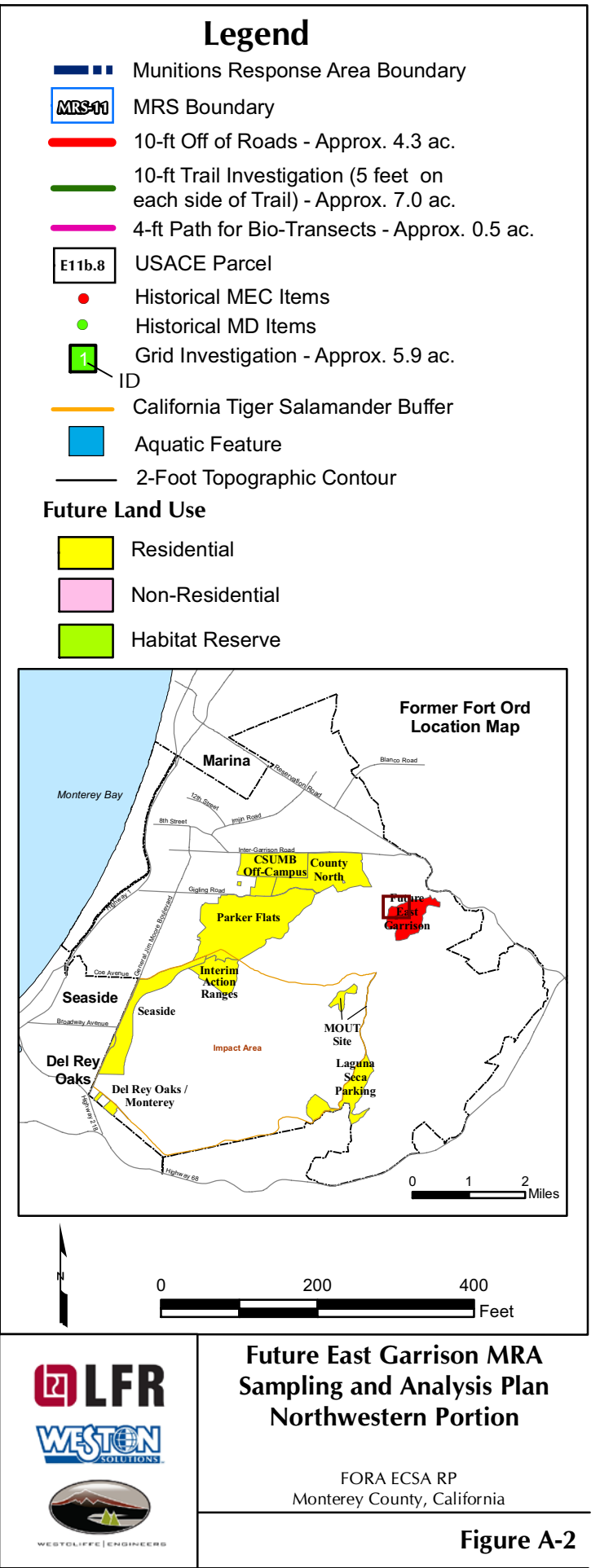
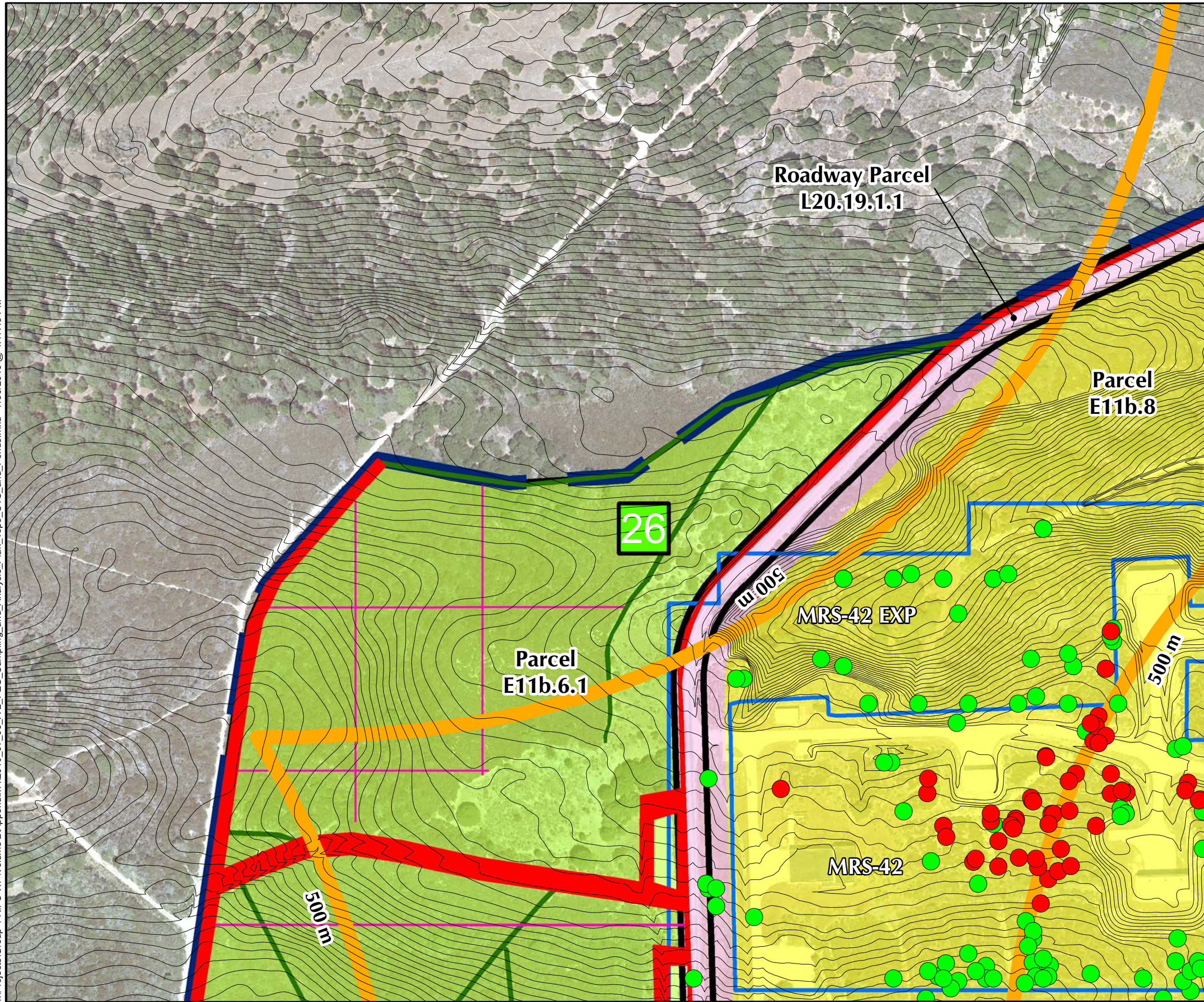


APPENDIX A

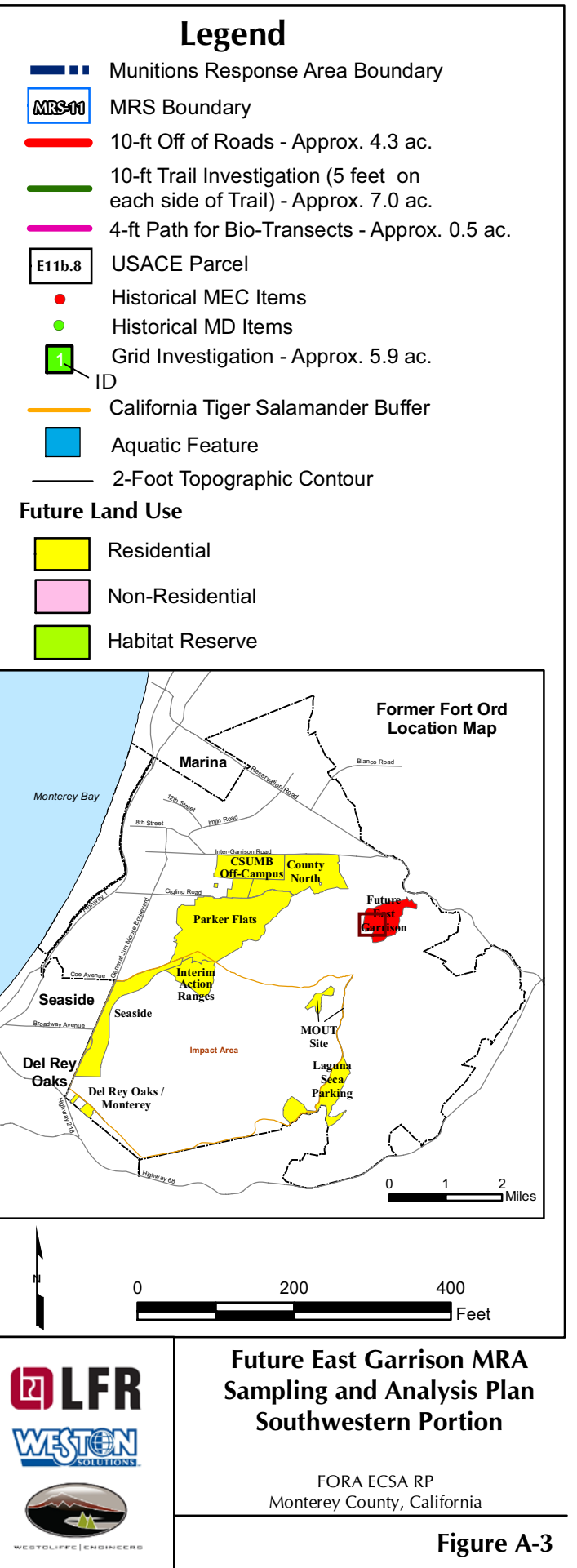
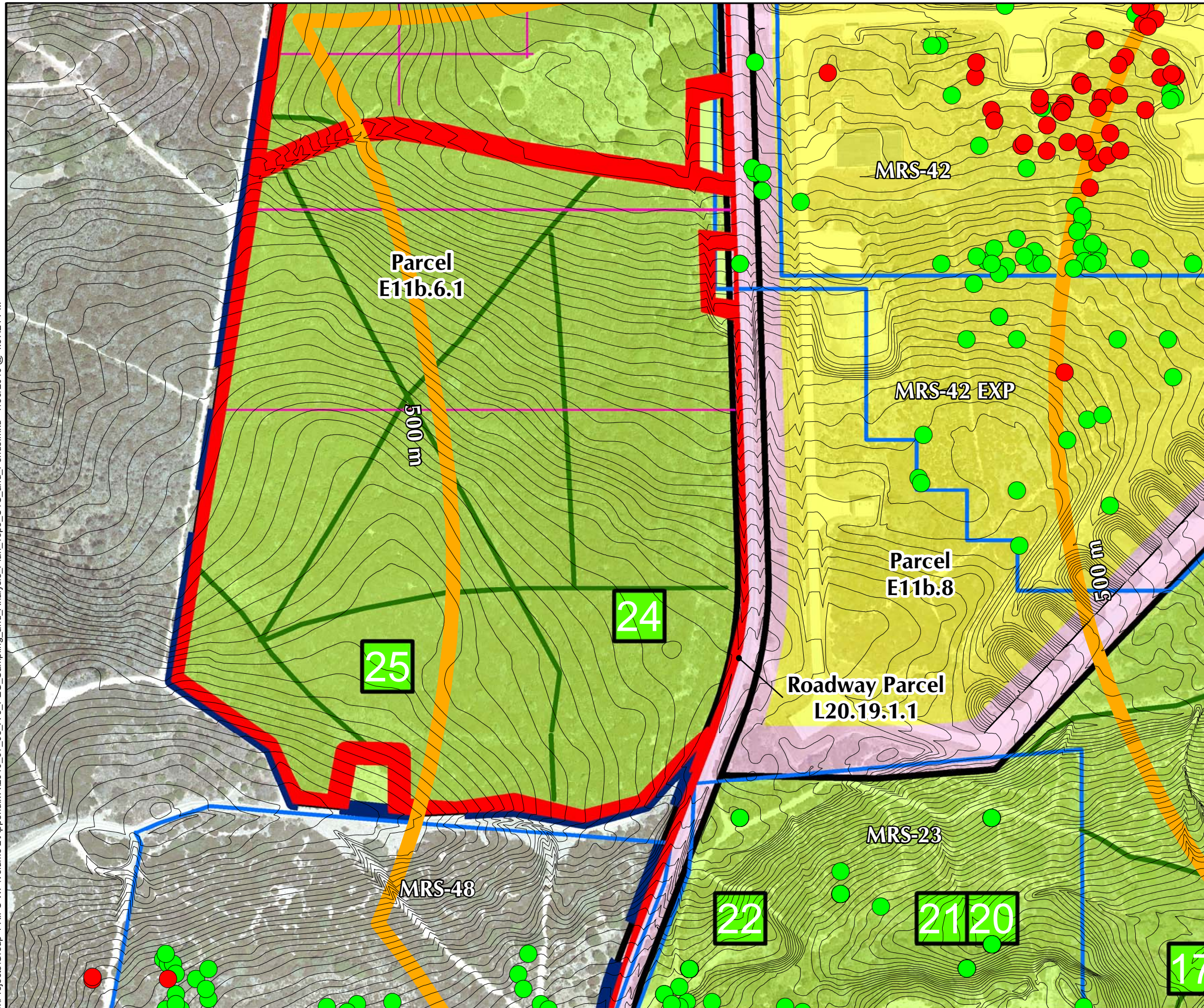
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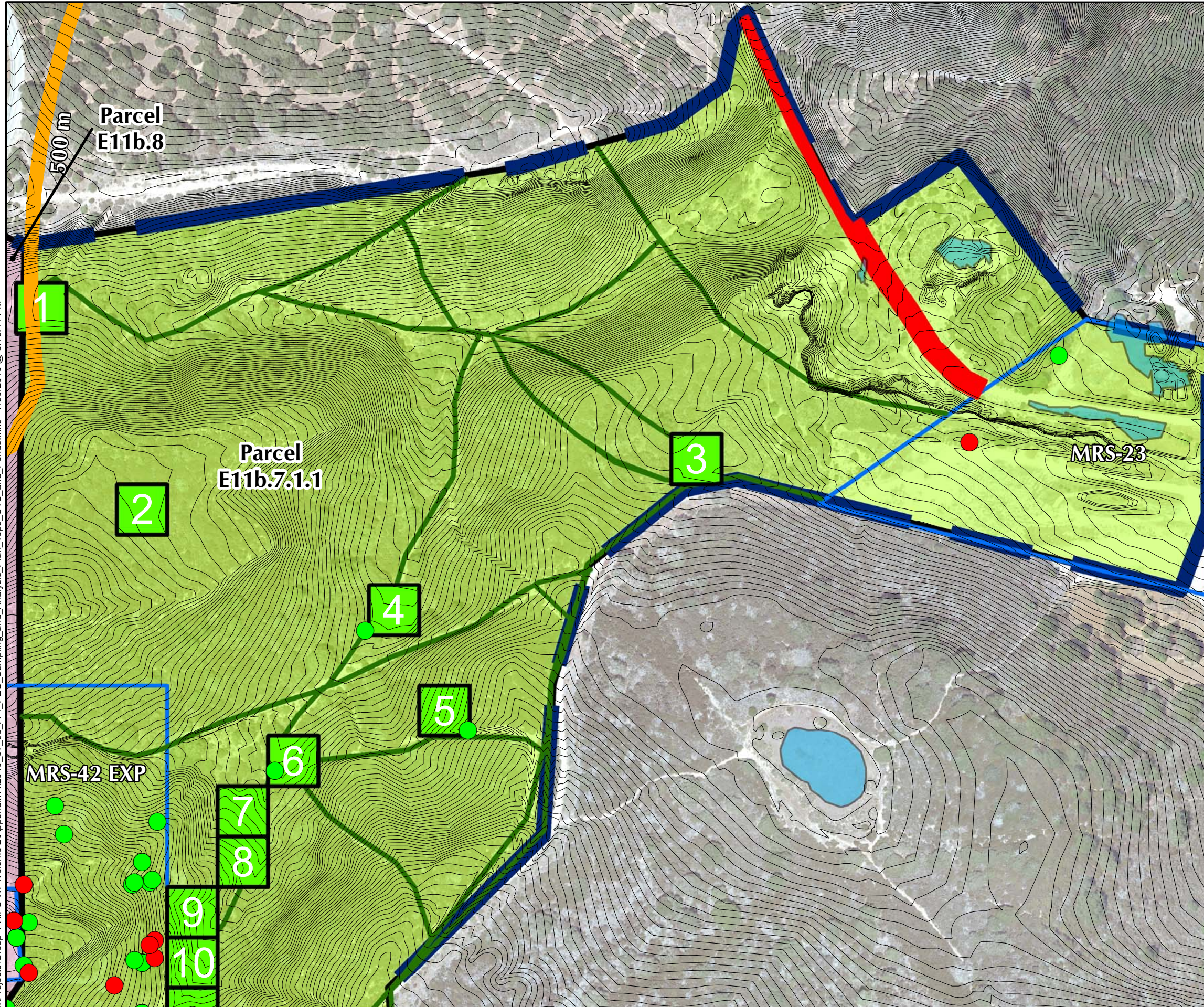




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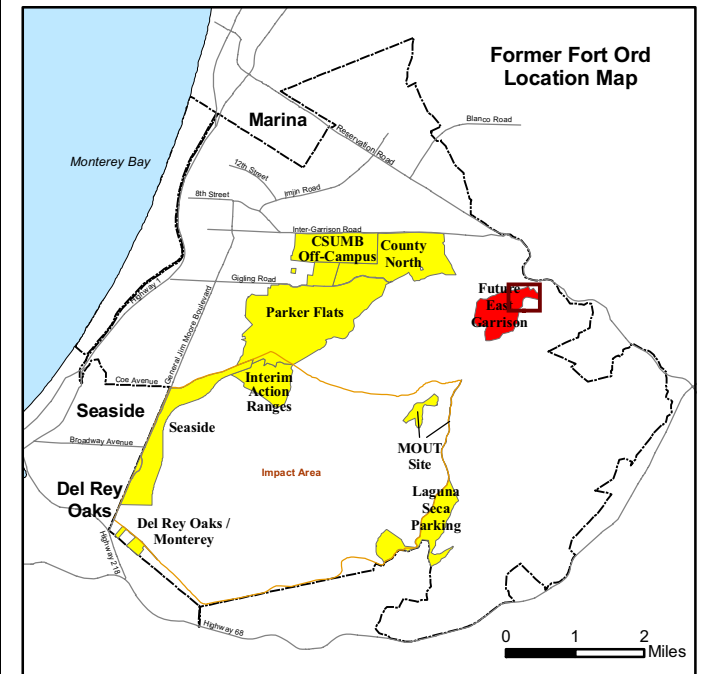


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Legend

- Munitions Response Area Boundary
- MRS Boundary
- 10-ft Off of Roads - Approx. 4.3 ac.
- 10-ft Trail Investigation (5 feet on each side of Trail) - Approx. 7.0 ac.
- 4-ft Path for Bio-Transects - Approx. 0.5 ac.
- E11b.8 USACE Parcel
- Historical MEC Items
- Historical MD Items
- Grid Investigation - Approx. 5.9 ac. ID
- California Tiger Salamander Buffer
- Aquatic Feature
- 2-Foot Topographic Contour
- Future Land Use**
 - Residential
 - Non-Residential
 - Habitat Reserve

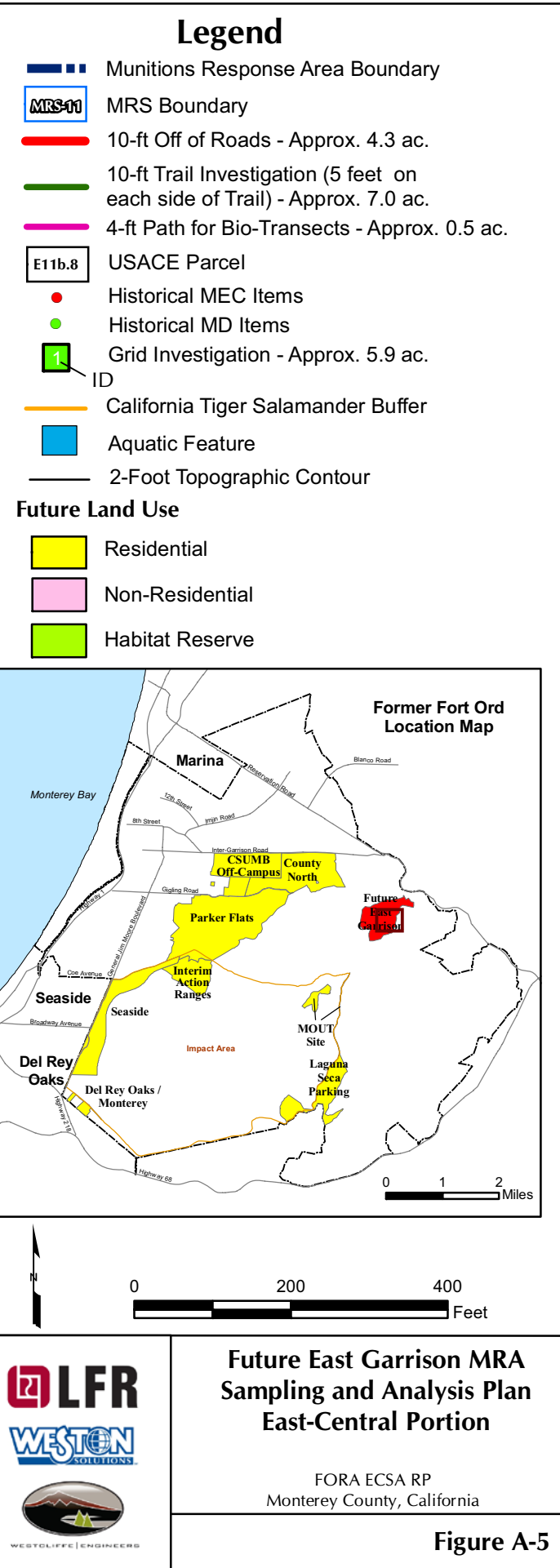
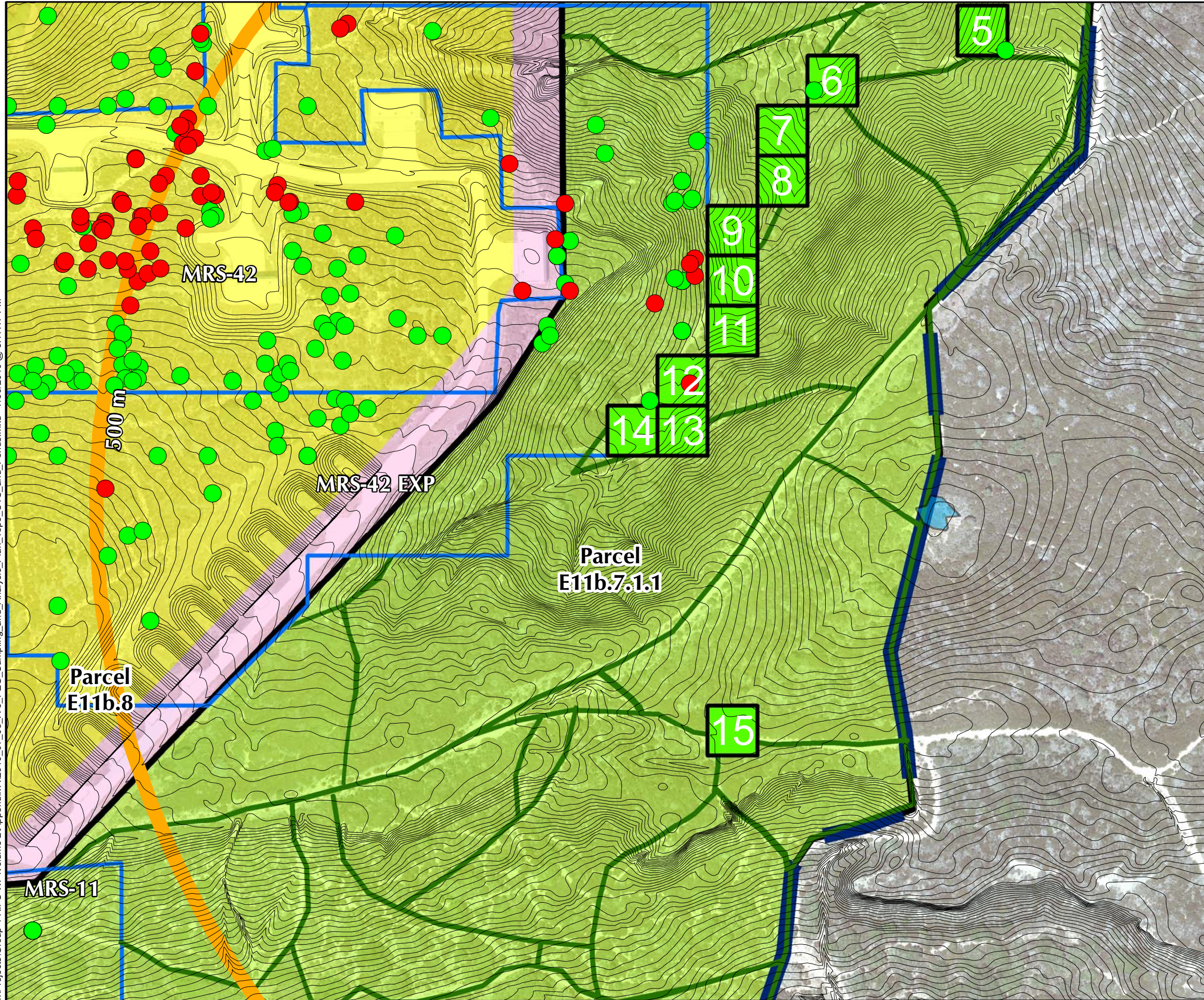


Future East Garrison MRA Sampling and Analysis Plan Northeastern Portion

FORA ECSA RP
Monterey County, California

Figure A-4

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APPENDIX B

MEC Data

Future East Garrison MRA – Types of MEC Removed and Hazard Classification

MEC ITEMS	UXO	DMM	ISD	Hazard Classification
Cap, blasting, electric, M6	1	0	0	1
Charge, 0.5-pound, demolition, TNT	1	0	0	2
Flare, surface, trip, M49 series	1	0	0	1
Fuze, grenade, hand, M204 series	1	0	0	1
Fuze, grenade, hand, practice, M228	0	183	0	1
Grenade, hand, fragmentation, MK II	9	0	0	3
Grenade, hand, Illumination, MK I	1	0	0	1
Grenade, rifle, antitank, M9 series	63	0	0	3
Grenade, rifle, smoke, M22 series	2	0	0	1
Projectile, 37mm, low explosive, MK I	2	0	0	3
Projectile, 3-inch, trench mortar, practice, MK I (Stokes)	0	0	9	1
Signal, ground, rifle, parachute, M17 series	1	0	0	1
Simulator, explosive booby trap, flash, M117	0	60	0	1
Flare, type unknown (model unknown)	1	0	0	NS
Projectile, 4.2-inch, smoke, white phosphorous, M2 with fuze, point detonating, M8 (model unknown)	0	0	1	NS
TOTAL	83	243	10	

Notes:

MRA = Munitions Response Area

MEC = munitions and explosives of concern

UXO = unexploded ordnance

DMM = discarded military munitions

ISD = insufficient data (could not be definitively classified as UXO, DMM, or Munitions Debris)

TNT = trinitrotoluene

mm = millimeter

NS = not specified

Reference: Ford Ord Military Munitions Response Program (MMRP) Database

Please note: Munitions descriptions have been taken directly from the Army's MMRP Database and/or other historical documents. Any discrepancies in terminology, filler type, model number, and/or caliber/size are a result of misinformation from the data sources.

Hazard Classification	Description
1	MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities
2	MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities
3	MEC that will kill an individual if detonated by an individual's activities

APPENDIX C

Standard Operating Procedures

STANDARD OPERATING PROCEDURE FOR CHIPPING OPERATIONS

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the minimum procedures and safety and health requirements applicable to the conduct of chipping operations in areas that are considered environmentally sensitive.

2.0 SCOPE

This SOP applies to all personnel involved in the conduct of chipping operations either using a disk-type or rotary-drum-type chipper.

3.0 REGULATORY REFERENCES

- Weston Corporate Safety and Health Program (FLD47)
- OSHA General Industry Standards, 29 CFR 1910
- OSHA Construction Standards, 29 CFR 1926
- USACE EM 385-1-1, Safety and Health Requirements Manual
- AR 385-10, Army Safety Program
- Operators Manual and Manufacturers Recommendations

4.0 RESPONSIBILITIES

4.1 Remediation Project Manager (RPM)

The RPM is responsible for ensuring availability of resources required to safely implement this SOP.

4.2 Senior Unexploded Ordnance Supervisor (SUXOS)

The SUXOS is responsible for incorporating this SOP in plans, procedures, and training.

4.3 UXO Safety Officer (UXOSO)

The UXOSO ensures that all chipping operations are being conducted in a safe manner, in accordance with the appropriate work plans, FLD 47, and this SOP.

4.4 Chipper Team Leader

The chipper team leader is responsible for the daily maintenance, upkeep, and repair of the machine, and certification of operator personnel.

4.5 Qualified Biologist

The Qualified Biologist will identify locations where mulch is not to be spread, to avoid affecting the re-establishment of Habitat Management Plan annual plants.

5.0 CHIPPING OPERATIONS

5.1 General

Chipping is required whenever vegetation removal is being conducted in the Habitat Management Area. In addition, it may be necessary to conduct chipping to improve ground visibility and safety.

5.2 Chipper Operation

The chipper will be manned by brush feeders (laborers). When feeding material into the chipper, feeders must exercise care not to place hands, or any other parts of the body, or loose clothing on the feed table when the chipper is in operation. Care will be taken not to reach past the “SAFE” point established on the feed table/chute. This point varies between chipping machines and will be identified to all personnel.

- A push stick of material consumable by the chipper will be available, one on either side of the chipper, for pushing material into the chipper when it is necessary to probe beyond the safe point.
- Brush draggers will be employed to drag brush to the feeders. The draggers will trim the brush as necessary to fit it into the chipper, and pass it to the feeders.
- Limbs and wood stock 3 inches or greater in diameter need not be chipped. These items can be left in the field as a source of habitat for bugs, salamanders, and other creatures.
- The chipper team leader must oversee the operation with regard to safety, work progress, weather/wind conditions, materials being chipped, and other factors that affect the operation.
- Poison oak will not be chipped by itself. If it is entangled within brush, it will be chipped based on the team leaders’ discretion.
- Any time the chipper is operated while disconnected from the team vehicle, the chipper’s wheels will be blocked or chocked to prevent it from rolling.
- Fluid levels and gauges will be checked periodically and at every break.

5.3 Chipped Mulch

Mulch will, in most locations, be spread over the area from which the original brush material was cut and be limited to 3 inches in depth. Mulch will not be spread any closer than 5 feet from the roadsides whenever possible. Mulch will not be spread in certain locations where sensitive annual plant habitat occurs, as identified by the Qualified Biologist.

5.4 Field Sanitation

The team decontamination station will be located at least 50 feet upwind of the chipping operation. If the team vehicle is attached to the chipper, the team equipment in the pickup bed will be covered with a tarp or plastic sheet material.

5.5 Hearing Conservation

The first day, the noise level will be measured using an appropriate measuring device(s). Readings will be taken at the machine, as well as in the vicinity of the machine, and noise attenuation devices selected and issued. Directives of FLD 01 will be adhered to at all times.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Modified Level D PPE will be required for personnel engaged in chipping operations to include:

- Coveralls – appropriately taped at ankles and openings
- Surgical/inner gloves
- Leather or canvas work/outer gloves
- Leather gauntlets
- Work boots – leather or suitable material
- Tyvek hood when in poison oak
- Hard hats
- Hearing protection –brush feeders will wear noise attenuating helmets or ear plugs, both will be worn if uninterrupted work period extends beyond 45 minutes
- Brush draggers will wear noise attenuating helmets or ear plugs
- Eye protection –all personnel will wear safety glasses, brush feeders will also wear face shields/screens
- Disposable dust masks - at any time that dust is being generated, disposable dust masks will be worn

No one will approach within 35 feet of an operating chipper without the appropriate PPE and hearing protection.

7.0 TRAINING

All personnel who work on a chipping crew will be qualified and certified through machine-specific, site-specific, and on-the-job training. This training will consist of:

- Mechanical operations and maintenance of the chipper
- Features of the chipper and its operational limits and characteristics
- Safety parameters relevant to chipping operations

STANDARD OPERATING PROCEDURE FOR MECHANICAL VEGETATION CUTTING

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) together with FLD 47 is to provide the minimum procedures and safety and health requirements applicable to the conduct of mechanical vegetation cutting operations.

2.0 SCOPE

All personnel performing operations utilizing mechanical equipment for vegetation cutting will conform to this SOP. This SOP is not a stand-alone document, and all personnel will become familiar with associated documents and/or manuals related to this operation.

3.0 REGULATORY REFERENCES

- Weston Solutions, Inc., Corporate Safety and Health Program
- OSHA General Industry Standards, 29 CFR 1910
- OSHA Construction Standards, 29 CFR 1926
- USACE EM 385-1-1, Safety and Health Requirements Manual
- AR 385-10, Army Safety Program
- Operator's Manual and Manufacturer's Recommendations

4.0 RESPONSIBILITIES

4.1 Remediation Project Manager (RPM)

The RPM is responsible for ensuring availability of resources required to safely implement this SOP.

4.2 Senior Unexploded Ordnance Supervisor (SUXOS)

The SUXOS is responsible for incorporating this SOP in plans, procedures, and training.

4.3 UXO Safety Officer (UXOSO)

The UXOSO ensures that all mechanical vegetation cutting operations are being conducted in a safe manner in accordance with the work plan and this SOP.

4.4 Mechanical Vegetation Cutting Team Leader

The team leader is responsible for the daily maintenance, upkeep, and repair of the machine and certification of operator personnel.

4.5 UXO Escort/Ground Safety Observer

The UXO Escort/Ground Safety Observer ensures that personnel and equipment remain within the site, and marks any munitions and explosives of concern (MEC) encountered and reports their location to the SUXOS.

4.6 Team Members

The team members are responsible for the proper and safe operation and maintenance of all equipment, such as weed eaters and chainsaws, and walking behind brush hogs.

5.0 MECHANICAL VEGETATION CUTTING OPERATIONS

Vegetation cutting operations will be consistent with the operator's manual and terrain features, and permits the Ground Safety Observer to perform those duties as directed to include a visual search/survey of the area(s) to be worked in.

- Personnel will not enter within 50 feet of an operating piece of equipment. If, at any time, personnel enter closer than 50 feet, the operator will immediately stop, return the engine to idle speed, and disengage power to all attachments.
- A communications check with the team personnel prior to operations commencing will be conducted. Hand signals are devised and used as a secondary means of communication. All team personnel must know these hand signals prior to operations commencing.
- The direction and manner in which the vegetation is to be removed will be directed by the team leader. Prior to cutting operations commencing, a visual search/survey is conducted to determine the hazards that may be encountered, including MEC, terrain slope, vegetation, wildlife, and environmental concerns. The team leader will also determine the personal protective equipment (PPE) requirements based on the identified hazards.
- The Ground Safety Observer precedes the equipment and performs a visual search for MEC, ordnance scrap, rats' nests, surface debris, and any other obstruction/object that may pose a hazard to team personnel. Hazardous items, impassable terrain, or vegetation that may affect operations will be marked and team personnel notified. The operator shall follow a route selected by the Ground Safety Observer while operations are ongoing.
- Team personnel will ensure that a 6-inch ground clearance is maintained during cutting operations. Those areas marked as hazards are to be avoided.

- MEC or MEC-related items encountered are marked and avoided. Notification of these items will be made to the SUXOS.

5.1 Safety

Safety is paramount. All personnel will observe those safety precautions/warnings that apply, or may apply, to vegetation cutting operations. Those listed below are general in nature and personnel will need to review applicable publications for more specific safety precautions/warnings. Distances are the minimum required.

- Maintain 200 feet from essential non-UXO personnel; UXO personnel engaged in intrusive work; and other mechanical equipment (e.g., backhoe).
- Maintain 50 feet between equipment and team personnel.
- Distances may be increased by the UXOSO, as determined by site history, MEC items encountered, terrain features, and other factors that may apply.
- Use equipment safety features (e.g., guards).
- Safety precautions/warnings found in the operator's manual(s)/manufacturer's publication(s) will be observed.
- Maintain 6 inches of ground clearance during cutting operations.
- Communications will be maintained between the Team Leader/UXO Escort, operator, and Ground Safety Observer at all times.
- Maintain site control.
- Observe safety precautions for items encountered or suspected.
- Ensure PPE is serviceable and worn/used in a proper manner.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Level D PPE will be required for personnel engaged in mechanical vegetation cutting. Clothing includes, but is not limited to:

- Coveralls or work clothing as prescribed
- Work gloves, leather or canvas as appropriate
- Safety glasses
- Face shields when appropriate
- Hard hats when working within 100 feet of equipment
- Hearing protection, noise attenuators or ear plugs when within 50 feet of equipment
- Dust mask, as required by wind conditions and/or the presence of airborne particulate matter

- Other PPE as needed (e.g., face shield, Kevlar chaps, etc.)

7.0 TRAINING

All personnel who work on a mechanical vegetation cutting crew will be qualified and certified through machine-specific, site-specific, and on-the-job training. This training will consist of:

- Mechanical operations and maintenance of the vegetation cutting equipment
- Features of the equipment and its operational limits and characteristics
- Safety parameters relevant to mechanical operations

STANDARD OPERATING PROCEDURE FOR HANTAVIRUS EXPOSURE PROTECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) along with FLD 43 is to provide the minimum procedures and safety and health requirements applicable to the conduct of operations involving potential exposure to Hantavirus.

2.0 SCOPE

To establish a policy to protect personnel engaged in activities at the former Fort Ord from potential exposure to Muerto Canyon Virus (MCV). Hantavirus Pulmonary Syndrome (HPS) is a respiratory disease, which is caused by a type of Hantavirus. The particular Hantavirus responsible for HPS is the MCV.

3.0 BACKGROUND

There have been confirmed cases of fatal Hantavirus infection in California in recent years. As a result, this SOP has been developed to provide guidance to personnel whose occupational activities might expose them to sources of this virus.

4.0 METHOD OF TRANSMISSION

MCV is transmitted to humans through the inhalation of aerosolized excreta (feces, urine, and saliva) and contaminated dust from rodents and their nests. This includes rats, deer mice, brush mice, and western chipmunks. Some sites where personnel will be working are infested with significant numbers of rat nests that may be encountered during the conduct of activities.

5.0 SYMPTOMS OF MCV

Workers infected with MCV develop febrile or respiratory illness within 45 days of their exposure. The initial symptoms are flu-like and may progress to life-threatening respiratory distress. Besides supportive measures, there are no proven therapeutic agents available at this time for MCV. Workers showing symptoms should seek medical attention immediately. The physician should be informed that MCV is a potential occupational risk and a blood sample should be drawn for comparison with the baseline serum sample. The blood samples should be forwarded to the California State Department of Health for transfer to the Center of Disease Control for testing. The required storage for drawn serum of -20° C may be impractical for extended periods in many locations. The serum will aid in diagnosis by clarifying baseline status, but it is not essential.

5.1 Medical Program

All employees working at the former Fort Ord have baseline blood serum samples drawn during the conduct of their pre-employment physical. The examination also includes a medical and occupational history review, blood and urine tests for contaminants of interest, electrocardiogram, pulmonary function tests, chest x-ray, and general physical examination including hearing and vision.

6.0 SPECIALIZED TRAINING

Specialized training regarding MCV is conducted during site-specific training for personnel who will be employed at the site. It includes use of protective equipment, safe and effective use and application of functional tools and equipment, work procedures and practices, medical surveillance requirements, recognition of symptoms and signs of exposure, physical nature of possible sources of exposure, and appropriate first aid.

7.0 EXPOSURE PREVENTION

The following procedures will be used to minimize exposure to MCV.

7.1 Indoor Work Areas

It is not anticipated that employees will be working in “indoor work areas” where there is a potential for exposure to MCV. If this should occur, or if additional buildings or housing to support operations are acquired that have been closed up or vacant for long periods of time, the following procedures will apply:

- Open building and air it out for at least 30 minutes prior to cleanup
- Spray the indoor area with a household disinfectant
- Wait 30 minutes prior to completion of cleanup

7.2 Field Latrines

The Army field latrines located throughout the former Fort Ord are considered to be contaminated with MCV. These latrines will be entered only as necessary to determine if munitions and explosives of concern (MEC) are located within the structure prior to demolition and removal. Field toilet facilities will consist of port-a-johns, strategically located within the work sites.

7.3 Outdoor Work Areas

Rat nests exist in varying numbers throughout the installation. It is expected that these are the prime threat of exposure for employees. When encountered during the course of brush clearing activities, the rat nests are cordoned off with engineer's tape and avoided. During brush clearing in close proximity to the nests, care is exercised to avoid disturbing the nests or creating dust clouds from them. The presence of these nests is recorded on grid sheets by the team leaders. During the conduct of geophysical and MEC activities, cordoned-off rat nests are avoided and the engineer's tape left in place.

7.4 Excavation Team Operations

After all brush cutting and geophysical and MEC activities in the grid are complete, the unexploded ordnance (UXO) excavation team disinfects, searches, and clears the areas beneath the nests.

7.5 Decontamination Method

MCV is easily killed in the environment with common disinfectant solutions such as household bleach/water solution (50/50 for Equipment and Nests, 10% for Personnel) or rubbing alcohol. These solutions and direct sunlight will kill the virus in less than 1 hour.

7.5.1 Decontamination Equipment

The below-listed equipment may be used for nest decontamination and destruction:

- Backhoe
- Backpack fire pumps
- 5-gallon water containers, buckets, and brushes
- Plastic storage and disposal bags
- Drop cloth
- Bleach/water and alcohol
- Rakes and pitchforks
- Other search and clearance equipment normally carried by teams

8.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Level C is the PPE required for personnel engaged in activities where a possibility of exposure to MCV exists. The UXO Safety Officer, in conjunction with the certified industrial hygienist, will make any applicable changes. Level C items include:

- Half-face, air-purifying respirator with high-efficiency particulate (HEPA) filter cartridges (N/P/R 99,100) and non-vented goggles or high-filtration dust mask with non-vented goggles
- Coveralls with hood (disposable if possible); rubber or plastic gloves; rubber boots or disposable shoe covers
- Wrist and ankles will be sealed with tape
- Hard hats will be worn in vicinity of earth moving equipment (backhoe)

Prior to donning a mask/respirator, the wearer must be clean-shaven in the areas of the face that help to create an air-tight seal between the face and the mask/respirator.

9.0 PROCEDURES FOR CLEARING RODENT NESTING AREAS

The below-listed procedures are used by the excavation team when disinfecting, searching, and clearing nests:

- All members of the team dress in prescribed PPE listed in Section 8.0.
- If the backhoe is to be used, the operator positions the backhoe in such a manner as to access nest(s) from the upwind side.
- The nest is drenched with bleach/water solution.
- Nest materials are swept clear of the next location with the backhoe or the rakes and pitchforks, with care being taken not to spread the materials over too large an area.
- The nest is checked with a magnetometer. If no anomalies are detected, the team continues to the next area; if an anomaly is detected, the team proceeds to the next step.
- Contacts are excavated as necessary, leaving materials dislodged.
- Spray again with bleach/water solution. Drench all materials and original nest site.

Be Prepared for Rodents or Snakes to Flee the Nest as Activities Progress.

The decision to use the backhoe or rakes and hand tools to clear nests is at the team leader's discretion, based on consideration for:

- Access to the nests with the backhoe
- Nest size, quantity, and location
- Environmental affect likely to be incurred through maneuvering the backhoe in and out of position (i.e., tire ruts, impressions, and outrigger disturbance of topsoils)

10.0 FIELD SANITATION

Upon completion of work in a potential MCV contamination area, team personnel process themselves through the team field sanitation station. Waste materials are placed in plastic bags with disinfectant solution that will completely wet the item disposed of. The plastic bag is then placed in trash receptacles for disposal as ordinary waste. Non-waste materials (coveralls, gloves, etc.) are placed in plastic bags with disinfectant solution, which will completely wet the items. Upon return to the support compound, the items are then processed for ordinary laundering.

11.0 RESPIRATOR FIT TESTING, INSPECTION, AND MAINTENANCE

Employees required to wear a respirator must be fitted properly and tested for a face seal prior to use of the respirator in a contaminated area. Manufacturers provide fitting instructions and use limitations on their product packaging. The following points should be considered for respirator inspection and maintenance:

- The wearer of a respirator will inspect it prior to its use.
- Supervisory personnel will periodically spot check respirators for fit and condition.
- Respirators not discarded after use will be cleaned after use, according to the manufacturer's instructions, by the user.
- Respirators not discarded after one use will be stored in a suitable container away from areas of contamination.
- Inspection and maintenance of respirators will be documented in the team leader's notebook.

STANDARD OPERATING PROCEDURE FOR BACKHOE/EXCAVATOR OPERATIONS

1.0 BACKGROUND

Backhoes/excavators are used at the former Fort Ord to excavate during investigation of subsurface magnetic anomalies, during clearing of rodent nests, and for minor road repair to facilitate site access and egress.

2.0 SCOPE

This standard operating procedure (SOP) contains information specific to the former Fort Ord. It is incumbent upon all designated operators to familiarize themselves with this SOP and Weston Solutions, Inc. (WESTON) FLD 22, and to periodically review them in an effort to remain current with safe, productive backhoe/excavator procedures.

3.0 OPERATIONS

Employees who operate backhoes on the former Fort Ord will be qualified through on-the-job training (OJT) consisting of equivalent OJT that was documented through previous employment or experience, or documented through formal training. When engaged in backhoe/excavator operations the operator will perform daily inspection and maintenance functions and operate the backhoe as directed. Inspections will be documented using the WESTON Equipment Inspection Form or forms from the Operation's Manual. The operator will also conduct OJT for other operators at the team leader's discretion.

3.1 Personal Protective Equipment (PPE)

Modified Level D PPE will be required for personnel engaged in backhoe operations. Clothing items will be:

- Coveralls or work clothing as prescribed
- Work gloves, leather or canvas, as appropriate
- Safety glasses - as wind conditions and airborne particulate matter dictate
- Hard hats
- Work boots (sturdy and of sufficient height to aid in ankle support)
- Hearing protection: noise attenuating helmet or earplugs will be worn by anyone within 25 feet of the backhoe while it is operating; FLD 01 will be followed and hearing protection for any other backhoe brought on site will be determined through a noise survey (sound-level meter survey)

- Dust masks - as wind conditions and airborne particulate matter dictate

***NOTE:** If the backhoe is being used for the clearance of rat nests to facilitate a magnetometer sweep, PPE will be in accordance with the Hantavirus SOP.*

3.2 General Safety Precautions

Maintain minimum separation distances as identified in the appropriate work plans.

The backhoe/excavator will not be operated without a spotter. This includes using the front and rear attachments and backing the tractor. Prior to starting an excavation, a safety arc will be etched in the ground with the rear boom fully extended. If operating on a hard surface, the safety arc will be marked with bright spray paint. Prior to anyone entering the safety arc, the operators will:

- Swing the boom arm fully to one side
- Lower the bucket to the ground
- Return the engine to idle speed
- Hold her/his hands clear of the controls or in the "hands up" position

3.2.1 Equipment Safety Precautions

See the operator's manual.

3.3 Team Composition

One unexploded ordnance (UXO) Technician will serve as a safety observer and director for other team personnel and all members of the backhoe team will be UXO qualified. The minimum team makeup will be:

- One operator
- One ground person

3.3.1 Ground Personnel

Team members working on a backhoe/excavator team will be qualified through OJT and will perform such tasks as magnetometer checks, manual excavation, and checks of the hole.

3.4 Training

Training will be documented in UXO Supervisors' field notebooks and in LFR\WESTON on-site records.

3.5 General Operational Procedures

The operator will have a radio in place so s/he can monitor radio transmissions while driving the backhoe to and from excavation sites. Prior to shutting off the tractor engine the operator should let the engine run at idle speed for a few minutes to allow the turbo charger to cool. Prior to excavation operations the UXO Team Leader will establish/review hand signals with all members of the team. The backhoe will not be used to excavate closer than 12 inches from MEC in accordance with EP-385-1-95A, Section 14, Paragraph b. Removed dirt will be placed at least 2 feet from the expected edge of the excavation, and on the uphill side when working on a slope. Excavations will not be deeper than 4 feet without authorization from the UXO Safety Officer. Such excavations require a competent person as defined by 29 CFR 1926.651-653 to determine step/slope requirements.

STANDARD OPERATING PROCEDURE FOR MEC WITH UNKNOWN FILLER

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures and safety and health requirements applicable in the event ordnance items are discovered and the filler cannot be positively determined at the former Fort Ord.

A Chemical Warfare Material (CWM) Risk Assessment has been completed for the former Fort Ord. The results indicated that the probability of encountering CWM munitions is “unlikely” while the probability of encountering CWM Chemical Identification Sets is “seldom.”

2.0 SCOPE

This SOP applies to all personnel involved in the conduct of munitions and explosives of concern (MEC) clearance on the former Fort Ord.

3.0 REGULATORY REFERENCES

- AR 385-61, AR 385-64, DA Pam 385-61, and DA Pam 385-64 for safety concerning Recovered Chemical Warfare Material (RCWM) containing explosives
- AR 50-6, Chemical Surety
- AR 190-11 Security for RCWM
- EP 75-1-3 RCWM Response Process

4.0 RESPONSIBILITIES

4.1 Remediation Project Manager (RPM)

The RPM is responsible for ensuring availability of resources required to safely implement this SOP.

4.2 Senior Unexploded Ordnance Supervisor (SUXOS)

The SUXOS is responsible for incorporating this SOP in plans, procedures, and training and ensuring that all personnel conducting MEC operations are familiar with and comply with this SOP.

4.3 UXO Safety Officer (UXOSO)

The UXOSO ensures that all operations pertaining to MEC clearance are being conducted in a safe manner and in accordance with the appropriate work plans and this SOP. The UXOSO conducts safety audits of the operations and ensures that all personnel are properly trained and utilizing the appropriate personal protective equipment (PPE).

4.4 UXO Team Leader

The UXO Team Leader is responsible for supervision of the team conducting the clearance operation. The UXO Team Leader is required to conduct training of personnel involved in MEC operations to ensure that every member of the MEC team thoroughly understands this SOP.

5.0 OPERATIONS

5.1 General

There are three ordnance items of concern that require positive identification of the filler prior to any disposition, the Livens Projector, the 4-inch Stokes mortar, and the 4.2-inch mortar.

- Visual recognition of the Livens Projector, 4.2-inch mortar, and the 4-inch Stokes is necessary and requires training on recognition features to ensure everyone uses the same techniques. The 4-inch Stokes mortar of concern is 19.56 (19/16) inches in length, measured from the end of the tail boom to the top of the threaded fuze well. 4-inch Stokes mortars of lesser lengths contain known fillers and will be treated as any other MEC item.
- All Livens Projectors and all 4.2-inch mortars are common in dimensions and have different fillers. These ordnance items along with the 19.56-inch-long, 4-inch Stokes will be treated as MEC with unknown fillers.
- Upon recognition/identification of a Livens Projector, a 4.2-inch mortar, or a 4-inch Stokes by any UXO team member conducting a MEC clearance operation, the team member will immediately notify the Team Leader who will measure the item. If the measurements indicate a possible CWM-filled Stokes, or if the item recognized/identified is a 4.2-inch mortar or a Livens Projector, the Team Leader will notify the SUXOS and the UXOSO.
- The UXO team and any other teams in the area will evacuate the area, proceeding at least 200 feet upwind, and await the UXOSO and the SUXOS.
- Upon arrival of the UXOSO, the UXO Team Leader will accompany her/him to the location of the suspect item.
- In the event the UXOSO and SUXOS determine that the item contains a known filler other than CWM, it shall be disposed of in accordance with the work plan.

- Upon verification by the UXOSO and SUXOS of an MEC item with an unknown filler, the exact location will be recorded using a Global Positioning System unit and backfilled with excavated material. The UXO Team Leader will evacuate to the safe area upwind, and the UXOSO and SUXOS will notify the RPM who will notify the Fort Ord Reuse Authority (FORA) who will notify the Presidio of Monterey Police who will notify the Technical Escort Unit (TEU). Following the property transfer from the Army to FORA, FORA will notify the local law enforcement agency who will notify the local Explosive Ordnance Disposal (EOD) unit assigned to the region. In addition, when FORA notifies the local law enforcement agency, they will also notify the Presidio of Monterey Police Department and the local BRAC Fort Ord Field office.
- In the event TEU or the EOD unit positively identifies the filler as CWM, or the filler remains unknown, TEU or the EOD unit will make the determination for and conduct a safe disposal of the item.
- In the event TEU or the EOD unit positively identifies the filler as non-CWM, they will release the item to WESTON for disposal in accordance with the work plan.

6.0 SAFETY

6.1 General

At no time will a Livens Projector, a 4.2-inch mortar, or a 4-inch Stokes mortar measuring 19.56 inches in length (fuzed or unfuzed) be moved prior to disposition determination by TEU.

6.2 PPE

Standard PPE for field MEC operations will be utilized in accordance with the work plan.

STANDARD OPERATING PROCEDURE FOR MATERIAL OR ACTIVITY NONCONFORMANCES

1.0 PURPOSE

This standard operating procedure (SOP) describes the means for the identification, control, handling, review, and disposition of nonconforming material and activities during all phases of the work at the former Fort Ord to prevent the unintended use or delivery of inadequate materials and/or work products.

2.0 RESPONSIBILITIES

Unexploded Ordnance Quality Control (UXOQC) personnel have the responsibility to identify, document, and report material, items, or activities that do not conform to prescribed technical and/or quality requirements during all phases of the project.

2.1 Remediation Project Manager (RPM)

The RPM has overall responsibility for implementing this procedure and for ensuring the availability of the resources needed to implement this SOP, and will also ensure that this SOP is incorporated in plans, procedures, and training for sites where this SOP is to be implemented.

2.2 Senior UXO Supervisor (SUXOS)

The SUXOS will be responsible on behalf of the RPM for receipt of all nonconformance reports (NCRs) and the determination of their disposition to correct the nonconforming condition accordingly.

2.3 UXO Quality Control Specialist (UXOQCS)

The UXOQCS will be responsible on behalf of the RPM for ensuring this SOP is effectively implemented.

3.0 PROCEDURES

UXOQC personnel will document nonconforming materials, items, or activities in an NCR. Instructions for completing an NCR are provided with the form. A hard copy or an electronic version may be used. The initiator shall fill out the description and apparent cause of the nonconforming condition. The UXOQCS will review, validate, denote severity level (Attachment 1), assign the corrective action due date, and sign the NCR. The UXOQCS will

establish and maintain a log of NCRs issued and track the progress of each NCR using the NCR log (Attachment 2).

3.1 Nonconformance Condition/Release

After the NCR is received and validated by the SUXOS, a nonconforming condition may be conditionally released if justified in writing and approved by the RPM or, where applicable, by the customer. Justification of release will be retained on file as a project record.

3.2 NCR Disposition/Review

The SUXOS may designate a competent individual, knowledgeable in the requirements and with access to pertinent information, to provide recommendations for the NCR's disposition as one of the following rework categories to meet the original requirements: re-clear, resurvey, reacquire, reprocess, or other with explanation. The RPM shall also review and concur with the recommended corrective action prior to implementation. Any corrective action is to be completed by the corrective action due date assigned on the NCR form.

For a severity level of 1, root cause analysis and corrective action (see SOP for Corrective and Preventive Action) to prevent recurrence is required.

3.3 NCR Closure

A verifier appointed by the UXOQCS will verify satisfactory completion of actions for disposition of the nonconformance. Reworked items will be re-inspected to demonstrate conformance to the requirements. If UXOQC personnel determine the corrective action completed is insufficient, the UXOQCS will disapprove the corrective action and initiate a new NCR documenting the determining unsatisfactory factors in the closeout comments section. If the corrective action implemented by the SUXOS effectively eliminated the nonconforming condition, the manner in which the corrective action was verified by UXOQC personnel will be documented by UXOQC personnel in the closeout comments section.

ATTACHMENT 1
Severity Level Descriptions

SEVERITY LEVEL	DESCRIPTION
1	A classification assigned to a condition that indicates repeated failures to prescribe or implement requirements properly, whose effect is systemic in nature, and that undermines the ability to ensure and demonstrate confidence in quality or safety.
2	A classification assigned to a condition that indicates a systemic failure to prescribe or implement requirements properly and whose effect undermines the ability to ensure and demonstrate confidence in quality or safety.
3	A classification assigned to a condition that indicates a systemic failure to prescribe or implement requirements properly. Its effect, however, on quality or safety is minimal.
4	A classification assigned to an obviously isolated condition that indicates a failure to prescribe or implement requirements properly and is non-systemic, but could lead to a Severity Level 3 or higher condition.

ATTACHMENT 2

Nonconformance Report (NCR) Log

[illegible]

STANDARD OPERATING PROCEDURE FOR CORRECTIVE AND PREVENTIVE ACTION

1.0 PURPOSE

This standard operating procedure (SOP) describes the method for conducting root cause analyses of severity level 1 nonconformities identified by NCRs and customer complaints, and evaluating the need for action to ensure that the nonconformities do not recur. Descriptions of the severity levels are provided in the SOP for Material and Activity Nonconformances.

The procedure establishes the methodology to conduct trend analyses of nonconformities identified through NCRs for severity levels 2, 3, and 4, corrective actions, quality surveillance reports, and internal audit results, to identify the repetitive nonconformities and determine preventive action to eliminate the cause of potential repetitive nonconformities.

2.0 RESPONSIBILITIES

2.1 Remediation Project Manager (RPM)

The RPM will establish an operations project team to investigate the root cause of a severity level 1 nonconformance and recommend action to prevent the recurrence.

The RPM is responsible for reviewing the results of the root cause analysis and trend analysis, assigning corrective and preventive actions, and monitoring process performance as a part of the RPM's management review.

2.2 Unexploded Ordnance Quality Control Specialist (UXOQCS)

The UXOQCS will provide support to effectively implement this SOP. Additionally, all root cause analyses, trend analyses, and preventive action reports will be reviewed and recommendations will be provided if applicable.

2.3 Senior UXO Supervisor (SUXOS)

The SUXOS will periodically conduct trend analysis of nonconformities from the sources described herein, and report the results to the RPM and UXOQCS.

3.0 PROCEDURES

3.1 Root Cause Analysis

The operations project team appointed by the RPM will determine the root cause of a severity level 1 nonconformance. The root cause determination will depend upon project-specific factors affecting the product development, product conformity, or process performance. The nonconformity may be classified using event and causal factor codes (Attachment 1) following the root cause analysis. The root cause analysis will identify corrective actions to prevent recurrence. The record of the root cause analysis and corrective action taken will be maintained on file with the UXOQCS as a part of the project record.

3.2 Trend Analysis

The operations project team review results from the following sources and perform a trend analysis when sufficient information and data are available to ensure that the analysis is meaningful. Typically, a trend analysis should be conducted once at least every 6 months for projects of 1 year or longer in duration. For short-duration projects, the trend analysis should be done at about the halfway point.

- (1) Corrective actions (severity level 1 NCRs, customer complaints)
- (2) Internal and external (including customer) audit results, quality surveillance/audit reports
- (3) NCRs (severity levels 2, 3, or 4)

3.3 Preventive Action

For the period under review, the project operations team shall determine the root cause(s) of potential repetitive nonconformities and evaluate the need for action to prevent their recurrence. The project operations team will prepare a report identifying the nonconformities for each area of the project processes/procedures, a consolidated summary of root causes of the nonconformities, and a statement of trends that are developing or have developed, and submit the report to the RPM. The RPM will provide appropriate corrective actions to the UXOQCS to prevent recurrence of the adverse trends. The team and the UXOQCS will verify implementation of the preventive actions and report the results to the RPM. The record of trend analysis and preventive action taken will be maintained on file by the UXOQCS as a part of the project record.

ATTACHMENT 1
Event and Causal Factor Codes

EVENT		CASUAL FACTOR	
CODE	DESCRIPTION	CODE	DESCRIPTION
A	Noncompliance with standards, policies, procedures, or other administrative controls	1	Incorrect or inadequate procedures
B	Human error/inattention to detail	2	Insufficient, inadequate, or lack of training
C	Failure to meet contractual requirements	3	Inadequate supervision/management skills or practices

STANDARD OPERATING PROCEDURE FOR UNANTICIPATED CHEMICAL CONTAMINATION CONDITIONS

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures applicable in the event that unanticipated chemical contamination conditions are encountered or suspected.

Unanticipated chemical contamination conditions may include, but are not limited to:

- oily, shiny, pigmented, or saturated soil or free product;
- soil with a strong chemical odor;
- discovery of objects or structures of environmental concern such as underground storage tanks and associated piping, buried drums, sumps, etc.;
- discovery of suspected debris of environmental concern such as buried refuse, painted building materials, asbestos-containing pipes, or Transite™;
- other conditions that vary materially from those documented during previous investigations;
- discovery of areas containing a high concentration of spent ammunition; and
- discovery of bulk explosives.

2.0 SCOPE

This SOP applies to all personnel involved in operations that have the potential to disturb or expose soil.

3.0 REFERENCE DOCUMENTS

- Weston Corporate Safety and Health Program (FLD47)
- ESCA RP Waste Management SOP
- 29 CFR 1910.120
- 29 CFR 1926.65
- 22 CCR Division 4.5

4.0 RESPONSIBILITIES

4.1 Remediation Project Manager (RPM)

The RPM is responsible for ensuring that the Fort Ord Reuse Authority (FORA), the United States Department of the Army (Army), and the appropriate regulatory agencies (identified in Table 2 of this SOP) are notified.

4.2 Senior Unexploded Ordnance Supervisor (SUXOS)

The SUXOS is responsible for incorporating this SOP in plans, procedures, and training. The SUXOS will be responsible for providing notification to the Environmental Services Cooperative Agreement Remediation Program (ESCA RP) Team members identified in Table 1 of this SOP.

4.3 UXO Safety Officer (UXOSO)

The UXOSO ensures that all operations are being conducted in a safe manner and in accordance with the appropriate work plan and this SOP. The UXOSO conducts safety audits of the operations and ensures that all personnel are properly trained and utilizing the appropriate personal protective equipment (PPE).

4.4 Field Personnel

Field personnel will be conducting the fieldwork activities. Personnel conducting fieldwork activities are responsible for completing their tasks according to specifications outlined in this SOP and associated work plans. In the event that suspected soil contamination is encountered during fieldwork activities, field personnel must notify the SUXOS immediately.

4.5 Environmental Professional

The environmental professional is a member of the ESCA RP Team who possesses sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and reach conclusions regarding conditions indicative of releases or threatened releases of hazardous substances to the soil. The environmental professional will be responsible for determining whether initial screening-level soil samples should be collected and/or notifying the RPM that the Army should be notified immediately, and FORA and the appropriate regulatory agencies should be notified within 24 hours by contacting their representatives listed in Table 2.

5.0 OPERATIONS

If suspected soil contamination is encountered during the fieldwork activities, the following procedures will be followed:

1. All field activities that may potentially disturb the unanticipated chemical contamination will be immediately stopped. Field personnel encountering the unanticipated chemical contamination must immediately notify the SUXOS and move to a safe location to avoid odors or leaking fluids (i.e., upwind or uphill).
2. If there is no immediate danger to personnel, field personnel will create an appropriate exclusion zone with markers and/or barricades around the suspect area to prevent further soil disturbance in this area.
3. If an emergency situation requiring medical attention, containment assistance, or other emergency assistance arises, the emergency procedures specified in the Site Safety and Health Plan will be followed.
4. The SUXOS will immediately notify the ESCA RP Team representatives listed in Table 1.
5. An environmental professional on the ESCA RP Team will be mobilized to visually assess the suspect area. If it is determined by the environmental professional that contamination by chemical compounds is possible (based upon visual observation or the analytical results of initial screening-level sampling), the environmental professional will notify the RPM.

Examples of suspect contamination include the discovery of:

- oily, shiny, or saturated soil or free product;
- significant areas (greater than 3 square feet) of pigmented soil that do not appear to be related to native soil coloring;
- soil with a strong chemical odor;
- objects or structures of environmental concern such as underground storage tanks and associated piping, buried drums, sumps, etc.;
- significant quantities of suspect debris of environmental concern such as asbestos-containing pipes, Transite™, or similar ACM;
- significant quantities of suspected debris of environmental concern such as treated wood waste, chipping, cracking, or alligatoring paint (indicative of LBP), or electrical components;
- other conditions that vary materially from those documented during previous investigations;
- areas of high concentrations of spent ammunition; and
- bulk explosives.

Examples of the above are found in Attachment 1.

The RPM will notify the Army immediately and FORA and the appropriate regulatory agencies within 24 hours by contacting their representatives listed in Table 2. Information provided to the Army will include the location of the discovery (including Global Positioning System [GPS] location) and approximate depth of discovery; the site conditions at the time of discovery; and a description of changes to the site conditions since the discovery.

6. If practicable and if it is safe to leave the area exposed, the suspected contamination will not be disturbed until the Army has determined whether soil samples or remedial activities are necessary. Work should not resume in the affected area until remedial activities have been completed or the suspected chemical contamination is determined to be benign.
7. If the suspected contamination is *not* a U.S. Army-retained condition (for example building debris) the ESCA RP Team may collect samples of the debris for classification purposes as described in the Waste Management SOP.
8. If samples collected by the ESCA RP Team indicate that the building debris may have affected site soils (for example if the material contains lead-based paint and fails the Soluble Threshold Limit Concentration [STLC]), the ESCA RP Team will consult with FORA and regulatory agencies to determine if additional investigation is necessary.
9. If only building materials are affected, the ESCA RP Team will remove the debris until no visible material is present, segregate the debris for disposal, and classify the material for waste disposal as described in the Waste Management SOP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

Appropriate PPE for the particular fieldwork activity will be utilized in accordance with the appropriate work plan. Equipment and clothing coming in contact with the potential contamination will be decontaminated in accordance with the appropriate work plan.

7.0 NOTIFICATIONS AND REPORTING

If unanticipated contamination is encountered or suspected in the field, the persons indicated in Table 1 must be notified immediately.

Table 1
ESCA RP Team Contact List

Contact	Telephone (office/cell)
ESCA RP Team	
Weston: Linda Temple (ESCA Remediation Project Manager) <u>and</u> Greg Clark (Site Safety Officer)	(831) 384-3221 / (831) 229-1668 (831) 384-3221 / (831) 240-1391
LFR: Christopher Spill (ESCA Technical Project Manager) <u>or</u> Wendy Bellah (ESCA Remediation Project Engineer) <u>and</u> Kristie Reimer (ESCA Remediation Program Manager)	(831) 384-3221 / (510) 387-3765 (510) 596-9608 / (510) 590-7317 (831) 384-3221 / (650) 224-8545

Notes:

Weston = Weston Solutions, Inc.

LFR = LFR Inc.

If unanticipated contamination is visually confirmed in the field by an ESCA RP Team representative identified in Table 1, the appropriate persons indicated in Table 2 will be notified within 24 hours by an ESCA RP Team representative. The Army representative will be notified immediately.

Table 2
Client and Regulatory Agency Contact List

Contact	Telephone (office/cell)
FORA: Stan Cook (FORA ESCA Program Manager)	(831) 883-3672
ESCA RP Team	
Weston: Nelline Kowbel (ESCA Remediation Project Engineer)	(925)948-2616 / (510) 932-9212
LFR: Chuck Pardini (ESCA Program Quality Manager)	(650) 469-7224 / (510) 813-1053
Army: Gail Youngblood (Environmental Coordinator)	(831) 242-7918
U.S. EPA: Judy Huang (Remediation Project Manager)	(415) 972-3681
DTSC: Roman Racca (Project Manager)	(916) 255-6407
Monterey County Department of Environmental Health, if needed	(831) 755-4500
Other agencies as applicable, e.g., National Response Center	(800) 424-8802

Notes:

U.S. EPA = United States Environmental Protection Agency

DTSC = Department of Toxic Substances Control

If unanticipated contamination is encountered, the ESCA RP Team will document it in a report that is submitted to the regulatory agencies within 30 days after the discovery of the unanticipated contamination. This report will include the following:

- brief description of the nature of suspected contamination and how it was discovered;
- verification of notification of personnel listed in Table 2;
- description/verification that the procedures outlined in this SOP were followed to alert the Army of the presence of a retained condition (if applicable); and
- characterization (including stockpile and confirmation sampling) data collected.



Photograph #1

Description of Photograph:

Example of product on equipment in trash pile.



Photograph #2

Description of Photograph:

Example of significantly stained oily soil.



Photograph #3

Description of Photograph:

View of pigmented soil.



Photograph #4

Description of Photograph:

Example of unanticipated buried tank.



Photograph #5

Description of Photograph:

Example of partially buried and damaged drum.



Photograph #6

Description of Photograph:

Example of Transite™ pipe.



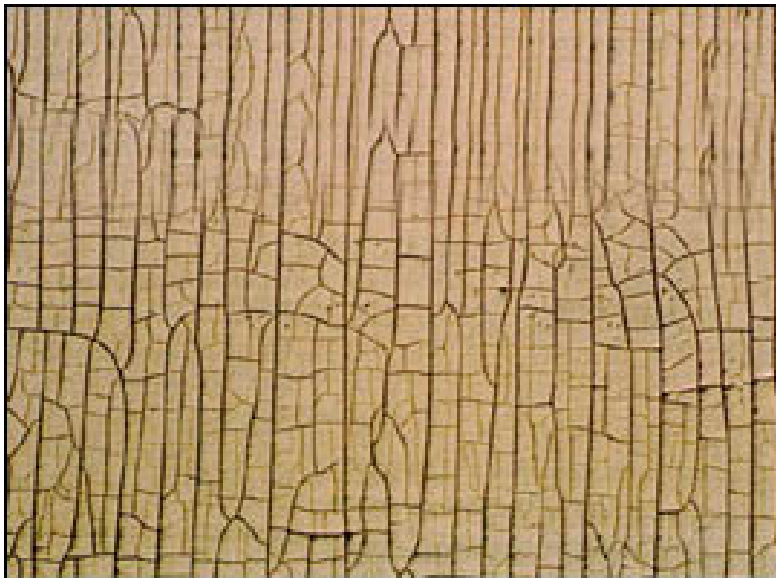
Photograph #7

Description of Photograph:

Example of asbestos-containing pipe wrap on water main.

Photograph Taken By:

Michael Doherty



Photograph #8

Description of Photograph:

Example of alligatoring LBP.



Photograph #9

Description of Photograph:

Example of cracking LBP.



Photograph #10

Description of Photograph:

Exampling of severely chipping LBP.

STANDARD OPERATING PROCEDURE FOR MANAGEMENT AND CHARACTERIZATION OF WASTE STREAMS FROM FIELD ACTIVITIES

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures for identifying waste streams generated from field activities and to provide guidance for the characterization and proper disposition of these waste streams.

For the purposes of this SOP “waste streams” have been defined as any material that was generated by field activities that will not be reused onsite. For the purposes of this report waste streams do not include environmental conditions retained by the U.S. Army such as potentially contaminated soil. If these materials are uncovered field personnel should refer to the soil management plan and the SOP for Unanticipated Chemical Contamination Conditions. For the purposes of this report waste streams do include recyclable materials. The Fort Ord Reuse Authority (FORA) Environmental Services Cooperative Agreement (ESCA) Remediation Project (RP) Team has identified the following potential waste streams at the Site which would be covered by this SOP:

- Painted construction debris;
- Lead affected soil, rock or fines;
- Lead-based paint chips;
- Friable asbestos-containing material;
- Non-friable asbestos-containing material;
- Treated wood;
- Unpainted construction debris not planned for recycling;
- Unpainted concrete-recyclable;
- Metal-recyclable;
- Asphalt-recyclable;
- White goods;
- Universal Waste-Florescent Bulbs;
- Universal Waste- Mercury switches, thermometers and gauges;
- Universal Waste-Batteries;
- Light Ballasts;
- Lubricating fluids;
- Vehicles and related debris (non tire);
- Tires-recyclable;
- Wood and vegetative mulch;

- Personal protective equipment (PPE) and field consumables;
- Decontamination water;
- Residual fluids in latrine pits; and
- Munitions debris.

Additionally, the ESCA RP Team understands that the reuse or recycling of some materials (specifically; asphalt road base, vegetative mulch, soil and/or gravel) may not be practicable due to concerns of residual constituents remaining within these materials (Section 5.0).

2.0 SCOPE

This SOP applies to all personnel involved in the characterization, manifesting, and disposition of waste stream materials. This document is intended to aid in planning for and handling waste streams which may be encountered at the Site. Not all waste streams described may be present at the Site.

3.0 REFERENCE DOCUMENTS

- Weston Corporate Safety and Health Program (FLD47)
- American Society for Testing and Materials (ASTM) Standard E1908-03
- 14 CCR Division 7
- 22 CCR Division 4.5
- 27 CCR Division 2
- MBUAPCD Rule 424
- Department of Toxic Substances Control (DTSC) “Information Advisory - Clean Imported Fill Material” Dated October 2001
- 29 CFR 1910.120
- 29 CFR 1926.65
- 40 CFR 61
- 40 CFR 260 to 279
- 40 CFR 761
- 49 CFR 171 to 173, 179

4.0 RESPONSIBILITIES

4.1 Remediation Project Manager (RPM)

The RPM is responsible for the proper classification, handling and disposition of the waste streams.

4.2 Senior Unexploded Ordnance Supervisor (SUXOS)

The SUXOS is responsible for incorporating this SOP in plans, procedures, and training of field crews. The SUXOS is also responsible for notifying the environmental professional when suspect hazardous waste is encountered or when materials will require classification prior to disposal. The SUXOS will be responsible for certifying that materials leaving the Site are free from explosives (FFE) using Form 1348.

4.3 UXO Quality Control Specialist (UXOQCS)

The UXOQCS also certifies that materials leaving the Site are FFE on Form 1348.

4.4 Field Personnel – HAZWOPER Trained

Field personnel will be conducting the discovery, handling, segregation, containerization, and related activities associated with the disposition of waste streams. Field personnel are responsible for completing their tasks according to specifications outlined in this protocol and associated work plans. In the event that suspected hazardous waste is encountered during activities, field personnel must notify the SUXOS immediately.

4.5 Environmental Professional

A member of the ESCA RP Team who possesses sufficient specific education, training, or experience necessary to exercise professional judgment to develop opinions and conclusions regarding the classification and condition of Site waste streams. The environmental professional will be responsible for determining whether sufficient data exists to accurately classify and characterize materials into appropriate waste streams for disposition.

4.6 Generator

The generator is the owner or operator of the waste stream and is ultimately responsible for properly characterizing and handling the waste streams generated at the Site.

The hazardous waste generator for the ESCA RP Team **prior** to the transfer of property to the Fort Ord Reuse Authority is:

The Ord Military Community
US Army DLIFLC – Presidio of Monterey
P.O. Box 5005
Monterey, California 93944
(831) 242-7933
Contact: Richard Schmitt

Mr. Schmitt should be notified at least 1 week prior to planned shipment of manifested waste to ensure that material disposal is authorized by and are properly characterized, logged, and manifested by the Army. Mr. Schmitt, or his authorized signatory, are the only designated Army contacts authorized to sign manifests and associated profiles, land disposal restrictions or similar waste documents on the behalf of U.S. Army.

The hazardous waste generator for the project team **after** the transfer of property to the Fort Ord Reuse Authority is:

The Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, California 93933
(831) 883-3672
Contact: Stan Cook

Mr. Cook should be notified at least 1 week prior to planned shipment of manifested waste to ensure that material disposal is authorized by and are properly characterized, logged, and manifested by FORA. Mr. Cook, or his authorized signatory, are the only designated contacts authorized to sign manifests and associated profiles, land disposal restrictions or similar waste documents on the behalf of FORA.

4.6.1 Generator Training Requirements

As required signatories responsible for filling out hazardous waste manifests should have an appropriate level of training necessary to understand classification, handling manifesting and disposal of the generated waste streams.

5.0 OPERATIONS

As described in Section 1, the ESCA RP Team has identified 23 possible waste streams that may be developed in the course of munitions cleanup operations at the portions of the former Fort Ord covered by the ESCA RP. The intent of this SOP is to ensure that potentially hazardous waste streams are identified, segregated, properly classified and handled in the course of field activities. Each waste stream released from the Site will have documentation showing that the material was characterized, shown to be free from explosives, and detailing the material's final disposition. A minimum of three individuals (the SUXOS, UXOQCS, and Environmental Professional) will investigate each waste stream to verify that either it is free from explosives or that the waste stream is either non-hazardous or is properly classified and manifested for off-Site disposal.

The ESCA RP Team understands that some materials that are generally considered non-hazardous or recyclable (Specifically - asphalt road base, vegetative mulch, soil and gravel) may have been affected by constituents which would disallow the reuse of the material off-Site. The ESCA RP Team will therefore seek regulator approval prior to the transport or disposition of the materials off-Site. Alternately these materials may be classified as munitions debris in the event of off-Site disposal.

A description of the process of classifying the environmental disposition of each of the 23 identified potential waste streams is found below. Please note that every waste stream may not be generated by field activities at the Site.

5.1 Painted Construction Debris

Painted building debris will be inspected for lead-based paint or will be assumed to contain lead unless determined otherwise by sampling and analytical testing. Building debris containing lead will be segregated and loose and flaking lead-based paint will be removed and managed as a separate waste stream. The remaining painted building components will be characterized following the procedures set out in ASTM E1908-03 and 22 CCR Div 4.5. Depending on the results of the total threshold limit concentration (TTLIC), soluble threshold limit concentration (STLC) and toxicity characteristic leaching procedure (TCLP) tests the materials will be labeled, packaged and manifested for disposal as either a federal hazardous waste, State of California hazardous waste or as non-hazardous waste at an appropriately permitted landfill.

5.2 Lead Affected Soil, Rock, or Fines

If lead contamination is suspected or if lead affected soil is discovered during the building survey or building demolition field activities, affected soil will be excavated and stored on an impermeable surface and covered with plastic sheeting or placed in lined closed top dumpsters. Composite samples will be collected from the soil and will be analyzed using the procedures set forth in 22 CCR Division 4.5. The RP Team anticipates that one composite soil sample consisting of four to eight aliquots will be sufficient for characterizing the soil associated with each building identified as having lead affected soil.

For larger excavation areas soil samples will be collected in general accordance with the Department of Toxic Substances Control (DTSC) “Information Advisory - Clean Imported Fill Material” dated October 2001. LFR anticipates that waste soil piles up to 1,000 cubic yards will be characterized by 1 composite soil sample per every 250 cubic yards of material or other analytical procedures as requested by the presumed disposal location.

5.3 Lead-Based Paint Chips and Ceramic Tiles

Known lead-containing waste streams created during work activities should be segregated from non-lead-containing waste streams. For example ceramic tiles and paint chips removed from buildings should be handled as lead-hazardous waste until bulk composite samples are collected and analyzed using the procedures set forth in 22 CCR

Division 4.5.

Depending on the results of the total threshold limit concentration (TTLC), soluble threshold limit concentration (STLC) and toxicity characteristic leaching procedure (TCLP) tests the materials will be labeled, packaged and manifested for disposal as either a federal hazardous waste, State of California hazardous waste or as non-hazardous waste at an appropriately permitted landfill.

5.4 Regulated Asbestos-Containing Material

Suspect asbestos-containing materials will be sampled and analyzed by polarized light microscopy for asbestos content. Materials determined to be greater than or equal to 1% asbestos will be considered an asbestos-containing material (ACM). Friable asbestos-containing materials and non-friable ACM that has been subjected to mechanical removal methods or is significantly damaged will be placed in labeled and doubled six-mil poly bags for transportation to the disposal facility as California Hazardous Waste.

5.5 Non-Friable Asbestos-Containing Material

Non-friable ACM such as roofing materials, floor tiles, Transite panels, etc., that are intact and have not been subjected to mechanical removal methods will be disposed of as nonhazardous asbestos-containing construction debris at a permitted Class 3 landfill. Shipment logs will be kept for non-friable ACM, a hazardous waste manifest is not required.

5.6 Treated Wood Waste

Used lumber treated with pentachlorophenol, creosote or other preservative treatments such as electric poles, telephone poles, and railroad ties will be disposed of at an approved landfill or hazardous waste disposal facility permitted to accept treated wood waste (TWW).

TWW will be segregated onsite from other materials and stored off the ground or on an impervious surface. Treated wood waste will be covered during inclement weather and labeled with the following information:

TREATED WOOD WASTE – Do not burn or scavenge.

TWW Handler

Name: _____

Address: _____

Accumulation Date: _____

Shipment logs will be kept for TWW, a hazardous waste manifest is not required.

5.7 Unpainted Construction Debris Not Planned for Recycling

Unpainted construction debris not suspected as being a TWW will be collected as disposed of at a permitted class 3 facility.

5.8 Unpainted Concrete-Recyclable

Unpainted concrete such as building foundations, non-asbestos concrete pipes and culverts, and like building materials will be collected, segregated and recycled.

5.9 Metal-Recyclable

Metals waste such as barbed wire, concertina wire, and used pipes will be collected and segregated and picked up by a metal recycler.

5.10 Asphalt-Recyclable

Asphalt and asphaltic concrete (AC) that is segregated during removal operations, for example demolition of road ways and parking lots, will be collected, segregated and sent for recycling.

5.11 White Goods

White goods will be collected and sent to a certified appliance recycler (CAR) for the removal of materials that require special handling and eventual recycling of the appliances.

5.12 Universal Waste-Lamps

Florescent lamps, sodium vapor lamps and high intensity discharge lamps will be removed intact, placed in padded recycling containers and brought to a recycler.

5.13 Universal Waste-Mercury Switches, Thermometers, and Gauges

Mercury switches, thermometers and gauges not installed in a building and not associated with an appliance or vehicle will be removed intact and placed in a padded recycling container for shipment to a mercury recycling facility.

5.14 Universal Waste-Batteries

Batteries found in alarm boxes, emergency lighting, rechargeable tools, as well as disposable batteries should be collected and stored as universal waste until they are sent to an approved recycler and/or disposal facility. Lead-acid type batteries (such as automotive batteries) should be recycled. Lead acid type batteries would be considered a hazardous waste if disposal is required.

5.15 Ballasts and Capacitors

Electrical ballasts and capacitors that are suspected to have been manufactured prior to 1979 and are not labeled “No-PCBs” should be removed intact and handled as if the unit contained PCBs at levels greater than or equal to 50 ppm and the disposition of these materials would be regulated under Toxic Substances Control Act (TSCA) and would be considered a Hazardous Waste in California.

Ballasts and capacitors labeled non-PCB may contain Di (2-ethylhexyl) phthalate (DEHP) and should also be removed intact segregated and sent to an approved recycler.

5.16 Lubricating Fluids

Used oil should be collected and segregated from other fluids to prevent contamination which would prevent recycling. The ESCA RP Team does not anticipate generating more than 55-gallons of waste oil from activities on the Site. Used oil should be collected by a certified hauler or delivered to a certified collection center to be recycled.

5.17 Vehicles and Related Debris (Non-Tire)

Vehicles and vehicle components should be sent to an approved recycler to allow for the reclamation of refrigerants, mercury switches, automotive fluids and similar items before scraping the vehicle.

5.18 Tires-Recyclable

The FORA ESCA RP Team does not anticipate generating more than 10 waste tires from operations at the Site however waste tires will be stored for collection by an approved Waste Tire Hauler and logged on a comprehensive trip log for recycling.

5.19 Wood and Vegetative Mulch

Where appropriate vegetative mulch will remain onsite to be used for erosion control or seed base. If a market exists salvage wood may be cut into fire wood and sold instead of being mulched.

5.20 Personal Protective Equipment (PPE) and Field Consumables

Used PPE will be disposed of as nonhazardous solid waste unless there is evidence of gross contamination, in which case the PPE will either be disposed as hazardous waste appropriate to the material handled or sampled and chemically tested to confirm a designation as non-hazardous.

5.21 Decontamination Water

Decontamination fluids will be containerized in DOT-approved 55-gallon drums or in temporary polyethylene storage tanks. When full, the drum and/or tank contents will be sampled and the samples submitted to an EPA-approved analytical laboratory for chemical analysis. The decontamination fluid containers will be labeled “Potentially Hazardous Waste Pending Further Investigation” until a hazardous or non-hazardous determination can be made based on the laboratory analysis results. The contents will then be disposed of appropriately based on the hazard designation.

5.22 Residual Fluids in Latrine Pits

Residual fluids from pit latrines will be pumped by an approved septic pumping company for treatment at a sewage waste treatment plant.

5.23 Munitions Debris

Non-recyclable munitions debris that requires disposal will be 100% investigated by the UXO technician before submitting the material for approval as free from explosives by the SUXOS and UXOQCS. The FFE munitions debris will be disposed of at an approved landfill.

6.0 LABELS AND HAZARD COMMUNICATION

All containerized materials will be appropriately labeled as required to allow workers sufficient warning as to the hazard potential of the container's contents. Labels should be of sufficient size to be clearly legible and display the container's content including if the material is a hazardous, an asbestos-containing, a TWW, a PCB-containing waste, a mercury-containing waste, or a non-hazardous waste. Additional information may be required on the label as required by specific regulation.

7.0 DISPOSAL OPTIONS

Hazardous, Asbestos-Containing, and TWW waste streams that are not scheduled for recycling will be stored in either satellite accumulation points or temporary (less than 90-day) storage areas. These waste streams will be manifested and transported for disposal or recycling in accordance with appropriate regulatory requirements. Disposal of hazardous streams will be at approved Class 1 treatment, storage, and disposal facilities.

Non-hazardous waste streams will be stored in general storage areas. Non-hazardous waste streams will be shipped using bills of lading, waste shipment records, or similar documentation. Non-hazardous waste streams not scheduled for recycling will be disposed only at approved Class 2 or Class 3 facilities.

APPENDIX D

Quality Assurance Project Plan

Appendix D: Quality Assurance / Quality Control Project Plan

FINAL
Group 4 Remedial Investigation / Feasibility Study
Work Plan

Volume 2 - Sampling and Analysis Plan

Future East Garrison Munitions Response Area

Former Fort Ord
Monterey County, California

October 8, 2010

Prepared for:

FORT ORD REUSE AUTHORITY

100 12th Street, Building 2880
Marina, California 93933



Prepared Under:

Environmental Services Cooperative Agreement
No. W9128F-07-2-01621

and

FORA Remediation Services Agreement (3/30/07)

Document Control Number: 09595-09-079-045

Prepared by:

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ACRONYMS AND ABBREVIATIONS

BADT	Best Available (and Appropriate) Detection Technology
bgs	below ground surface
CAR	Corrective Action Report
CEP	Circular Error Probable
cm	centimeter
DGM	digital geophysical mapping
DQOs	Data Quality Objectives
ESCA	Environmental Services Cooperative Agreement
FORA	Fort Ord Reuse Authority
GPS	Global Positioning System
GSV	Geophysical System Verification
IVS	Instrument Verification Strip
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MQOs	Measurement Quality Objectives
MRA	Munitions Response Area
mV	millivolt
ODDS	Ordnance Detection and Discrimination Study
Pd	probability of detection
PDOP	positional dilution of precision
QAPP	quality assurance project plan
QC	quality control
RP	Remediation Program
RTK	real-time kinematic
STDEV	standard deviation
SUXOS	Senior Unexploded Ordnance Supervisor
UXOQCS	Unexploded Ordnance Quality Control Specialist

1.0 PLAN OVERVIEW

The objective of the quality assurance project plan (QAPP) is to provide unbiased evidence of the quality of the data acquired and decisions made during the munitions and explosives of concern (MEC) investigation at the Future East Garrison Munitions Response Area (MRA), as evaluated against the measurement performance criteria described in this plan. This plan covers the use of digital and analog operations.

The measurement performance criteria are called Data Quality Objectives (DQOs). The primary methods used to provide evidence of compliance with DQOs are:

- Prequalification of policies and procedures
- Acceptable performance on a test strip
- Auditing of field activities
- Acceptance sampling of completed work

To support project DQOs, individual Measurement Quality Objectives (MQOs) will be implemented to document that the procedures and acquired data can achieve the performance goals. MQOs include the implementation of an Instrument Verification Strip (IVS), instrument standardization protocols, and data set collection parameters with pass/fail metrics to monitor and evaluate the geophysical results. Quality Control (QC) measurement metrics will be verified using the IVS prior to further data collection. A summary of the DQOs and MQOs are provided in Table 1.

The Fort Ord Reuse Authority (FORA) Environmental Services Cooperative Agreement (ESCA) Remediation Program (RP) is committed to using the Best Available (and Appropriate) Detection Technology (BADT) for locating subsurface MEC.

1.1 Digital Geophysical Operations

From an operational perspective digital geophysical mapping (DGM) can be defined as four subsystems:

- Digital Geophysical Survey
- Data Processing
- Anomaly Reacquisition
- Anomaly Excavation

This plan provides DQOs for each of the subsystems and also establishes DQOs for the overall DGM system.

System DQOs depend on the subsystems for their success. The system performance is described by the Probability of Detection (Pd) DQO, the Positioning Delta DQO, and the False Positive DQO.

1.1.1 Probability of Detection

The detection objective within the habitat areas of Future East Garrison is to detect a 37 millimeter (mm) projectile buried at 12 inches below ground surface (bgs). Based on the results of previous studies and utilizing published physics-based sensor response curves, the calculated sensor response for a 37mm projectile buried 12 inches bgs is approximately 120 millivolt (mV; summed channels). However, to allow for potential influences related to terrain and fluctuations in background noise, which may influence the peak response of buried conductive items, a threshold of 50mV will be used.

Pd is a measure of whether the system successfully detects and recovers applicable MEC and MEC-like targets. This plan has a multilevel approach to Pd. The first level DQO is the goal of 100% Pd. This means that any MEC, including MEC-like surrogates (i.e., QC seeds), not detected and removed during operations will automatically trigger the creation of a Corrective Action Report (CAR). The project team will do a root cause analysis and determine if changes in equipment and/or procedures are warranted. The second level of Pd was created in recognition of the fact that DGM has inefficiencies and rarely if ever achieves the 100% Pd goal. The DGM processes used at the former Fort Ord are rated between 75 and 85% Pd for targets near or at the detection limits of the equipment. The project's second level DQO for Pd is 85% with a 90% confidence level. If the project as a whole or any part of it drops below this level, then the project must be halted and full design review by the project team completed before work can begin again.

1.1.2 Positioning Delta

The Positioning Delta DQO states that the XY positioning provided to the reacquisition team is within a certain range of the actual target. The DQO is that the target must be found within 2 feet of the reported position at 95% Circular Error Probable (CEP).

1.1.3 False Positives

False Positive (i.e., No Contacts) refers to locations that are reported to the excavation team but nothing is recovered during the excavation. The DQO is that every false positive reported in the field must be resolved by the project geophysicist. If the geophysicist is picking close to noise level then the resolution may be reclassifying the target as noise. If it is a large anomaly, then the geophysicist will resubmit the anomaly to the dig team.

DQO	Metric	Measurement
Pd (First Level)	100% of QC in the established detection zone	Detection of seed items
Pd (Second Level)	85% Pd with a 90% confidence	Detection of seed items
Positioning Delta	Reported position must be within 2 feet (at 95% CEP) of the true location of the item. This DQO is specific to the reported positions of the state-plane coordinates for each data point in the final version of the geophysical data.	Comparison of dig list with excavation report. Reported positions above the DQO and between 2 and 3 standard deviations (STDEV) above the mean will be annotated. Positions beyond 3 STDEV above the mean will require cause analysis.
False Positive	100% of false positives (i.e., No Contacts) must be resolved by geophysicist	Comparison of dig list with excavation report

To achieve the project Pd DQOs, each part or subsystem of the DGM system is evaluated from two perspectives:

- Is the subsystem designed to achieve the maximum efficiency possible?
- Is the subsystem operated to achieve the maximum efficiency possible?

1.2 Analog Operations

This plan provides analog DQOs (i.e., “mag and dig”). Analog operation DQOs are discussed in Sections 1.4, 2.1, 2.2.2, 4.2 and 4.3 of this QAPP.

1.3 Geophysical System Verification

For DGM surveys a physics-based Geophysical System Verification (GSV) program approach will be initiated for the MEC investigation. The GSV approach capitalizes on the known performance of geophysical sensors and establishes metrics that monitor the entire mapping effort rather than depending only on sensor evaluations made during initial geophysical prove-out procedures.

As part of this GSV approach, an IVS will be constructed in an anomaly clean area. The IVS will be seeded with target MEC-like surrogate items in order to validate that the geophysical instrumentation is achieving detection performance metrics as established in the approved work plan. IVS data will be collected daily both pre- and post- production in conjunction with standard quality control tests.

Initial IVS results will be discussed between the Project Geophysicist and the QC Geophysicist. A memorandum describing the design and initial results of the IVS will be submitted to the project team before the start of geophysical operations. Feedback will be included in the IVS memorandum. The IVS memorandum will include the following:

- As-built drawing of the IVS including depth and orientation of seed items
- Representative photographs of the seed items
- Color plots of the DGM data
- Target dig lists showing comprehensive results
- Summary of the IVS results

1.4 Operation Evaluation

The evaluation of DGM and analog operations is accomplished through auditing. There are two methods of auditing. The first is called performance auditing. This is accomplished by burying inert MEC or MEC-like surrogates (i.e., QC blind seeds) within the project boundaries. The operation performance is evaluated based on whether the QC blind seed items are located and recovered. The second audit method is called a procedural audit. This method is accomplished by checking the field operation of a system component against the policies and procedures for that component. Sections 2.0 through 4.0 describe DGM and analog survey components and subsystems in terms of design and operation.

2.0 GEOPHYSICAL SURVEY

There are two main components to the geophysical survey system for both analog and DGM methods:

- Navigation
- Geophysical Instrument

2.1 Navigation

2.1.1 Navigation Design DQO

This document sets a DQO standard for the positioning and accuracy of the DGM survey systems, and lane spacing for analog operations.

DQO	Metric	Measurement
DGM		
Raw Positional Data	Kinematic positional error at known monuments will not exceed 20 centimeters (cm) at 100% CEP.	QC audit of positioning system error test records.
Analog		
Survey Speed	Senior Unexploded Ordnance Supervisor (SUXOS) will observe operations and verify that operator instrument swing speed does not exceed best practices.	There is not a quantitative measure for analog instrument swing speed.
Lane Spacing	The DQOs for analog operations are qualitative and depend on consistent use of the policies and procedures identified in this plan.	Individual survey lanes shall not exceed 3 feet in width.

The proposed navigation subsystem for the DGM survey system is the Trimble R8 receiver, which is a real-time kinematic (RTK) Global Positioning System (GPS). The system is proven to meet or exceed the Raw Positional Data DQO.

2.1.2 Navigation Operations

- All operators will ensure that the RTK correction signal is locked (fixed) before collecting data. Surveying will not proceed in conditions where the positional dilution of precision (PDOP) is greater than 5. The PDOP number is a dimensionless quality indicator calculated by the GPS system and is based upon the GPS satellite geometry at the time of the survey. This number is to determine the quality of the RTK signal. Although the operating rule requires a PDOP of 5 or less an exception can be made when the electronic compass is being used to correct for small RTK dropouts. For further discussion of the electronic compass please refer to the work plan. If the raw positional data does not exhibit RTK signal lock (fix), the PDOP is greater than 5, and the compass is not being used no data will be collected until the system meets the DQO standard.
- All operators who set up and operate the navigation subsystem will be trained in the policies and procedures for navigation system setup and operation of RTK GPS (Appendix A of this QAPP). A certification form for each operator will be on file in the main project office (Appendix B of this QAPP).

Control of lane spacing during analog surveys is described in the Analog Locator Operations Policy and Procedure Manual (Appendix E of this QAPP).

2.1.2.1 Quality Report

Appendix C of this QAPP contains samples of the Project Processing and Deliverable forms. For digital geophysical surveys the geophysicist will fill out the quality report daily and keep it on file in the project office. For analog operations the Unexploded Ordnance Quality

Control Specialist (UXOQCS) will complete a daily QC report and keep it on file in the field office.

2.2 Geophysical Instrument

2.2.1 Design

Four geophysical instruments (two analog and two digital) will be available for use during the remedial investigation. The two analog instruments that will be used are the Schonstedt® GA-52/Cx magnetic gradiometer and White's All Metals detector, which will be used for "mag and dig" operations. The two digital geophysical instruments that may be used are the data recording Geonics® EM61-MK2 towed array (i.e., the FORA ESCA Sled) and the Geonics® EM61-MK2 Handheld. The instrument selection criteria are discussed in Section 5.15.1 of this work plan.

2.2.1.1 Certification

Preexisting Prove-outs

Based on the investigations completed at the Future East Garrison MRA and surrounding areas, it is not anticipated that additional types of MEC will be encountered. The proposed geophysical instruments (EM61-MK2, Schonstedt magnetometer, and White's All Metal detector) have been certified through the Ordnance Detection and Discrimination Study (ODDS) as meeting the detection requirements of the Future East Garrison MRA.

Instrument Verification Strip

The objective of establishing a project-specific IVS is to confirm detection system performance with respect to both design and operations. An IVS may be established in the Future East Garrison MRA (Section 1.3 of this QAPP).

Instrument Verification Strip Reporting

Initial IVS results will be discussed between the Project Geophysicist and the QC Geophysicist. A report describing the design and initial results of the IVS will be submitted to the project team prior to beginning geophysical operations, as described in Section 1.3 of this QAPP.

2.2.2 Operations

2.2.2.1 EM61-MK2

The policies and procedures for the operation of the EM61-MK2 are provided in Appendix D for this QAPP. The policies and procedures are titled: Operational Use of the EM61-MK2 Single Unit and Operational use of the EM61-MK2 Towed Array.

- All operators who set up and operate the EM61-MK2 will be trained for proficiency in the policies and procedures outlined in Appendix D of this QAPP. A certification form for each operator will be on file in the main project office (Appendix B of this QAPP).
- The QC Geophysicist will conduct periodic audits of compliance with the policies and procedures (Appendix D of this QAPP) as well as spot checks of the daily Project Processing and Deliverable forms for the EM61-MK2 (Appendix C of this QAPP).

DQOs

The following EM61-MK2 DQOs must be met.

DQO	Metric	Measurement
Deviation of background noise	Summed Channel = i.e., < 2 mV	Run Statistics on all data below a reasonable level (between 7 and 9 mV) or window a section of background data and run statistics on that segment
Mean Acquisition Speed	< 3 miles per hour	Run Statistics on velocity between points in each file (create a “velocity channel”)
Along-Track Measurements	Along-track sampling densities should not exceed 0.5 foot. 95% of the data must meet this metric. The sampling density will not exceed 20 cm (~8 inches).	Run Statistics on distance between points in each file, and generate sample separation maps per data set
Cross-Track Measurements	The across-track line spacing will not exceed 3 feet. The surveys will be run to achieve a 2.5-foot spacing. 95% of the data must meet this metric. 5% of the data may lie between 2.5 and 3 feet. This will allow for variation in spacing reporting caused by rough terrain.	Conduct a review based on gridded data between lines. Run gap analysis script to determine adequate line spacing.
Standard Response	Response above background to standard object will not vary more than 20%	Standardization tests: QC audit of response test records

Quality Report

Appendix C of this QAPP contains samples of the Project Processing and Deliverable forms for the EM61-MK2.

Corrective Actions

Evaluation of compliance with many of the DQOs is made in the field at the beginning of the day when the QC function tests are performed. The survey may not begin until the equipment meets all of the relevant DQOs and passes all of the required tests.

Other DQOs, such as along-track and cross-track measurements, are evaluated by the data processing operator after the survey has been completed. If there is a violation of the operational DQOs, then a note is made in the project log and a root cause analysis is prepared followed by a CAR, as necessary. The grid will not be passed as completed until the CAR is resolved. The corrective action resolution may involve a resurvey of the grid, but can also include other remedies as approved by the project team.

2.2.2.2 *Schonstedt*

The Schonstedt® GA-52/Cx handheld magnetometer has been approved for use at the former Fort Ord as documented in the ODDS. Schonstedts are typically used to locate ferrous anomalies, and are typically used in conjunction with the White's XLT® E Series metal detector.

Schonstedt magnetometer surveys (i.e., “mag and dig”) are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. “Mag and dig” approaches will also be used when there is insufficient difference between MEC at the site and other metallic fragments and debris, such that digital discrimination is ineffective.

Prior to operating an analog instrument (i.e., Schonstedt and White's XLT® E Series), the analog operator will undergo and document the analog checkout procedure as defined in the Analog Locator QC Checkout Policy and Procedure Manual (Appendix E of this QAPP).

The analog instrument will be used during the following operations:

- Analog Locator Daily QC Checkout
- Analog Surveys (“mag and dig”)
- Near-Surface Anomaly Detection
- Backhoe Excavations
- Analog Locator QC Surveys (10% check of analog survey areas)

The policy and procedure manual for Analog Locator Operations provides descriptions of these operations (Appendix E of this QAPP).

DQOs

The DQOs for Schonstedt operations are qualitative and depend on consistent use of the policies and procedures identified above.

Quality Report

The policy and procedure manuals (Appendix E of this QAPP) contain the reporting forms related to the use of analog instruments.

2.2.2.3 White's All Metals Detector

The White's XLT® E Series handheld all-metals detector is also commonly used for geophysical investigations. White's All Metals detectors are typically used to locate all metal anomalies and are typically used in conjunction with the Schonstedt® GA-52/Cx handheld magnetometer.

White's XLT® E Series handheld all-metals surveys (i.e., "mag and dig") are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. "Mag and dig" approaches will also be used when there is insufficient difference between MEC and other metallic fragments and debris, such that digital discrimination is ineffective.

Prior to operating an analog instrument (i.e., Schonstedt and White's XLT® E Series), the analog operator will undergo and document the analog checkout procedure as defined in the Analog Locator Checkout Policy and Procedure Manual (Appendix E of this QAPP).

The analog instrument will be used during the following operations:

- Analog Locator Daily QC Checkout
- Analog Surveys ("mag and dig")
- Near-Surface Anomaly Detection
- Backhoe Excavations
- Analog Locator QC Surveys

The policy and procedure manual for analog locator operations provides descriptions of these operations.

DQOs

The DQOs for White's All Metal detector operations are qualitative and depend on consistent use of the policies and procedures identified above.

Quality Report

The policy and procedure manuals (Appendix E of this QAPP) contain the reporting forms related to the use of analog instruments.

3.0 DATA PROCESSING

The following paragraphs describe the DQOs for the data processing subsystem of the digital geophysical survey methods.

3.1 Design

Design encompasses the selection of all algorithms and software used in the data processing subsystem. The data processing engine used is Geosoft Oasis Montaj™. This is the industry standard software for preprocessing and post-processing of geophysical data for MEC investigations.

3.2 Operations

The policies and procedures for data processing are included Appendix F of this QAPP (Quality Control Procedures and Geophysical Data Processing).

- All operators who conduct data processing will be trained for proficiency in the policies and procedures outlined in Appendix F of this QAPP. A certification form for each operator will be on file in the project office (Appendix B of this QAPP).
- The operators will fill out the Project Processing and Deliverable Forms (Appendix C of this QAPP).
- The QC Geophysicist will conduct periodic audits of compliance with the policies and procedures as well as spot checks of the daily Data Processing and Deliverables Report.

3.2.1 EM61-MK2 DQOs

DQO	Metric	Measurement
Electromagnetic Leveling (Drift) Statement	For any given data set of electromagnetic data, all data channels will be leveled using the same routines and parameters when possible.	Not Applicable
Instrument Latency	Instrument latency will be corrected based on the lags or time differences observed in anomaly peak positions. Corrections will be applied using the appropriate correction routine that accounts for instrument latency time and sensor velocity. “Zig-zag” or “chevron” effects should not be visible in the data maps when plotted at the scales used to detect the smallest amplitude signal for a given MEC item.	Not Applicable
Processing Statement	All leveling and/or filtering routines that are applied to data sets will be evaluated, on a data set by data set basis, to confirm that those routines do not alter the nature of the original measured response.	Not Applicable

3.2.2 Anomaly Selection DQOs

DQO	Metric	Measurement
Anomaly Selection	100% of anomalies that are above the project threshold are selected for anomaly reacquisition and excavation.	Visual and manual review by QC Geophysicist

3.2.3 Corrective Actions

In the event that it is discovered during data processing that the data from the field does not meet a DQO, then a root cause analysis and CAR will be prepared. In the resolution of the CAR, it will be determined if a resurvey of the affected area is warranted or if the problem can be resolved by reprocessing the data.

If the DQO failure is a Pd failure, meaning that MEC or a MEC-like surrogate was not selected for excavation, then a root cause analysis and CAR will be prepared. The CAR must be resolved with a root cause analysis and a proposed solution so as to avoid a repeat of the error. In the event that MEC did not present as a distinct anomaly that could be separated out through any means available, then it will be noted as such. If the number of unresolved MEC detection failures rises to a level where the Pd falls below 85%, then the project must be stopped and a complete design review undertaken before the project can be restarted.

4.0 ANOMALY REACQUISITION AND EXCAVATION

The following paragraphs describe the DQOs for the anomaly reacquisition and excavation subsystems of the digital geophysical survey operations and for the anomaly investigations conducted under analog operations.

4.1 Anomaly Reacquisition

The policies and procedures for anomaly reacquisition are in Appendix G of this QAPP (Anomaly Reacquisition and Excavation Procedure).

- All operators who conduct anomaly reacquisition will be certified for proficiency in the policies and procedures. A certification form for each operator will be on file in the project office (Appendix B of this QAPP).

4.1.1 Anomaly Reacquisition DQOs

DQO	Metric	Measurement
Flag Placement	Flags will be placed within 20 cm (8 inches) of the position reported by the geophysicist	Not Applicable
Flag Completeness	100% of reported anomaly positions will be flagged	Not Applicable

4.2 Anomaly Excavation

The policies and procedures for anomaly excavation are in Appendix G of this QAPP (Anomaly Reacquisition and Excavation Procedure).

- All technicians will be certified for proficiency in the policies and procedures. A certification form for each technician will be on file in the project office (Appendix B of this QAPP).
- The SUXOS will conduct periodic audits of compliance with the policies and procedures.

4.2.1 Anomaly Excavation and Investigation DQOs

DQO	Metric	Measurement
DGM Only		
Anomaly Excavation	100% of reacquired anomalies will be investigated.	Not Applicable
DGM and Analog		
Reporting	Required information will be entered into the handheld data logger and verified daily.	Not Applicable

4.3 Quality Control Performance Audits Anomaly Excavation

The primary method for performance auditing is to bury inert munitions debris (MD) or MEC-like surrogate items (i.e., QC blind seeds) in the path of the survey. Performance is measured by calculating the ratio between seeds that were found and seeds that were not found.

4.3.1 Quality Control of Known Items

QC items will be used during the geophysical data collection to quantify positional accuracy of each data set. The QC items will consist of 6-inch rebar spikes or equivalents inserted vertically into the ground.

For digital geophysical surveys, the anomaly response from the QC item will be identified during data processing and analysis. Each known item will be reviewed to quantify positional accuracy by measuring the anomaly target location to the actual geo-referenced location of the rebar spike recorded during the grid survey. The measured offset will be logged for each data set in the geophysical processing form spreadsheet. Offset distance between the anomaly target selection and the actual known item location will not exceed the reacquisition metric.

4.3.2 Quality Control Seeds (Blind Seeds)

Blind seed items will be placed within areas planned for investigation. The project UXOQCS will determine the locations of the blind seed items.

Seeds will be located using a survey-grade GPS or equivalent within the DGM survey areas. The blind seeds will consist of MD items, MEC-like surrogates, or equivalent, buried no greater than the depth interval at which a 100% Pd was determined for the geophysical instrumentation to be used in that area. The location of the seed items will not be known to the on-site project personnel. QC personnel will review the DGM data against the seed locations. The blind seeds will be detected within the reacquisition metric of the seed survey location.

The location of the seed items will be recorded in the QC log based on XY position and grid identification. The seed item location will be revisited by the UXOQCS during re-collection surveys in each seeded grid to ensure the seed item was detected and removed by the unexploded ordnance teams.

If any seed item is not picked and excavated, a root cause analysis and CAR will be prepared as per the 100% Pd DQO. Corrective action nonconformance reviews will be conducted as presented in Section 11.7 of Volume 2 (Sampling and Analysis Plan) of the Group 4 Remedial Investigation / Feasibility Study Work Plan.

5.0 REFERENCES

Parsons. 2002. Draft Final, Ordnance Detection and Discrimination Study, prepared for U.S. Army Corps of Engineers, Sacramento District. December. (Fort Ord Administrative Record No. OE-0297B)

Table 1
Quality Control and Verification Summary

Data Quality Objectives / Measurement Quality Objectives	Measurement Verification	Performance
Digital Instrument Survey and Data Acquisition (Geonics EM61-MK2)		
Static Background Function Test - Standard deviation of all four EM61-MK2 data channels are < 2 millivolts (mV).	Calculate standard deviation for pre- and post-survey static background function tests to verify noise levels. Report results on processing form.	Standard deviation of function tests and survey data will be < 2 mV. If static background fails noise metric, determine root cause of ambient noise interference.
Static Response Function Test - Standard deviation of all four EM61-MK2 data channel is < 2 mV. Response between pre- and post-survey tests will not vary more than 20%.	Calculate standard deviation for pre- and post-survey static response function tests to verify noise levels. Compare peak response from pre-survey test and post-survey test to determine percent difference. Report results on processing form.	Standard deviation of function tests and survey data will be < 2 mV. If static response fails noise metric, determine root cause of ambient noise interference. If post-survey static response differs by 20% of pre-survey test, determine root cause of increased or decreased signal from test item.
Cable Connection Function Test - Standard deviation of all four EM61-MK2 data channels are < 2 mV. No visible spikes observed in data.	Calculate standard deviation for pre- and post-survey static background function tests to verify noise levels. Review data profile to verify no spikes were introduced during test. Report results on processing form.	Standard deviation of function tests and survey data will be < 2 mV. If static background fails noise metric, determine root cause of ambient noise interference. If spikes are observed in data, perform further tests to identify connection failure and repair.
Noise Level - Standard deviation of the sum of four EM61-MK2 data channels is < 2 mV.	Calculate standard deviation for pre- and post-survey static background and static response function tests to verify noise levels. Window data set in an anomaly free area and calculate standard deviation to determine dynamic survey noise.	Standard deviation of function tests and survey data will be < 2 mV. If function tests fail noise metric, determine root cause of ambient noise interference. If survey data fail noise metric, determine root cause of increased ambient or dynamic data collection related noise.
Mean Acquisition Speed - Speed during data collection is < 3 miles per hour (mph).	Calculate mean speed across data set using point to point distance and time. Report results on processing form.	Average data set speed will be < 3 mph. If speed exceeds metric, determine root cause of increase. Review along-track measurements to ensure adequate data density. Re-collect data as necessary based on corrective action.

Data Quality Objectives / Measurement Quality Objectives	Measurement Verification	Performance
Along-Track Measurements - Data points will be spaced < 0.5 feet.	Calculate point to point distance across data set. Report results on processing form.	Average along-track measurements in each data set will be < 0.5 foot. 95% of the data must meet this metric. The sampling density will not exceed 20 cm (8 inches). If distance exceeds metric, determine root cause of increase. Re-collect data as necessary based on data gap metric or corrective action.
Across-Track Measurements - Survey lanes will not exceed 3 feet.	Use spatial analysis to identify areas where line spacing exceeds metric. Report results on processing form.	Surveys will be run to achieve a 2.5-foot spacing. 95% of the data must meet this metric. 5% of the data may lie between 2.5 and 3.0 feet. This will allow for variation in spacing reporting caused by rough terrain. Re-collect data as necessary based on data gap metric or corrective action.
Navigation/Positioning - Positioning will be < 20 centimeters (cm) (~8 inches) at 100% circular error probable (CEP).	Compare anomalies to known seed locations or monuments and measure offset.	Survey positioning will be < 20 cm (~8 inches) at 100% CEP. If offsets in a data set exceed the metric, determine root cause by verifying instrument functionality, terrain considerations, and tree canopy. Re-collect data as necessary based corrective action.

**Analog Instrument Survey and Data Acquisition
(Schonstedt and White's All Metals)**

Survey Speed	Senior Unexploded Ordnance Supervisor (SUXOS) will observe operations and verify that operator instrument swing speed does not exceed best practices.	There is not a quantitative measure for analog instrument swing speed.
Lane Spacing	The Data Quality Objectives (DQOs) for analog operations are qualitative and depend on consistent use of the policies and procedures identified in this plan.	Individual survey lanes shall not exceed 3 feet in width.

**Digital Data Processing and Analysis
(Geonics EM61-MK2)**

Processing Statement - Anomalies will not be altered by more than 10% from raw data.	Processes identified during an Instrument Verification Strip (IVS) will be used to correct all data.	All leveling and/or filtering routines that are applied to data sets will be evaluated, on a data set by data set basis, to confirm that those routines do not alter the nature of the original measured response by more than 10%. If metric is exceeded, correction parameters may be modified. Changes will be reported in the processing log.
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Appendix D

Data Quality Objectives / Measurement Quality Objectives	Measurement Verification	Performance
Leveling/Drift Correction - Low frequency, long wavelength noise will be removed.	Window data set in an anomaly free area and calculate mean response to verify leveling/drift correction.	Mean response will be within +/- 5 mV. If metric is not achieved, verify leveling/drift correction routine parameters or check ambient noise levels.
Instrument Latency - No chevron effects visible in data set.	Latency tests will be run daily to determine time delays related to the digital instrumentation.	Instrument latency will be corrected based on the lags or time differences observed in anomaly peak positions. Corrections will be applied using the appropriate correction routine that accounts for instrument latency time and sensor velocity. “Zig-zag” or “chevron” effects should not be visible in the data maps when plotted at the scales used to detect the smallest amplitude signal for a given munitions and explosives of concern (MEC) item.
Anomaly Selection - All anomalies meeting the approved selection criteria will be added to the dig list	The Quality Control (QC) Geophysicist will review the digital data sets to ensure all anomalies meeting the selection criteria are selected.	100% of all anomalies meeting the selection criteria were selected. Missing or QC anomalies will be added to the dig list.
Field Investigation and Reporting (Geonics EM61-MK2)		
MEC Detection - 100% of MEC in the established detection zone.	All metrics will be verified to ensure data achieve measurement quality objectives (MQOs). Use QC seeds to determine detection ability during surveys. Confirm with QC procedures.	All MEC (37mm projectile and greater) will be detected within established detection zone, within 12 inches bgs. If MEC is identified, determine root cause by using measurement quality objective results and re-collect data as necessary based on corrective action.
False Positives - Reduce number of false positives. Resolve false positives identified as “no contacts”.	Review excavation results to identify no contacts. Use field notes to determine terrain variation or cultural interference which may have influenced the digital data.	Resolve 100% of no contacts. Processing and analysis procedures may need to be modified to reduce false positives.
False Negatives - No false negatives identified in data sets.	Perform post-dig QC steps to verify no MEC was missed during data processing or data collection.	All MEC (37mm projectile and greater) will be detected within established detection zone, within 12 inches bgs. If MEC is identified, determine root cause by using measurement quality objective results and re-collect data as necessary based on corrective action.

Data Quality Objectives / Measurement Quality Objectives	Measurement Verification	Performance
Anomaly Reacquisition - Pin flags will mark the anomaly location within 20 cm (~8 inches) of the position reported on the dig list.	Known QC spikes will be within 20 cm (~8 inches) of marked/flagged location.	Anomaly reacquisition will be performed on selected digital geophysical mapping (DGM) anomalies throughout the duration of the project. 95% of the locations of reacquired anomalies should lie within 3 feet of their original surface location as marked on the dig list.
Dig List Backcheck - 100% of reported anomaly positions will be reacquired and flagged.	Unexploded Ordnance Quality Control Specialist (UXOQCS) and QC Geophysicist will verify dig list with dig results.	All anomalies will be reacquired. Missing anomalies will be reacquired and investigated.
Anomaly Excavation - 100% of reacquired anomalies will be investigated.	UXOQCS and QC Geophysicist will verify dig list with dig results in the database.	All investigated targets will have an entry in the data base. Targets without data will be reacquired and investigated.
Reporting - 100% of anomalies will be resolved.	Required information will be entered into the handheld data logger and verified daily.	No missing investigation information is evident on dig list.

**QC Digital and Analog Geophysical Surveys
(Geonics EM61-MK2)**

QC-1 - No MEC remains following excavation.	Verify removal of the source of each DGM anomaly within 3 feet of a flag. Location will be checked using the same instrument used for survey.	All MEC will be recovered during excavation. If the source of the anomaly does not appear to have been removed, the intrusive operation will continue until a significant reduction in signal is observed by the instrument operator.
QC-2 - No additional MEC recovered within original survey area.	Digital resurveying of 16% percent of the DGM investigation areas.	A failure will be constituted by the discovery of MEC or similar item, or five re-acquirable anomalies as a result of the QC survey, or the discovery during the QC process of five non-selected anomalies that should have been selected during the initial survey within a single 100-foot by 100-foot grid or equivalent area (with dimensions similar to a 37 mm projectile or greater, within 12 inches bgs). Perform Root Cause Analysis and identify and implement Corrective Action.

Appendix D

Data Quality Objectives / Measurement Quality Objectives	Measurement Verification	Performance
Analog QC	At least 10% QC of analog investigation areas will be performed, using an analog or “mag and flag” instrument.	The discovery of a MEC or MEC-like item within 12 inches bgs sufficient in size to represent a 37mm projectile or larger military munitions item will constitute a failure of the 100-ft by100-ft investigation area. If there is a failure, a root cause analysis will be conducted to determine the cause of the failure. A corrective action applicable to the root cause will be determined and implemented. Corrective action may include additional QC surveys of the analog investigation areas.

APPENDIX A

Navigation System Setup and Operation of Global Positioning System – Real-Time Kinematic

WSI POLICY AND PROCEDURE MANUAL	
SUBJECT: Navigation System Set-up and Operation of Global Positioning System (GPS) – Real time Kinematic (RTK)	No. Op.001.nav.rtk
EFFECTIVE DATE: February 11, 2008	SUPERSEDES:
SECTION: Geophysics Group	DEPARTMENT: OU 1494
NAME/TITLE: J. Williams/Sr. Technical Manager	
SIGNATURE: 	DATE APPROVED: February 05, 2008

1. PURPOSE

This procedure outlines the technical requirements and operational use of the RTK GPS for use in geophysical surveys.

2. APPLICABILITY AND SCOPE

The requirements of this procedure are applicable to all project activities which include the use of the RTK GPS. The instrument is utilized to collect real-time corrected GPS positions used to precisely locate geophysical sensors while collecting data. The data generated is streamed directly into geophysically instruments providing sub-centimeter accuracy of positions.

3. REFERENCES

3.1. TrimbleR7-R8_223A_UserGuide, Trimble Webpage

4. DEFINITIONS

4.1. Central Equipment Stores (CES) - WESTON's central equipment storage location in West Chester, PA. This group is responsible for securing, maintaining, and distributing equipment.

4.2. Real-Time Kinematic (RTK) Global Positioning System (GPS) components:

4.2.1. R8 Global Navigation Satellite System (GNSS) – advanced global positioning tracking receiver capable of acting as a base and rover receiver. Unit is capable of achieving accuracies of +/- 10 mm horizontal and +/- 20 mm vertical accuracy.

4.2.2. HPB450 Series Radio Transmitter – powerful radio capable of broadcasting real-time correction signals from base R8 to rover R8 at 35 watts.

4.2.3. Trimble TSC2 Data Collector – data collector with Survey Controller

software for stakeout and collecting points.

5. SET-UP AND OPERATION

This section outlines the steps for setting up the RTK GPS system in the field for use with geophysical instruments. Be sure to follow all operating manuals for set-up and operation.

- 5.1. An established control point (of necessary accuracy) must be known before starting an RTK survey. Set up the base unit tripod over the control point and level the tripod.
- 5.2. Place the base receiver on the tripod and connect the power to Port 1 on the receiver. The receiver should turn on as soon as power is applied. Confirm that the satellite led on the front display is blinking yellow at one second intervals.
- 5.3. Set-up the second tripod and assemble the radio antenna and connect it to the tripod. Connect the coaxial cable to the back of the radio and connect the power cable to an external battery.
- 5.4. Turn on the datalogger and open Survey Controller software.
 - 5.4.1. Click on Configuration – Controller – Bluetooth
 - 5.4.2. Make sure Bluetooth is turned on and select the corresponding serial number (located beneath the base receiver on barcode) and click connect, then accept. Return to main menu. Make sure data logger is displaying the satellite number and power display of the receiver.
 - 5.4.3. Select Survey – RTK – Start Base Station
 - 5.4.3.1. Under the point name click – List and then select the point you have entered for the control point in which you are set-up over (note the station index marked). Click Start, the data logger will begin to start the receiver and tell you when you can proceed to the next step. Make sure that the radio is transmit led (TX) is blinking every second.
 - 5.4.4. Power up the rover receiver, and connect to it via Bluetooth via step 5.4.2 except find the corresponding serial number for the rover receiver and connect, then click accept.
 - 5.4.5. Once the logger connects to the rover receiver (showing the satellite count and battery power on the logger screen), go to Survey – RTK – Start Survey. The controller will search for a base station broadcast and display the station index (if this is the same as the one you entered when you started the base) click accept. The survey will begin, wait for initialization (< 5 seconds) and confirm RTK fix by the display at the bottom of the logger (will display RTK fix and you horizontal and vertical accuracy). You are now ready to survey.

- 5.4.6. Configuration file must be uploaded to the R8 rover receiver in order to stream the NMEA string into the geophysical data collector. Connect the Lemo-9 pin to Port 1 on the R8 Rover receiver and the female serial DB9 cable to the corresponding connection on the geophysical sensor. Open the chat mode or terminal screen on the geophysical survey logger and verify NMEA string is communicating with the geophysical data collector. You are now ready to collect data.

6. Navigational QC Check

- 6.1. Weston Solutions, Inc. performs navigational accuracy checks daily during the latency test performed to measure instrument delay time. This is performed by traversing a survey spike of known coordinates with the geophysical sensor(s) in two directions. The surveyed peak amplitude location must be within 1 foot of the actual survey spike. If differences are noticed, first make sure the operator is surveying directly over the spike, and then check the rover receiver by mounting the R8 rover on the range pole and navigate to the same point and determine the offset. If still unacceptable make sure step 5 was followed correctly. All reporting will be carried out in the daily latency reporting. QC seed items are sometimes planted in geophysical grids, these serve as a secondary test on navigational accuracy.

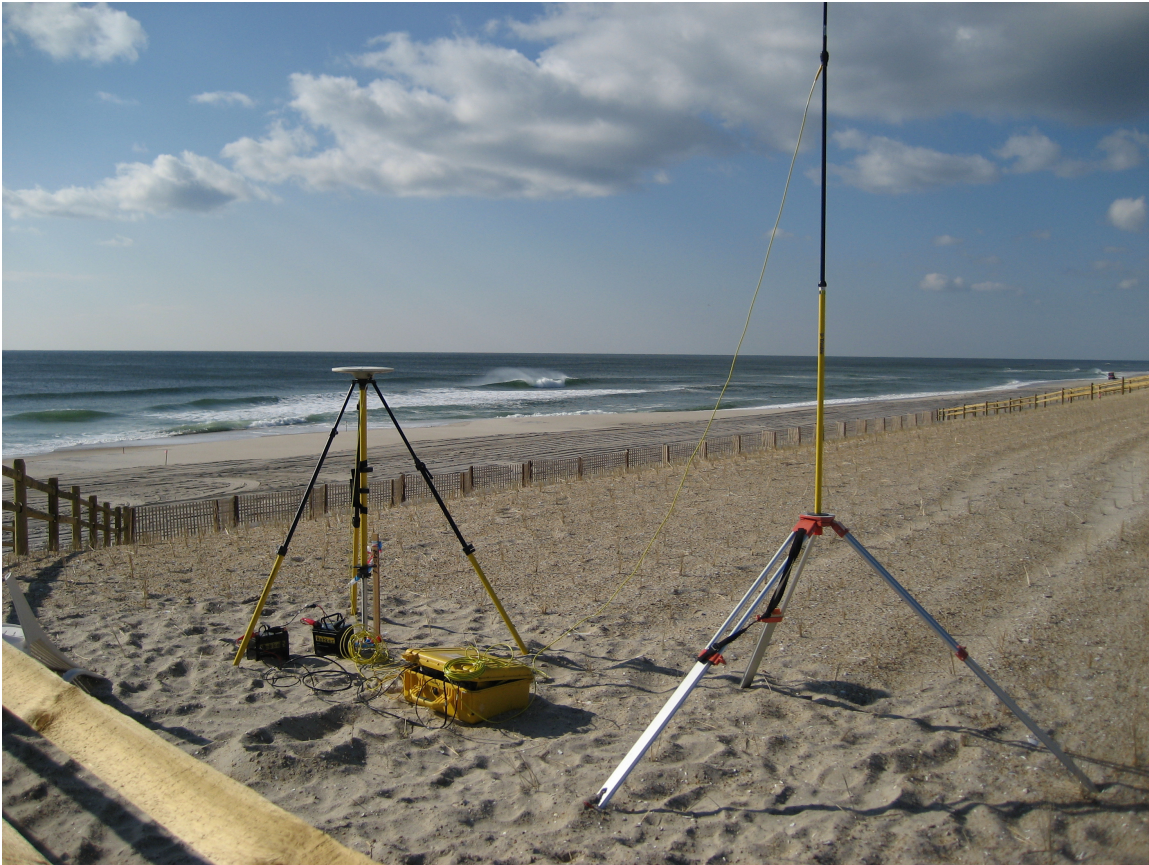
Applicable References:

Trimble R7-R8_223A_UserGuide, Trimble Webpage

Project Specific Work Plan - Data Quality Objectives (DQO) with established metrics

Review/Revision Date:	J. Williams - 02/04/08
Original Prepared By/Date:	M. Saunders – 01/14/2008
Revision #1 –	

Photo 1 Field Set-up of the RTK GPS



APPENDIX B

Geophysical Standard Operating Procedure Checklist

<i>WSI</i> POLICY AND PROCEDURE MANUAL	
SUBJECT: Geophysical SOP Checklist	No. Op.001.SOPCertChcklst.
EFFECTIVE DATE: May 13, 2008	SUPERSEDES:
SECTION: Geophysics Group	DEPARTMENT: OU 1494
NAME/TITLE: J. Williams/Sr. Technical Manager	
SIGNATURE: 	DATE APPROVED: May 13, 2008

By placing my signature below, I certify that I have read the following (checked) Geophysical Standard Operating Procedure (SOP) and fully understand its procedures and requirements. The procedures set forth therein can only be superseded by site-specific work plans, or as directed by the Project Geophysicist or QC Geophysicist.

- ☐ **Op.001.nav.rtk:** Navigation System Set-up and Operation of Global Positioning System (GPS) – Real Time Kinematic
- ☐ **Op.001.em61mk2.ta:** Operational use of the EM61-MK2 Towed Array
- ☐ **Op.001.em61mk2.su:** Operational use of the EM61-MK2 Single Unit
- ☐ **Op.001.G856.mag:** Operational use of G-856 Magnetometer
- ☐ **Op.001.G858.mag:** Operational use of G-858 Magnetometer
- ☐ **Op.001.Analog Locator Operations.su:** Analog Locator Operations
- ☐ **Op.001.Analog Operator Checkout.su:** Analog Locator Operator Checkout
- ☐ **Op.001.QCdat:** Quality Control Procedures and Geophysical Data Processing Anomaly Selection
- ☐ **Op.001.reac:** Anomaly Reacquisition and Excavation Procedure

Print Name: _____ Signature: _____

Company: _____ Date: _____

APPENDIX C

Project Processing and Deliverable Forms



Daily Notes

Project	Date		
Mare Island DGM	3/13/2006		
Days Weather			
PC 50			
Daily Notes			
0630 Onsite 0700 H&S meeting 0800 Team JH and TF planting seeds in entire PMA/SSA. GT putting final touches on EM towed array. 1230 Navy seeded SSA and PMA area No data collected Onsite: M. Saunders G. Turner T. Fitzgerald J. Hunter Equipment Used RTK GPS			
Daily Mag Acreage	Total Mag Acreage	Daily EM Acreage	Total EM Acreage
	0		0

Wednesday, February 06, 2008



EM Data Processing

Date of Survey:	4/3/2006	Team ID:	Team 1
File Name:	0403_EM_TowedArray	Internal QC Performed On:	4/4/2006
Geosoft Database:	0403_EM_TowedArray.gdb	Weston QC Performed On:	4/26/2006
Instrument:	EM61-MK2 Towed Array	Weston QC Initials:	JAW
Drift Correction	☒	Were QC evaluation tests performed	☒
Latency Coil AM:	0.3		
Latency Coil PM:	0.3		
Velocity:	2.1	< 2.5 mph	
Mean Sample Separation:	0.31	< 0.5 ft	
Channel Analyzed:	Clipped Area		
Noise Mean:	0	Noise Standard Deviation:	0 < 3.0
Target Selection	☐	Target Selection Database:	
Target Selection Threshold:			
Processing Notes:	Latency Coil 1 = 0.25 Latency Coil 2 = 0.3 Latency Coil 3 = 0.3 Not able to determine good Noise mean and St Dev due to large dynamic values present in the data.		
Seed in DGM Area	☒		
Seed ID:	QC143	Anomaly ID:	Closest Anomaly
Seed Easting:	1855528.294	Anomaly Easting:	1855527.51
Seed Northing:	13826257.425	Anomaly Northing:	13826256.98
Seed Depth:	0	Anomaly Distance:	0.90148821414 < 2 ft
Seed Orientation:	Vertical	Anomaly Orientation:	WSW
Acres Surveyed:	1.798	Total Acres Surveyed to Current Date	1.798



Mag Data Processing

Team ID	Team 1	Internal QC Performed On:	3/16/2006
Survey Date	3/15/2006	Weston QC Performed On:	4/4/2006
Geosoft database	0315_MagCart.gdb	Weston QC Initials:	JAW
Instrument	MagCart		

Data Processing

Drift Correction	☐	Diurnal Correction	☒
Latency	0		

Dynamic Background Levels

Clipping Values:		
	Mean	Std. Dev. <3.0
Background Noise:	0	0

Target Selection

Target Database	U-Hunter Software
Initial Target Screening Level	U-Hunter Software

Seed Characterization

Seed ID:	QC144
Target ID:	Closest Anomaly
Target Offset Distance:	1.1936 < 2.0ft
Offset Direction:	NW

Data Sampling

Velocity (<= 2.5 mph)	2.32
Sample Separation (<=0.5 ft)	0.28

Processing Notes: No Latency Correction Required

Acres Surveyed	1.38	Total Acres Surveyed	1.38
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EM QC Report

Survey Date: 4/3/2006
Team ID: Team 1
Geosoft db: 0403_EM_TowedArray_QC.gdb
Instrument ID: EM61 MK2
Sensor Number: Blue
Internal QC Performed On: 4/5/2006
Weston QC Performed On: 4/26/2006
Weston QC Initials: JAW

Static Background Test								
Pre-Survey					Post-Survey			
	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
Maximum	0.68	0.41	0.25	0.22	0.59	0.42	0.33	0.33
Minimum	-0.36	-0.27	-0.16	-0.16	-0.37	-0.36	-0.17	-0.16
Mean	0.1	0.07	0.05	0.03	0.09	0.08	0.05	0.05
Std. Dev. < 2.0	0.13	0.09	0.07	0.06	0.13	0.1	0.07	0.07

		Static Spike Test							
		Pre-Survey				Post-Survey			
		CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
Maximum		317.46	234.55	143.53	6.43	379.89	275.65	174.06	7.9
Minimum		-212.12	-113.25	-66.19	-4.21	-251.64	-124.55	-88.89	-4.37
Mean		87.9	54.6	35.8	1.77	93.14	60.61	37.65	1.75
Std. Dev. <2.0		99.57	66.42	41.47	2.02	110.52	72.28	42.95	2.12

Cable Connection Test								
Pre-Survey					Post-Survey			
	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
Maximum	0.5	0.44	0.3	0.2	0.99	0.52	0.27	0.24
Minimum	-0.3	-0.2	-0.16	-0.15	-0.39	-0.18	-0.16	-0.16
Mean	0.09	0.08	0.05	0.03	0.13	0.09	0.06	0.03
Std. Dev. <2.0	0.14	0.1	0.07	0.06	0.18	0.11	0.08	0.06

Comments: Values displayed are the drift corrected values for the Pre and the Post QC Survey. Static Spike test indicates object used for QC object (2 inch trailer balls fixed in a 2x4, positioned on the coils) was too great a response. Different object to be used next time. - MS



GEOPHYSICS DAILY
EM61-MK2 Towed Array CHECKLIST

Date:

Team ID:

Team Members:

Weather:

Approx Survey Area:

☐ Warm-up Instruments

☐ Check Coil Offsets

Quality Control Tests AM

Quality Control Tests PM

Remember to increment your AM and PM Lines in your AM and PM QC Files!!!!

QC Filename:

QC Filename:

☐ Static Test (1 min.) ☐ Line Number:

☐ Static Test (1 min.) ☐ Line Number:

☐ Static Spike (1 min) Line Number(s):

☐ Static Spike (1 min) Line Number(s):

☐ Cable Shake (30 sec.) Line Number:

☐ Cable Shake (30 sec.) Line Number:

☐ Latency Loop Line Numbers:

☐ Latency Loop Line Numbers:

☐ Repeat Lines Collected Line Numbers

Survey Filename(s):	Operator(s):	Line Numbers:

Survey Notes:



GEOPHYSICS DAILY MagCart Checklist

Date:

Team ID:

Team Members:

Weather:

Approx Survey Area:

☐

Warm-up Instruments

☐

Check Sensor Offset Measurements



GPS

QC Filename: Dataset1 (Always put all QC in Dataset 1)

Quality Control Tests AM

☐

Static Test (1 min.) Line Number:

☐

Spike Test (Jig 1 min) Line Number:

☐

Cable Shake (30 sec.) Line Number:

☐

Latency Loop Line Number:

☐

Repeat Lines Collected (PUT GRID ID's with line #)

Quality Control Tests PM

☐

Static Test (1 min.) Line Number:

☐

Spike Test (Jig 1 min) Line Number:

☐

Cable Shake (30 sec.) Line Number:

☐

Latency Loop Line Number:

Survey Filename(s):	Operator(s):	Line Numbers:

Survey Notes:



MAG QC Report

Survey Date 3/15/2006

Sensor Number 1

Team ID 1

Sensor Serial # C498

Geosoft db 0315_MagCart_QC.gdb

Internal QC Performed On: 3/16/2006

Weston QC Performed On: 4/4/2006

Weston QC Initials: JAW

Static Background Test

AM Mean 392.91

PM Mean 396.98

AM Std Dev 0.53 <2.0

PM Std Dev 0.16 <2.0

Static Spike Test

AM Mean 555.7

PM Mean 559.93

AM Std Dev 0.31 <2.0

PM Std Dev 0.61 <2.0

Cable Connection Test

AM Mean 393.49

PM Mean 395.8

AM Std Dev 2.18 <2.0

PM Std Dev 0.18 <2.0

Comment:

Switched out Sensor 1 and replaced with C498. Deviation in AM Cable Test is personnel walked to close to sensor, note PM cable test is OK along with sensor 2 AM cable test. MS.

APPENDIX D

Operational Use of the EM61-MK2 Single Unit and Operational Use of the EM61-MK2 Towed Array

<i>WSI</i> POLICY AND PROCEDURE MANUAL	
SUBJECT: Operational use of the EM61-MK2 Single Unit	No. Op.001.em61mk2.su
EFFECTIVE DATE: February 11, 2008	SUPERSEDES:
SECTION: Geophysics Group	DEPARTMENT: OU 1494
NAME/TITLE: J. Williams/Sr. Technical Manager	
SIGNATURE:	 DATE APPROVED: February 5, 2008

1. PURPOSE

This procedure outlines the technical requirements and operational use of the Single Unit EM61-MK2 TDEM for use in geophysical surveys.

2. APPLICABILITY AND SCOPE

The requirements of this procedure are applicable to all project activities which include the use of the EM61-MK2. The instrument is utilized to collect transient electromagnetic signals from the subsurface up to a depth of four feet (unofficial estimate). The data generated are collected concurrently with a navigational system (RTK or total station) and stored on an Allegro CX field computer.

3. REFERENCES

3.1. EM61-MK2 Operating Manual, Geonics Limited.

4. DEFINITIONS

4.1. Central Equipment Stores (CES) - WESTON's central equipment storage location in West Chester, PA. This group is responsible for securing, maintaining, and distributing equipment.

4.2. EM61-MK2 components:

- 4.2.1. Bottom 1 m x 0.5 m coil (including wheels)
- 4.2.2. Top 1 m x 0.5 m coil
- 4.2.3. Backpack with electronics box, batteries and chargers
- 4.2.4. Two meter cable to connect electronics box with Bottom Coil
- 4.2.5. Pig tail connector to connect Bottom Coil to Top Coil

4.2.6. Handle

4.2.7. Navigational mount

4.2.8. Allegro CX Data Logger (battery charger, data link and download cables)

5. SET-UP AND OPERATION

This section outlines the steps for setting up the EM61-MK2 system in the field for the acquisition of geophysical data using a Global Positioning System (GPS). Be sure to follow all operating manuals for set-up and operation.

5.1. Assemble EM61-MK2 according to operating manuals.

5.2. Interface the EM61-MK2 with a navigational system for precise location data. Connect serial cable from navigational system into Port 2 on the Allegro CX.

5.3. Set-up the specific data collection software (Dat61MK2 or NAV61MK2) on the Allegro CX field computer.

5.3.1. Set the appropriate data collection rate (sampling rate, i.e. 10 Hz for MEC mapping).

5.3.2. Set the EM61-MK2 to interface with COM1 and the navigation device to interface with COM2.

5.3.3. Adjust line increments and stations start as needed.

5.4. Perform 10-15 minute warm-up of EM61-MK2 according to ambient temperature.

5.5. Perform spot check readings to locate an area free of noise and representative of background to null the instrument and perform QC function tests.

5.6. Perform Pre-survey QC function tests (see separate QC SOP) which usually consists of a 2-3 minute Static Test (remain stationary with no object – record readings), Static Spike (remain stationary with a metallic object [i.e. 5-6 inch ½ diameter rebar] beneath coil – record readings), and 0.5-1 minute Cable Vibration Test (remain stationary with no object moving cables – record readings). Note any spikes or abrupt changes in data.

5.7. Perform Latency Test

5.8. If all QC data is verified, collect data, according to operating manual.

5.8.1. If a Geophysical Prove-out survey is required, data acquisition will be performed following the guidance established in the Site Specific GPO Work Plan.

5.8.2. For production surveys, data acquisition will be performed following the

guidance established in the Site Specific Geophysical Investigation Plan (GIP).

Applicable References:

Geonics, Ltd., 1996, www.geonics.com/em61.html.

Geonics, Ltd. 1999. *Operating Manual for EM61-MK2 61 High Sensitivity Metal Detector*.

McNeill, J.D. 1980. “*Electromagnetic Terrain Conductivity Measurements at Low Induction Number*.” Technical Note TN-6, Geonics, Ltd., Mississauga, Ontario.

Plugge, D., R. J. Selfridge, and R. Young. 2003. *Planning Geophysical Prove outs for Munitions Response Projects*. Huntsville, Ala.: U.S. Army Engineering and Support Center.

USAESCH (U.S. Army Engineering Support Center, Huntsville). 2003. *Munitions Response Data Item Descriptions (DIDs)*. Revised 1 December 2003.

Project Specific Work Plan - Data Quality Objectives (DQO) with established metrics

Review/Revision Date:

J. Williams - 02/04/08

Original Prepared By/Date:

M. Saunders – 01/14/2008

Revision #1 –

<i>WSI</i> POLICY AND PROCEDURE MANUAL	
SUBJECT: Operational use of the EM61-MK2 Towed Array	No. Op.001.em61mk2.ta
EFFECTIVE DATE: February 11, 2008	SUPERSEDES:
SECTION: Geophysics Group	DEPARTMENT: OU 1494
NAME/TITLE: J. Williams/Sr. Technical Manager	
SIGNATURE:	 DATE APPROVED: February 5, 2008

1. PURPOSE

This procedure outlines the technical requirements and operational use of the EM61-MK2 Towed Array for use in geophysical surveys.

2. APPLICABILITY AND SCOPE

The requirements of this procedure are applicable to all project activities which include the use of the EM61-MK2 Towed Array. The instrument is utilized to collect transient electromagnetic signals from the subsurface up to a depth of four feet (unofficial estimate – dependent on size of target). The data generated from the multiple EM61-MK2 are collected concurrently with a navigational system (RTK or total station) and stored on a field computer running MagLogNT software from Geometrics.

3. REFERENCES

- 3.1. EM61-MK2 Operating Manual, Geonics Limited.
- 3.2. MagLogNT operating manual, Geometrics Inc.

4. DEFINITIONS

- 4.1. Weston Geophysics Group - WESTON's geophysics team in West Chester, PA. This group is responsible for securing, maintaining, and distributing equipment.
- 4.2. EM61-MK2 Towed Array components (number of EM61-MK2 units dependent on particular array configuration (usually 3 or 4 units):
 - 4.2.1. Bottom 1 m x 0.5 m coil
 - 4.2.2. Top 1 m x 0.5 m coil
 - 4.2.3. Electronic boxes
 - 4.2.4. 7 meter cables to connect electronic boxes with Bottom Coil.

- 4.2.5. Sync Cable?
- 4.2.6. Pig tail connectors to connect Bottom Coil to Top Coil
- 4.2.7. Navigational mount
- 4.2.8. Panasonic Toughbook with MagLogNT software.
- 4.2.9. Towed Array pieces made of fiberglass and fiberglass nuts and bolts to assemble the array.
- 4.2.10. Tow vehicle – usually a John Deere Gator or Kubota Utility Vehicle.

5. SET-UP AND OPERATION

This section outlines the steps for setting up the EM61-MK2 system in the field for data collection. Be sure to follow all operating manuals for set-up and operation.

- 5.1. Assemble Towed Array components according to labeled pieces and color coding.
- 5.2. Assemble EM61-MK2s according to operating manuals and configure on the Towed Array according to the specific project objectives (i.e. line spacing).
- 5.3. Interface the one of the EM61-MK2 with a navigational system and mount for precise location data.
- 5.4. Connect the main tow beam on the receiver hitch on the tow vehicle. Be sure to attach safety cabling from the tow beam to the back of the tow vehicle in case the hitch becomes dislodged during survey (it won't pull by the electronics cables it will pull by the safety cabling).
- 5.5. Connect all 7 meter cables from the multiple EM61-MK2s along the main tow beam and into the back of the tow vehicle and connect to the electronics boxes in the appropriate interface. Be sure to enclose the cables in some protective covering and tape so everything is tight against the beam.
- 5.6. Connect the electronic boxes cables into an interface device (either a 4 port serial hub or PCMCIA adapter). Then connect the cable from the serial hub into the USB port on the field computer.
- 5.7. Set-up the MagLogNT software on the field computer. The most important thing is that the port settings are the set correctly. If using the serial hub the ports are usually 5, 6, 7, and 8. Set MagLogNT to interface with all the units according to their port assignments, be sure to make certain you know which EM61-MK2 unit is connected to which port. The same procedure is followed for setting up the GPS port assignment. See Photo 5.1 for an example of one of the Towed Array configurations

- 5.7.1. Set the appropriate data collection rate (sampling rate, i.e. 10 Hz for MEC jobs).
- 5.8. Perform 10-15 minute warm-up of EM61-MK2 according to ambient temperature.
- 5.9. Perform Pre-survey QC (see separate QC SOP) which usually consists of a 2-3 minute Static Test (remain stationary with no object – record readings), Static Spike (remain stationary with a metallic object beneath coil – record readings), and Cable Vibration Test (remain stationary with no object moving cables – record readings). Note any spikes or abrupt changes in data.
- 5.10. Perform Latency Test
- 5.11. If all QC data is verified, collect data, according to operating manual.

Applicable References:

Geonics, Ltd., 1996, www.geonics.com/em61.html.

Geonics, Ltd. 1999. *Operating Manual for EM61-MK2 61 High Sensitivity Metal Detector*.

McNeill, J.D. 1980. “*Electromagnetic Terrain Conductivity Measurements at Low Induction Number*.” Technical Note TN-6, Geonics, Ltd., Mississauga, Ontario.

Plugge, D., R. J. Selfridge, and R. Young. 2003. *Planning Geophysical Prove outs for Munitions Response Projects*. Huntsville, Ala.: U.S. Army Engineering and Support Center.

USAESCH (U.S. Army Engineering Support Center, Huntsville). 2003. *Munitions Response Data Item Descriptions (DIDs)*. Revised 1 December 2003.

Project Specific Work Plan - Data Quality Objectives (DQO) with established metrics

Review/Revision Date:

J. Williams - 02/04/08

Original Prepared By/Date:

M. Saunders – 01/14/2008

Revision #1 –



Photo 5-1 Four coil configuration of the EM61-MK2 Towed Array

APPENDIX E

Analog Locator Operations and Analog Locator Operator Checkout

<i>WSI</i> POLICY AND PROCEDURE MANUAL		
SUBJECT: Analog Locator Operations		No. Op.001.Analog Locator Operations.su
EFFECTIVE DATE: February 29, 2008	SUPERSEDES:	
SECTION: UXO Service Line	DEPARTMENT:	
NAME/TITLE: J. Williams/Sr. Technical Manager		
SIGNATURE:		DATE APPROVED: February 5, 2008

1. PURPOSE

This procedure outlines the requirements for analog locator operations.

2. APPLICABILITY AND SCOPE

The analog locator will be used during the following operations:

- Analog Locator Daily QC Checkout
- Analog Surveys (“mag and dig”)
- Near-Surface Anomaly Detection
- Backhoe Excavations
- Final 10% Analog Locator QC Surveys

The following section provides descriptions of these operations.

3. OPERATIONS

Analog Locator Daily QC Checkout

The UXO Technicians will conduct a daily instrument standardization check by placing the instrument over a standard item prior to commencing daily field activities. The standard item will be buried with the item description, depth and orientation annotated on a wooden stake marking where the item is located. The standard item will remain in the same location until the block of grids has been completely investigated.

An Analog Locator Checkout and Return Form will be filled out daily by equipment operators to record the results of the analog locator QC checkout and document the condition of the equipment.

Analog Locator Surveys

Analog locator surveys (i.e., “mag and dig”) will be performed in areas that cannot be surveyed using the digital techniques. “Mag and dig” sweeps are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. The “mag and dig” approach will also be used in areas where metallic fragments and debris make digital discrimination from MEC ineffective.

UXO Technicians will use the procedure described in Section 4.0 of this SOP to conduct analog locator surveys. The location of any MEC items that are located by using this method will be recorded with a GPS (or other survey method if under vegetation canopy) and all collected field data will be recorded in personal digital assistant’s (PDAs).

Near-Surface Anomaly Detection

Near-surface anomalies are those subsurface anomalies that can be excavated using hand tools. Throughout the excavation, the UXO Technician will use a magnetometer to check and verify the location of the anomaly.

Backhoe Excavations

Some anomalies are more deeply buried and require excavation using heavy equipment (i.e., backhoe). Prior to the arrival of the heavy equipment, the UXO Team Leader will ensure that a cleared entrance and egress path is available for the heavy equipment. Once on-site, the heavy equipment will be used to excavate the earth overburden from the suspect anomaly. The distance to the anomaly will be checked with the magnetometer during the excavation.

Final 10% Analog Locator QC Surveys

Quality control surveys will be performed after intrusive operations have been completed. A 10 percent QC survey will be performed by the UXOQCS using the analog instrument for all grids originally surveyed digitally. The discovery of any UXO or UXO-like item sufficient in size to represent a 37mm projectile or larger will constitute a failure of the grid (area) being investigated. Results of the 10 percent analog locator QC survey will be documented by the UXOQCS in the daily quality control (QC) report.

4.0 ANALOG LOCATOR SURVEY PROCEDURE

The following procedure will be used by equipment operators to conduct “mag and dig” operations with a handheld analog locator:

- The UXO Team Leader will direct personnel to establish individual search lanes approximately 3 feet wide and to begin searching each lane using a handheld analog locator.
- The equipment operator will start at one end of each lane and move forward toward the opposing baseline.

- During the forward movement, the UXO Technician will move the magnetometer back and forth in a sweeping motion from one side of the lane to the other. Both forward movement and the swing of the analog locator are performed at a pace that ensures that the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies.
- Whenever a subsurface anomaly or metallic surface object is encountered, the technician will halt and investigate the anomaly or place a flag for later investigation. Throughout this operation, the UXO Team Leader will closely monitor individual performance to ensure these procedures are being performed with due diligence and attention to detail.

6.0 ANALOG LOCATOR QUALITY CONTROL REPORTS

The quality control reports and forms used to document the QC activities listed in this policy and procedure manual are as follows.

Review/Revision Date:	L. Temple - 01/22/08
Original Prepared By/Date:	S. Young – 01/14/2008
Revision #1 –	

FIELD SUPERVISOR REVIEW SHEET

I have read the Project Work Plan and Standard Operating Procedure (SOP) UXO Technicians Analog Locator QC Checkout. I understand it. To the best of my knowledge the processes described in the Work Plan and this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure all persons assigned to this process are qualified, have read and understand the requirements of the Work Plan and SOP, and have signed the worker's statement for this process. If necessary, I will conduct an annual review of the Work Plan and SOP. If deviations from this SOP are necessary, I will ensure that project activities are stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will ensure that project activities are stopped until the hazards have been eliminated.

[illegible]

FIELD TEAM REVIEW SHEET

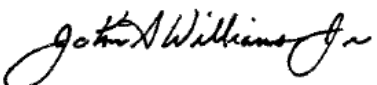
Each field team member shall sign this section after site-specific training is completed and before being permitted to work on-site.

I have read the Project Work Plan and Standard Operating Procedure for UXO Technicians Analog Locator QC Checkout. I have received the hazard control briefing. I understand them. I will follow the Work Plan and SOP unless I identify a hazard not addressed in it or encounter an operation I do not understand. If that occurs, I will stop site activities and notify my immediate supervisor of the problem.

[illegible]



Month _____ Instrument _____ Serial No. _____ Work Site _____		Date	CHECKOUT PROCEDURE <i>Check case for damage; open case Check instrument for damage Open battery compartment Install batteries Audio switch in "A" position Power up; adjust sensitivity control Set volume control Verify digital display Report to test grid Test grid results; Pass/Fail</i>	RETURN PROCEDURE <i>Clean instrument Open battery compartment Remove and store batteries Close battery compartment Return instrument to storage case Return case to storage area</i>
		1		
		2		
		3		
		4		
		5		
		6		
		7		
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<i>WSI</i> POLICY AND PROCEDURE MANUAL		
SUBJECT: Analog Locator Operator Checkout		No. Op.001.Analog Operator Checkout.su
EFFECTIVE DATE: February 29, 2008	SUPERSEDES:	
SECTION: UXO Service Line	DEPARTMENT:	
NAME/TITLE: J. Williams/Sr. Technical Manager		
SIGNATURE:		DATE APPROVED: February 5, 2008

1. PURPOSE

This procedure outlines the requirements for analog locator operator checkout.

2. APPLICABILITY AND SCOPE

The Geophysical Test Plot will be used as the analog locator operator checkout area. The Geophysical Test Plot Plan identifies the approximate number and type of items buried in the test plot. Equipment operators must successfully locate the required number of targets prior to commencing field data collection.

3. TEST OPERATIONS AND REPORTING

Prior to collection of field data, each equipment operator will be certified in the established test plot. To achieve certification, each operator must demonstrate the ability to locate 85% of target items. The UXO Technician Analog Locator Qualification Form will be used to record the results of the test and will serve as a record of the individual's analog locator qualification history.

Failure to locate 85% of the items will require a root cause analysis. After corrective action, operators may be reprocessed through the test plot to demonstrate their ability to reach the required levels of detection.

Upon successful completion of the test, certification of the operators/equipment will be recorded by the UXOQCS on the Analog Locator Qualification Form and documented in the daily quality control (QC) report on the day that certification occurs.

Review/Revision Date:	L. Temple - 01/22/08
Original Prepared By/Date:	S. Young – 01/14/2008
Revision #1 –	

Attachment A

ANALOG LOCATOR QUALIFICATION FORM

Name:			Member ID:		Team #	Date:
Analog Locator Unit Serial Numbers:						
1.						
2.						
Item No.	Target Located?		Location of Target		Radial Error of Target Location (in)	Comments
	Yes	No	Northing (ft)	Easting (ft)		
UXOQCS Name:			Signature:			Date:

APPENDIX F

Quality Control Procedures and Geophysical Data Processing

WSI <i>POLICY AND PROCEDURE MANUAL</i>		
SUBJECT: Quality Control Procedures and Geophysical Data Processing		Op: 001.QC dat
EFFECTIVE DATE: March 13, 2008	SUPERSEDES:	
SECTION: Geophysics Group	DEPARTMENT: OU 1494	
NAME/TITLE: J. Williams/Sr. Technical Manager		
SIGNATURE:		DATE APPROVED: March 13, 2008

1. PURPOSE

This procedure outlines the technical requirements and procedures for geophysical data processing and basic QC metrics established for geophysical projects.

2. APPLICABILITY AND SCOPE

The requirements of this procedure are applicable to all project activities which include the use of the EM61-MK2 and G-858 magnetometer either single sensor or array configuration. The data processing steps and QC metrics outlined in this SOP require intermediate knowledge of Geosoft Oasis Montaj (main geophysical processing software used by Weston Solutions, Inc.)

3. REFERENCES

3.1. Oasis Montaj Manual version 6.4, 2008.

4. DEFINITIONS

4.1. Geosoft Oasis Montaj - WESTON's main processing software for all electromagnetic data and magnetometry data collected during field survey.

5. QUALITY CONTROL

This section outlines the basic concepts and techniques used to measure and process QC data. Table 5-1 illustrates the basic list of QC tests that are run at every project and the frequency in which they are to be performed. The tests will now be explained below.

5.1. Equipment Warm-up – All geophysical equipment must be warmed up for at least 5 minutes dependent on ambient temperature. This allows the sensors to regulate themselves.

5.1.1. For the Mag G-858 execute the SELF TEST “Magnetometer Test” to confirm that values for the Battery, Lithium, RF, Bright, Cold, and Signal are appropriate with normal warm up values documented in the Magmapper Ops Manual.

- 5.2. Record Sensor Positions – All sensor positions and navigation system offsets will be recorded daily on the field notes. This will allow the processing geophysicist to accurately locate all sensors in space.

Table 5-1 - QC Tests for Geophysical Surveys

Test Description	Acceptance Criteria	Power On	Beginning of Day	End of Day	1 Line per Day
Equipment Warm-Up	Equipment Specific (5-15 minutes)	X			
Record Sensor Positions	±1 inch (2.54 cm)		X		
Personnel Test	EM-61 2mVp-p, Mag 3nT p-p		X		
Vibration Test	Data profile does not exhibit spikes		X	X	
Static Background	Background: EM61-MK2 +/- 2.5 mV,		X	X	
Static Spike	20% of standard item response		X	X	
Repeat Data	Repeatable ±20% of response amplitude, ±20 cm for positional accuracy				X

Note: Static and cable Vibration Tests must be performed with the sensor in a fixed “static” position. It is recommended that a non metallic jig or stand be used for this procedure. It is imperative that the operator avoid moving or influencing the sensor during these tests.

- 5.3. Personnel Test – Operators of the equipment should check themselves for influence on the sensor readings by approaching the sensors and noting the readings before and after (operators should remove all metal from the person before running this test). This test does not need to be recorded but should be ran everyday to ensure the operator does not have any metallic items that may interfere with the survey (i.e. metal grommets on boots are a typical factor).

- 5.4. Vibration Test (Cable Test) – the operator collects data and moves cables and electronics to note any possible fluctuations (may indicate a broken wire or an electronic interference from some data loggers).
- 5.5. Static Background – the operator collects data for a period of 3 minutes over a background area. The purpose is to identify any variations in the collected signal. The amplitude should remain constant within +/- 2.5 mV for EM and 3 nT/m for MAG.
- 5.6. Static Spike - the operator collects data for a period of 3 minutes over a spike object (usually a 2 in. pipe or 2 in. trailer ball). The purpose is to identify any variations in the collected signal. The amplitude should remain constant within +/- 2.5 mV for EM and 3 nT/m for MAG.
- 5.7. Repeat Data – the operator collects data over a predetermined survey line (original line) and then collects a separate line over the same position (repeat line). The data is then compared and the repeat line must have an amplitude within 20% of the original line and navigational accuracy within +/- 20 cm. Note a QC repeat survey is different from a repeat line. Quality Control repeat surveys are a repeat of a predetermined portion of a survey area where the data is collected again and selected targets and processed results are compared. Quality Control repeat surveys are project specific requirements and not required for all surveys.
- 5.8. Height Optimization Test – this test is performed at the beginning of the project to determine the optimal operating height of the data collection instrument. The test is performed by measuring the response of a calibration object (usually the smallest item of interest at your site) and varying the depths of this object to determine the height that yields the highest signal to noise quality.
- 5.9. Instrument Specific Tests – there are several instrument specific tests associated with magnetometry that also need to be performed at the beginning of the project.
 - 5.9.1. Azimuth Test – the test is performed if using the line and fiducial method and is performed by placing the sensor over a background area and rotating around this point in the cardinal directions and recording the results. The results are entered into a heading table and used to correct heading errors associated with affects from direction of survey.
 - 5.9.2. Octant Test – the test is performed when the instrument is interfaced with a navigational system. A background spot is marked on the ground and the operator traverses in all cardinal directions (at least 10 feet on either side of the spot). The database is then analyzed and a heading correction table is automatically generated from the data.

6. DATA METRICS

- 6.1. Sample Rate – the sampling rate will be conducive to the target size expected. For example on MEC projects with small MEC a sampling rate of 10 Hz (hertz – samples/second).
- 6.2. Sample Separation – the sample separation will not exceed 0.5 feet along line. Sample separation is calculated through Oasis Montaj's Sample Separation Calculation tool. This tool creates a map and lets the processing geophysicist examine if sample separation metrics are exceeded.
- 6.3. Velocity – velocity less than 3.0 mph will be maintained at all times. Optimal velocity has been noted around 2.0-2.5 mph. Velocity is calculated through Oasis Montaj's Velocity Calculation tool. This tool creates a channel in the survey database and lets the processing geophysicist examine if velocity metrics are exceeded. Logging velocity can also be monitored during data collection when using MagLogNT and NavTrack61MK2.
- 6.4. Line Spacing – also know as across line spacing is the distance of one survey line to the previous survey line measured perpendicular (normal) to each other. The maximum line spacing allowed is 2 feet.
- 6.5. Navigation Accuracy – navigation accuracy will be checked and documented daily by using a known point. This accuracy check is performed during the latency test as the latency test already makes use of known items and the location. The location accuracy of the peak response after latency correction will be with 1 foot of the actual location.
- 6.6. Diurnal Correction – this correct applies specifically to magnetometry data. Diurnal data will be monitored separately using a BaseStation (G-856) to monitor the daily natural magnetic background fluctuations. The data are used to apply a correction to the collected total field data with the G-858 sensors. The correction removes the daily diurnal effects from the data and is applied during the export process of the magnetometry data.
- 6.7. Drift Correction – drift correction is applied to remove the fluctuation (“drift”) in the instrument thought the survey. Instruments (especially the EM61-MK2) are noted to drift thought the day due to mainly temperature related issues in the day, which causes the electronics box to warm or cool affecting the response of the instrument. Drift is determined by using the no response signals (background – non amplitude signals) and applying a non-linear filter to the collected data, this filter can be changed to a zero-order trend, first order trend, second order trend removal, median or a combination of all the above. There are several ways to determine the drift of your survey. A statistical breakdown of your survey can be run illustrating the breakdown of your survey and will more adequately allow the processing

geophysicist to determine drift parameters to apply. Collecting a “tie-line” in the field at the end of the survey. A tie-line is a separate line collected from the end of the survey (most recently collected data) perpendicular across the survey to the first survey line. This will allow the processing geophysicist to create a tie-line channel and use this data to run the drift correction.

- 6.8. Processing DQO statement - All drift correction and/or filtering routines that are applied to datasets will be evaluated, on a dataset by dataset basis, to confirm that those routines do not alter the nature of the original measured response. All data processing steps will be recorded in the database audit log or a separate data processing form.
- 6.9. EM61-MK2 Sum Channel – Weston utilizes a Sum Channel (sum of the individual drift corrected channel data 1-4) to grid datasets and select targets. Weston has noticed that by using the Sum helps to eliminate smaller noise induced targets.
- 6.10. Magnetic Analytic Signal – the analytical signal is a result of taking the X, Y, and Z derivative and using those grids to calculate the Analytic Signal grid. The Analytic Signal grid can be thought of the measured rate of change over an anomaly. It collapses dipole signatures to a single point (usually located at the inflection point) and is used to select targets.

7. TARGET SELECTION

Targets will be selecting using the 4 channel sum for Electromagnetic data and the analytic signal channel for magnetometry data.

- 7.1. Initial Target Selection Threshold – the initial target selection threshold will be determined using the GPO/Test Plot data and determining what threshold is needed to select the smallest MEC item at the detection depth for the instrument. After the initial target selection threshold is determined, that threshold must be used throughout the project. The threshold can be changed after digging has commenced and the threshold is deemed to low, a project meeting must take place with all decision makers present and supporting evidence presented to raise the threshold. The threshold cannot be changed unless all stakeholders in the project are in agreement.
- 7.2. Target Selection - the Project Geophysicist will perform an automatic anomaly selection based on the Stack or Analytic Signal channel using UX-Detect Blakely algorithm within Oasis Montaj and the agreed upon selection threshold. A review of decay profiles (for the appropriate channels in EM data) at all suspect and/or low-amplitude anomalies will be performed to remove anomalies from the list not exhibiting response characteristics typical of buried metallic objects. A manual review of the remaining anomalies will be conducted to center the anomaly response as needed. All corrected geophysical data and anomaly locations will be exported to a database according to DID guidelines.

8. TYPICAL DATA PROCESSING SCENERIO

8.1. Initial Field Processing - Initial field processing will include data file QC review and correction of the following:

8.1.1. File/Grid or mile mark identification and location

8.1.2. Precision of the navigational data – An initial QC check will be performed on data collected using a 2-Point Function Test, which will be conducted on the established QC site near the GPO grid at the beginning and end of each work day. This data will be reviewed on a daily basis for precision of the navigational field data relative to known, geo-referenced items.

8.1.3. Checking navigational data for comprehensive coverage – The data will be reviewed to locate gaps in survey coverage in the data set that may require additional fill-in.

8.1.4. Reviewing data sets and QC tests with respect to signal to noise levels and acceptance criteria.

8.1.5. Removal of data dropouts and spikes associated with interference sources.

8.1.6. Begin initial data processing after all QC tests have been deemed valid.

8.2. Data Processing

8.2.1. Gridded plots for sum of the EM time gates/channels (Stack channel) will be prepared and transposed on electronic site base maps. The plots will be used to mark the horizontal dimensions of subsurface anomalies using Oasis Montaj™ (UX-detect) geophysical software. The crew will perform a comprehensive data analysis as described above to produce digital target tables, target maps, and identify and evaluate all geophysical anomalies detected by the geophysical instrument. Initially, the project geophysicist will process and interpret the four channels conducting a collective review of the respective decay characteristics. A summation of appropriate channels will be performed and the Stacked or Analytic Signal data will be processed. The final output will include processed data for the Stack or Analytic Signal (based on signal-to-noise ration [SNR] statistics for the site) and will include an automatic/manual anomaly selection. The Oasis software database audit log will also be reviewed as part of the QC process.

8.3. Quality Control of Target Selection

8.3.1. A quality control of selected targets is performed by measuring selected targets over known QC points (usually grid corner spikes or implanted QC seeds within the grid)

9. ANOMALY SELECTION

Targets will be selecting using the Stack channel for Electromagnetic data and the analytic signal channel for magnetometry data.

9.1. Gridded plots for sum of the EM time gates/channels (Stack channel) will be prepared and transposed on electronic site base maps. For the Magnetometer data, grid plots of the vertical gradient, analytic signal or total field (as defined in the Work Plan) will be prepared and transposed on electronic site base map. The plots will be used to mark the horizontal dimensions of subsurface anomalies using Oasis Montaj™ (UX-detect) geophysical software. The crew will perform a comprehensive data analysis as described above to produce digital target tables, target maps, and identify and evaluate all geophysical anomalies detected by the geophysical instrument. Initially, the project geophysicist will process and interpret the four EM channels conducting a collective review of the respective decay characteristics. A summation of appropriate channels will be performed and the Stacked (EM) or Analytic (MAG) Signal data will be processed. The final output will include processed data for the Stack or Analytic Signal (based on signal-to-noise ration [SNR] statistics for the site) and will include an automatic/manual anomaly selection. The Oasis software database audit log will also be reviewed as part of the QC process.

9.2. Initial Target Selection Threshold – the initial target selection threshold will be determined using the GPO data and determining what threshold is needed to select the smallest MEC item at the detection depth for the instrument. After the initial target selection threshold is determined, that threshold must be used throughout the project. The threshold can be changed after digging has commenced and the threshold is deemed to low, a project meeting must take place with all decision makers present and supporting evidence presented to raise the threshold. The threshold cannot be changed unless all stakeholders in the project are in agreement.

9.3. Target Selection - the Project Geophysicist will perform an automatic anomaly selection based on the Stack or Analytic Signal channel using UX-Detect Blakely algorithm within Oasis Montaj and the agreed upon selection threshold. A review of decay profiles (for the appropriate channels in EM data) at all suspect and/or low-amplitude anomalies will be performed to remove anomalies from the list not exhibiting response characteristics typical of buried metallic objects. A manual review of the remaining anomalies will be conducted to center the anomaly response as needed. All corrected geophysical data and anomaly locations will be exported to a database according to Appendix C of the USACE DID guidelines.

9.4. Quality Control of Target Selection

9.4.1. A quality control of selected targets is performed by measuring selected targets over known QC points (usually grid corner spikes or implanted QC seeds within the grid).

10. PREPARATION OF TARGET DATA BASE AND DIG INFORMATION

10.1. Exporting Target Information – all targets that have passed geophysical manual review and are to be selected for reacquisition and digging must be exported with the necessary reporting information as mandated by the DID.

10.1.1. Reacquisition Sheets – reacquisition sheets are supplied to the reacquire team so targets can be tracked as they are reacquired in the field using the same navigational method used to collect the data.

10.1.2. Navigation Target Location File – a comma delimited file containing target ID, Northing, and Easting (in that order with no header info) to be uploaded into the navigation data collector for reacquisition.

10.1.3. UXOFast Upload File – a predefined formatted excel file that is used to upload targets to UXOFast.

10.1.4. Target Dig Map – map of the grid area (if the scale is applicable) showing target locations and name for aid in reacquisition and digging.

Applicable References:

USAESCH (U.S. Army Engineering Support Center, Huntsville). 2003. Munitions Response Data Item Descriptions (DIDs). Revised 1 December 2003.

Project Specific Work Plan - Data Quality Objectives (DQO) with established metrics

Table 1
Typical DQO for DGM
(Subject to Revision per Site Specific Work Plan)

Typical DQO Parameters		Typical Metric	How QC metrics are measured	Rationale
1	Standard deviation of background noise	EM - (summed channel) = i.e. <2 mV. Mag Analytic Signal	Run statistics on all data below a reasonable level (i.e. between 7 and 9 mV)	Decreased Noise=lower False Positives
2	Mean acquisition speed	= i.e. <2.5mph	Run statistics on velocity between points in each file (created a “velocity” channel)	To provide appropriate data density to resolve smaller items.
3	Along track measurements [Note : 1]	= i.e. <0.5ft, across track = i.e. <3 ft	Metric based on mean speed during GPO.	Lower speed = less “vibration” and system noise
4	Sum of positioning errors	= i.e. < 1 foot	Developed navigation test appropriate to sensors Control points AM track plots PM track plots	
5	Instrument Latency	No chevron patterns in interpretation maps	Evaluation (visual review) of gridded data.	To reduce duplication of and introduction of false positive anomaly selections
6	Consistency of processing parameters within a dataset	Identical for each channel within a dataset	Analyst applies common set of parameters (leveling and drift routine filters), for processing all channels within dataset.	All signals to undergo standardization to support anomaly prioritizations. [Note : 2]
7	Signal to noise variance	= i.e. < lesser of 5% or 5mV	Random review of 3 small (less than 100mV) and 3 large (greater than 100mV) anomalies per dataset	To compare preprocessed and final processed peak responses.
8	Automated anomaly selections based on sum of channels or AS.	Verify we maintained peak response characteristics in the event anomaly is ambiguous	All automated anomaly selections will be based on sum of all channels and reviewed by a geophysicist	1-To confirm low amplitude anomalies are not “processed-out” 2- To facilitate anomaly prioritization if needed.

	Typical DQO Parameters	Typical Metric	How QC metrics are measured	Rationale
9	Random anomaly review	Reacquisition = i.e. < 2 feet	A random sample of anomalies (i.e. 2 per acre) to be reacquired and confirmed.	To demonstrate anomaly reproducibility (random reacquisition) and anomaly detections (blind QA items), both to within 2 feet, the data would be defensible in supporting project objectives.
10	Placement of Blind seed item within the Grid.	Tests Detection and Selection of anomaly (i.e. within 2 feet of known location)	The QA geophysicist places blind seeds throughout the survey area at a rate of 1 per 2 acres.	To confirm quality of detection and accuracy/precision of navigation.
Note: 1- Some (team decision) flexibility is required, to allow gaps (over entire survey area) up to an acceptable limit relative to design metrics and stated objectives. 2- Some exceptions with complex data or parsed sections affected by cultural interference				

Review/Revision Dates:

J. Williams - 02/04/08

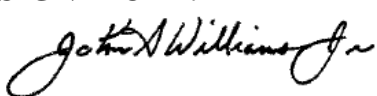
Original Preparer/Date:

M. Saunders – 01/17/08

Revision #1 –

APPENDIX G

Anomaly Reacquisition and Excavation Procedure

<i>WSI</i> POLICY AND PROCEDURE MANUAL	
SUBJECT: Anomaly Reacquisition and Excavation Procedure	No. Op.001.reacrev3
EFFECTIVE DATE: May 21, 2008	SUPERSEDES: Op.001.reacrev2
SECTION: Geophysics Group	DEPARTMENT: OU 1494
NAME/TITLE: J. Williams/Sr. Technical Manager	
SIGNATURE: 	DATE APPROVED: May 21, 2008

1. PURPOSE

This procedure outlines the technical requirements and procedures for performing anomaly reacquisition and excavation of selected geophysical targets.

2. APPLICABILITY AND SCOPE

The requirements of this procedure are applicable to all project activities which include the excavation and investigation of selected geophysical targets.

3. REFERENCES

3.1. None

4. PROCEDURES

4.1. *Target Anomaly Flagging*

- 4.1.1. Upload of selected targets into navigational data logger as provided by the Geophysicist.
- 4.1.2. Set up the Real Time Kinematic (RTK) - Global Positioning System (GPS) in accordance with Weston Op.001.nav.rtk rev 1.
- 4.1.3. Perform instrument checkout in accordance with Weston Op.001.Analog Operator Checkout.su
- 4.1.4. Proceed to Control Point (i.e., Fort Ord 36) and verify the accuracy (offset less than 0.1 ft).
- 4.1.5. Using the dig sheet information proceed to reacquire the anomaly targets identified marking each location with a non-metallic flag bearing the unique target ID. (ie. SCA W130 - 12). Place the flag within 0.1 feet of the target coordinates as determined on the RTK..

- 4.1.6. The Unexploded Ordnance (UXO) Dig Team will use the appropriate hand held instrument, depending on the type of instrument used for the digital geophysical mapping survey (EM61-MK2 data – All Metals, G-858 data – Schonstedt to investigate an area 3 feet around each flag to confirm the anomaly response. The UXO Team will note any offset from the flag to the excavated anomaly or anomalies and log accordingly.

4.2. Excavation of Target Anomalies

- 4.2.1. Once the target anomalies are flagged as described in Section 4.1, the Dig Team will begin anomaly excavation activities.
- 4.2.2. The Dig Team will upload the selected target anomalies onto the Personal Digital Assistant (PDA) (UXOFast program).
- 4.2.3. The Dig Team will proceed to each flagged anomaly. One of the team members will bring up the Target ID on the UXOFast program to begin data collection.
- 4.2.4. The Dig team will excavate each anomaly location flag or the spray painted location.
- 4.2.5. Hand held instruments such as a Schonstedt or White will be used to assist the excavation work. The handheld instruments will be tested in the Geophysical Test Plot.
- 4.2.6. The excavation team will investigate all anomalies within 3 feet of the flag or spray painted location. Do not move the flag location in the event that multiple items are recovered from this area. Off-sets shall be measured from the original flagged location.
- 4.2.7. All anomalies will be identified and logged into the PDA running the UXOFast software.
 - 4.2.7.1. Target characteristics logged include but are not limited to; Item type (Munitions and Explosives of Concern (MEC), Munitions Debris (MD), cultural debris, QC item), item description (concrete, practice grenade), offset from flagged location, weight of item, depth, hole cleared, comments, etc. Once the data is entered, SAVE the entry.
 - 4.2.7.2. If the target anomaly is a MEC item, the Dig Team will notify the Senior UXO Supervisor who will then determine the course of action.
- 4.2.8. After logging an excavated item, the UXO techs will continue to sweep the anomaly location for additional items and arrive at two possible situations:
 - 4.2.8.1. If no further items are found within the radius of the flagged location, the hole is considered completed (cleared).

4.2.8.2. If different, additional items are found they are logged under the same target but given a different suffix (-1, -2, -3, etc) and logged as described above.

4.2.8.2.1. The Dig Team will proceed with excavation and removal of buried debris to the depth required in order to clear the hole.

4.2.8.2.2. The Dig Team will remove all items from the excavation hole. Items will not be placed back into the hole even if they are not MEC-related.

4.2.8.2.3. If the hole cannot be cleared due to extensive debris or the presence of an in-place object (e.g., a pipeline), the hole will be logged as “Not Cleared” and the Dig Team will inform the Senior UXO Supervisor of this finding. The hole may be investigated at a later time using heavy equipment (such as a backhoe or dozer).

4.2.9. The Dig Team shall handle all items recovered based on the type as specified in the work plan and explosive safety submission (ESS).

4.2.10. The Dig Team will then spread the spoils/excavated dirt into a thin lift and check the material for the presence of metal debris using a Schonstedt and/or White handheld instruments. The excavation will not be backfilled until the spoils have been checked and verified not to contain MEC or other metal debris.

4.2.11. Once the spoils have been checked, the Dig Team will backfill the hole.

4.2.12. If no anomalies are found the Dig Team the flag will be left at the original location and note the anomaly location as a “No Contact”. No Contacts will be reviewed by the Geophysicist and checked as part of the QC-1 process.

4.3. Common Questions Encountered During Digging Procedures

4.3.1. What if the UXO Techs come to a flag and their instrument response is outside the sweep radius?

4.3.1.1. The UXO tech will check to see if any additional flags are near the response they are detecting. If there is, that response is due to that other flagged location. If there are no additional flags then the Dig Team will log that item under the flag location in which they started and mark the offsets accordingly. The offset failure will be identified by the QC geophysicist and an examination of the geophysical data will be performed to identify the reason for the failure. The offset failure distance is anything outside 2 feet of the original flagged location. Note the target is only considered a failure if there are no items dug within two feet of the flagged location. If additional items are found outside the two foot radius they are not failures.

4.4. Download and review of Dig Data

- 4.4.1. Upon returning from the field the UXO techs will turn in all PDA's and the site geophysicist (or designated person) will "*Send*" all the logged data onto the SQL UXOFast server.
- 4.4.2. The Site Geophysicist will review all the data for consistency and check the agreement with geophysical data (does the logged item "make sense" with the amplitude of the target).
- 4.4.3. The UXO QC Specialist and Senior UXO Supervisor will review any targets identified to be MEC or MD and review the entry information for consistency and accuracy.
- 4.4.4. Upon completing the QC procedures the targets will be made viewable to all parties via Teamlink.
- 4.4.5. The following morning and prior to using the PDA's, the Geophysicist (or designated person) will "*Get*" all the tables for the PDA's in order to "*Sync*" all the units with the same information.

Review/Revision Date:

J. Williams – 6/23/08

Original Prepared By/Date:

M. Saunders – 3/14/08

Revision #3

APPENDIX E

Anticipated Fieldwork Schedule

Activity ID	Activity Name	Activity % Complete	Original Duration	Start	Finish	2010	
						Oct	Nov
Group 4 - Future East Garrison MRA							
MEC Field Work - Map 1 (Future East Garrison)							
Mobilization & Demobilization							
04.010	Mobilization of Field Crew, Map 1 (Future East Garrison)	0%	1	08-Oct-10*	08-Oct-10		
Survey							
04.030	Survey, MAP 1 (Future East Garrison)	0%	4	08-Oct-10	13-Oct-10		
Brush Removal							
04.040	Brush Cutting, Map 1 (Future East Garrison)	0%	15	08-Oct-10	28-Oct-10		
MEC Sub-Surface Removal							
04.070	SS MEC Removal - Mag and Dig, MAP 1 (Future East ...	0%	20	18-Oct-10	12-Nov-10		
04.080	DGM and Data Analysis, MAP 1 (Future East Garrison)	0%	5	09-Nov-10	15-Nov-10		
04.100	SS MEC Removal, Reacq & ID, MAP 1 (Future East Ga...	0%	6	15-Nov-10	22-Nov-10		
04.170	Quality Control - Digital MAP 1 (Future East Garrison)	0%	2	23-Nov-10	24-Nov-10		
04.190	Quality Control - Analog, MAP 1 (Future East Garrison)	0%	15	04-Nov-10	24-Nov-10		

APPENDIX F

Resumes of Key Personnel

BRUCE M. MOE**Qualifications Summary**

- Over 22 years of experience in the UXO and environmental industries.
- Experienced Project Supervisor, managing MEC response projects.
- Highly qualified in the reconnaissance and classification of U.S. and foreign military munitions.
- Experience in MEC geophysical techniques including magnetics, frequency, and time domain electro-magnetics.
- Experienced in the analysis, handling, and disposal of MEC.
- Experience in handling CWM and disposal.
- Certified USN Diver.
- Class "A" CDL with HAZMAT endorsement.

Registration

UXO Certification, USACE Huntsville Center (No. 1065)

Fields of Competence

All phases of Munitions and Explosives of Concern (MEC) and Chemical Warfare Material (CWM) response project. Plans, coordinates, and supervises most aspects of an OE response. Proficient in the preparation and execution of plans, procedures, and project documentation, while ensuring compliance with DOD Directives, as well as local, state, and federal statutes, codes, and regulations. Experienced in site management and supervision of multiple field teams, ensuring compliance with project plans and objectives while accomplishing tasks in a safe manner.

Can perform all tasks for any level Unexploded Ordnance (UXO) Technician, including the reconnaissance and classification of UXO; identification of U.S. and foreign guided missiles, bombs, projectiles, grenades, rockets, land mines, fuzes, pyrotechnic items, military explosives, and demolition materials; location of subsurface UXO using geophysical equipment; excavation and recovery of subsurface UXO; construction of UXO-related protective works; transporting and storing UXO, ensuring compliance with federal, state, and local laws; disposal of UXO; UXO Safety and Quality oversight and inspections; handling, certification, and disposition of scrap material; emergency leak sealing and packaging of chemical warfare material.

Education

EOD Basic School, U.S. Navy (1984)

Dive School, U.S. Navy (1984)

Bomb Disposal School, U.S. Army (1984)

Credentials

40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), (1984)

10-Hour Construction Safety Training, OSHA 29 CFR 1926
Class "A" CDL with HAZMAT Endorsement

Employment History

2006-Present WESTON
2003-2005 WESTON
1988-2002 UXB International, Inc.
1982-1987 U.S. Navy (Active Duty)

Key Projects

ESCA Remediation Program, Former Fort Ord, Marina Ca., Fort Ord Reuse Authority, Senior Unexploded Ordnance (UXO) Supervisor (SUXOS).

Responsible for the field execution of remedial investigations and removal actions on approximately 3,400 acres on the former Fort Ord. Managing multiple UXO teams and supervising demolition activities.

Time Critical Removal Action, Former Tobyhanna Artillery Ranges, Tobyhanna, PA, U.S. Army Corps of Engineers (USACE), SUXOS. Responsible for the field execution of a removal action of approximately 300 acres on the former Tobyhanna Artillery Ranges. Managed multiple UXO teams and supervised demolition activities.

Time Critical Removal Action, Mare Island Naval Shipyard, Vallejo, CA, NAVFAC/EFA-West, UXOSO, UXOQCO, and Demolition Manager. Responsible for implementing site Health and Safety plans, and Quality Control criteria during sifting and clearance operations. Managed all demolition activities.

Screening of Dredge Materials, Naval Weapons Station Earle, Colts Neck, NJ, NAVFAC/MIDATL, SUXOS. Responsible for the management of night-time operations during the screening of dredge materials.

Chino Hills UXO Removal, Chino Hills, CA, Site Manager/SUXOS. Site Manager for a MEC removal action, under a Times and Materials Contract, at the former open detonation grounds. Managed all site activities and personnel during the excavation and sifting of approximately 500,000 cubic yards of soil and recovery of over 30,000 UXO items.

Remedial Investigation/Feasibility Study (RI/FS), Former Tobyhanna Artillery Ranges, Tobyhanna, PA, USACE, SUXOS. Managed the execution of an RI/FS on the former Tobyhanna Artillery Ranges. Development of RI Work Plan and its execution at this formerly used defense site that consists of over 21,000 acres. The RI included both munitions and explosives of concern (MEC) and munitions constituents. The RI entailed coordinating several different disciplines and crews including geophysical mapping, intrusive reconnaissance, demolition support, survey, and brush removal. Responsible for disposal operations for all military munitions recovered.

MEC Clearance Activities, Nevada Test Site, Nye County, NV, SUXOS. Responsible for managing multiple UXO teams during MEC clearance activities as part of a Department of Energy Corrective Action Investigation.

Key Projects (Continued)

Disposal of Chemical Weapons, MMD-1 Mobile Munitions Demilitarized Site, Dugway, UT, USACE, SUXOS. Responsible for the disposal of non-stockpile chemical weapons at the Dugway Proving Ground.

DONALD JOSEPH KEAN**Qualifications Summary**

- Over 20 years of professional experience.
- Over 20 years of EOD/UXO experience including 11 years of active duty military impact/demolition range operations as an EOD/Mine-Warfare/Demolitions Instructor performing UXO, Mine, booby-trap search, detection, identification, clearance and disposal operations.
- Ten Years of civilian UXO industry experience
- UXO Operations Supervisor and Quality Control Supervisor

Registration

UXO Certification, USACE Huntsville Center (No.1581)
Certified EOD Technician, Canadian Military (1990)
Certified EOD Technician Phase I & II U.S Navy EOD School (1996)

Fields of Competence

Supervision of chemical munitions warfare (CWM)/munitions and explosives of concern (MEC) project; unexploded ordnance (UXO) Quality Control (QC) Supervisor; high hazard remediation; Supervisor site excavation, removal and disposal; range clearance and disposal operations; explosive ordnance disposal (EOD Senior Unexploded Ordnance Supervisor (SUXOS) high hazard remediation operations.

Education

Grade XI Honor student – Beaconsfield High School, St John’s Newfoundland, Canada (1982)
Graduate, Canadian Forces EOD School, Borden, Ontario, Canada (1990)
Graduate, U.S. Navy EOD School Phase I Eglin AFB, FL (1996)
Graduate, U.S. Navy EOD School Phase II Indian Head, MD (1996)

Credentials

40- Hour Hazardous Waste and Emergency response Operations Course, 29 CFR 1920.120(e)(3), (2001) Kaho’olawe Island Restoration Project ,UXB International
8 Hour Hazwoper Refresher Course 29 CFR 1910.120(e)(8) & RCRA Generator 40 CFR 262.34 & 265.16, Weston Solutions, Inc (2007)
U.S. Army Corps of Engineers Construction Quality Management for Contractors

Employment History

Aug 2007 – Present	Weston Solutions, Fort Ord Quality Control Supervisor
Aug 2006-Aug 2007	WESTON, Mare Island Naval Shipyard, Vallejo, CA, SUXO/Tech III/QC

Section (Continued)

June 2006-Aug 2006	Zapata Engineering, Inc, Schofield Barracks, Oahu, Hawaii, Tech III Supervisor
Mar 2006-June 2006	Environmental Chemical Corporation, Mare Island Naval Shipyard, Vallejo, CA, Tech III Supervisor
June 2005-Mar 2006	Zapata Engineering, Inc, Schofield Barracks, Oahu, Hawaii, Tech III Supervisor
May 2004-June 2005	USA Environmental, Inc, Fort Ord, Marina, CA, Tech II
Apr 2001-Apr 2004	UXB International, Inc, Kaho'olawe, Hawaii, Tech III Supervisor/UXOQCSS
Feb 2000-Dec 2000	European Landmine Solutions, Kurdistan, Northern Iraq, UXO/Demining QC Supervisor
May 1996-Feb 2000	Canadian Forces School of Military Engineering, CFB Gagetown, New Brunswick, Canada, SGT.
Jan 1989-May 1996	Canadian Army, Various tours of duty

Key Projects

UXO Quality Control Supervisor for the Fort Ord Remediation Program at Fort Ord, Marina, CA. Weston Solutions, Inc

UXO Tech III, SUXO and QC for the remedial investigation, detection, identification and removal of potentially hazardous UXO items at Mare Island Naval Shipyard, Vallejo, CA. Weston Solutions, Inc

UXO Tech III Munitions Response/Construction Support work at Schofield Barracks Cleanup Project. Oahu, Hawaii. Responsible for daily team safety briefings, search, detection and identification of munitions and explosives of concern (MEC) and Chemical warfare munitions (CWM) items during surface and subsurface detection. Also responsible for the inspection and removal of ordnance scrap and range related debris. Zapata Engineering, Inc

Remedial investigation of munitions and explosives of concern (MEC) UXO Tech III, Mare Island Production of Munitions Area, Mare Island Naval Shipyard, Environmental Chemical Corporation (ECC).

UXO Quality Control Specialist Supervisor (UXOQCSS) UXB International, Inc, Kaho'olawe Island Ordnance Cleanup Project, Hawaii. Responsibilities included the supervision of a QC Team conducting MIL-STD 1916 surface and subsurface clearance inspections. Also Responsible for conducting visual inspections of 5X material, thermally processed material and light ordnance and demilitarization system (LOADS) processes.

UXO Instructor/ Supervisor, European Landmine Solutions (ELS), Kurdistan, Northern Iraq. Responsible for course supervision, development of Standard Operating Procedures, lesson preparation, and instruction of UXO package for the United Nations Office of Project Services

Section (Continued)

(UNOPS). Also responsible for the supervision and guidance for the daily operations of the UXO team.

Demining Group Supervisor, European Landmine Solutions (ELS), Kurdistan, Northern Iraq. Responsible for Quality Control Inspections of several minefield operations

Instructor of Mine Warfare and Demolitions, Canadian Forces School of Military Engineering. Responsible for the administration, management and training of various courses associated with demolitions and EOD operations. Other responsibilities included planning and preparation of instruction material for EOD training packages which encompassed conducting and managing both live and practice EOD/Demolition range exercises.

EOD/Mine Awareness operations while deployed overseas in Iraq-Kuwait, and Croatia.

Responsible for management and supervision of section members while conducting EOD/Mine clearance operations.

GREGORY B. CLARK

Qualifications Summary

- Over 12 years of experience in the UXO industry.
- 14 years military experience with training in Canada, United Kingdom and the United States
- Experienced Team Supervisor, UXO Safety and Quality Specialist for munitions response projects.
- Unexploded ordnance (UXO) analysis, handling, and disposal.
- Fork Lift and Backhoe Operator
- Certified Military/Civilian Diver
- First Aid/CPR Trained
- Automatic External Defibrillator Operator

Registration

USACE Certified UXO Technician (No. 1582)

Fields of Competence

UXO and Modified CWM response projects.

Plans, coordinates, and supervises most aspects of an OE response. Versed in the preparation and execution of plans, procedures and project documentation, while ensuring compliance with DOD Directives, as well as local, state and federal statutes, codes and regulations. Experienced in Site Safety and Quality Control management and supervision of multiple field teams, ensuring compliance with project plans and objectives while accomplishing tasks in a safe manner. Can perform all tasks for any level UXO Technician, including:

- Reconnaissance and classification of UXO; identification of U.S. and foreign guided missiles; bombs; projectiles; grenades; rockets; land mines; fuzes; pyrotechnic items; military explosives and demolition materials.
- Location of subsurface UXO using geophysical equipment.
- Excavation and recovery of subsurface UXO
- Construction of UXO-related protective works
- Transporting and storing UXO assuring compliance with Federal, state, and local laws;
- Disposal of UXO
- UXO Safety and Quality Control oversight and inspections
- Handling, certification and disposition of scrap material

Credentials

Canadian EOD Basic School – 1982

Canadian Navy Dive School - 1982

Canadian & United Kingdom IEDD - 1994

US Navy EOD Basic School – 1994

40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), (2001)

30-Hour Construction Safety Training, OSHA 29 CFR 1926

Weston Construction Site Manager/Field Safety Officer

Employment History

2007-PRESENT UXO Safety Officer, Weston Solutions, Fort Ord Marina Ca.

Duties include site preparation for clearance operations in special case areas and construction support for road grading activities. This entails assisting in coordination of community safety plan between community services, public interest groups, and project personnel.

2005-2007 Safety Officer/Quality Control Officer, Schofield Barracks Hawaii, and Sierra Army Depot Nevada, UXO Tech III Fort Hood Texas, and UXO Tech II Fort Belvoir Virginia, all positions with Zapata Engineering. Schofield Barracks is a modified Chemical Clearance Project where he was employed as an Intrusive Team Leader for subsurface clearance operations and was then promoted to a Site Health and Safety Officer. He finished out the project as a combination Quality Control/Safety Officer. Sierra Army Depot was a combination QC/SO position for a land use turnover project. Texas and Virginia projects were both pre-construction clearance sites.

2004-2005 UXO Tech II/ Tech III, USA Environmental, Fort Ord Marina Ca.

Performed as a team member by conducting analog and digital operations for locating, identifying and disposing of numerous types of ordnance and remnants. As Team Leader performed QC operations, conducted safety briefs, and completed all logistical duties of that position.

2001-2004 UXO Specialist Supervisor, UXB International, Kahoolawe Hi.

As an Area Preparation Team Supervisor he was responsible for control of all aspects of an AP team consisting of 8 team members. These duties included brush cutting and clearance operations, ordnance location, identification, disposition, and UXO remnant removal. He was also responsible for all safety, infield training, administration, and coordinating team activities.

1996-2001 Associate Instructor, RAMDAR Consulting, Victoria BC Canada

Instructed clients in the identification of basic military and commercial explosives and related materials. Demonstrated telephone bomb threat scenarios and responses through lecture and practical demonstration.

1996-1996 EOD Specialist, SNC Technologies, Montreal Que. Canada

Located, identified and disposed of numerous types of ordnance and related materials. Performed quality control and certified scrap to be Free from Explosives.

1982-1995 Clearance Diver/EOD Technician, Canadian Armed Forces

Performed as an Instructor at Explosive Ordnance Disposal School for 3 years, instructed up to 20 students on identification, hazards, safety precautions, and disposal of explosive ordnance and improvised devices.

APPENDIX G

Explosives Siting Plan

FORA ESCA REMEDIATION PROGRAM

Appendix G: Explosives Siting Plan

FINAL Group 4 Remedial Investigation / Feasibility Study Work Plan

Volume 2 - Sampling and Analysis Plan

Future East Garrison Munitions Response Area

Former Fort Ord
Monterey County, California

October 8, 2010

Prepared for:

FORT ORD REUSE AUTHORITY

100 12th Street, Building 2880
Marina, California 93933



Prepared Under:

Environmental Services Cooperative Agreement
No. W9128F-07-2-01621

and

FORA Remediation Services Agreement (3/30/07)

Document Control Number: 09595-09-079-045

Prepared by:



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- 3 Remedial Investigation Minimum Separation Distances
- 4 Explosive Storage Location (Building 763) Minimum Separation Distances
- 5 Explosive Storage Location (Building 764) Minimum Separation Distances
- 6 Explosive Storage Location (Building 765) Minimum Separation Distances
- 7 MSDs and Fragmentation Characteristics for Projectile, 37mm Low Explosive MK I

ACRONYMS AND ABBREVIATIONS

Army	U.S. Department of the Army
ASP	Ammunition Supply Point
BRAC	Base Realignment and Closure
DDESB	Department of Defense Explosives Safety Broad
ESCA RP	Environmental Services Cooperative Agreement Remediation Program
ESL	explosive storage location
ESP	Explosives Siting Plan
FORA	Fort Ord Reuse Authority
ft	foot or feet
FUDS	Formerly Used Defense Sites
HFD	hazardous fragment distance
LDSP	Land Disposal Site Plan
LE	Low Explosive
MCRFD	Monterey County Regional Fire District
MEC	munitions and explosives of concern
MFD	maximum fragmentation distance
MGFD	munition with the greatest fragmentation distance
mm	millimeter
MRA	Munitions Response Area
MSD	minimum separation distance
NA	not applicable
POM FD	Presidio of Monterey Fire Department
RI	Remedial Investigation
SUXOS	Senior Unexploded Ordnance Supervisor
TSD	team separation distance
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance
UXOSO	Unexploded Ordnance Safety Officer

1.0 INTRODUCTION

The former Fort Ord, Monterey County, California is the focus of this Explosives Siting Plan (ESP) in support of a Remedial Investigation (RI) to be conducted at the Future East Garrison Munitions Response Area (MRA). This Future East Garrison RI covers approximately 252 acres that potentially contain munitions and explosives of concern (MEC). Detailed information about the Future East Garrison MRA can be found in Volume 1 of this Group 4 Remedial Investigation and Feasibility Study Work Plan. This plan for siting explosives operations conforms to the requirements of Data Item Description MR-005-004. The RI fieldwork is scheduled to start in September 2010.

Figure 1 shows the location of the former Fort Ord and the general site layout. Figure 2 shows the RI area within the Future East Garrison MRA. Figure 3 includes all anticipated minimum separation distances (MSDs) for the Future East Garrison MRA RI area.

1.1 Explosive Storage Magazines

Explosive donor charges will be drawn from the established explosive storage location (ESL). The ESL is the former Fort Ord Ammunition Supply Point (ASP) shown on Figure 1. The Department of Defense Explosives Safety Board (DDESB) approved the siting and final safety submission for this ASP on March 8, 1990. The ASP's magazines are standard earth-covered facilities. After Fort Ord closed under Base Realignment and Closure (BRAC), DDESB approved a change to the use of the magazines and resited them to allow the U.S. Department of the Army (Army) to use the magazines for the storage of demolition materials for unexploded ordnance (UXO) contractors executing Fort Ord's munitions response actions. The Army used the magazines in this way for a number of years. The Army is no longer using the magazines and deeded transfer of the entire ESL to the Fort Ord Reuse Authority (FORA). The ESL will continue to be used for UXO contractor munitions response actions for approximately 7 years. Siting of these magazines is covered under the DDESB final approval of the "2nd Addendum to the 3rd Amendment to the 17 Feb 94 Land Disposal Site Plan (LDSP) for BRAC of Fort Ord, California," dated January 14, 2008 (ESCA RP Team 2008). The MSD requirements for each of the three earth-covered facilities being used at the ESL (Buildings 763, 764, and 765) are shown on Figures 4, 5, and 6.

1.2 Engineering Controls

Engineering controls will be implemented during intentional detonations per the guidance set forth in HNC-ED-CS-S-98-7, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions. Only one item will be disposed of at a time when engineering controls are being employed.

In areas where an acceptable fragmentation distance cannot be achieved, items that are safe to move may be moved to another area as long as the movement does not require transportation on public roads. If movement to another area is not possible, engineering controls (in accordance with HNC-ED-CS-S-98-7) will be employed to reduce the fragmentation hazard.

1.3 Munitions and Explosives of Concern

All recovered MEC will be blown-in-place in the grid found; engineering controls will be utilized to mitigate the hazard posed by fragments produced by the detonation.

1.4 Minimum Separation Distance

Figure 3 includes all anticipated MSDs for the Future East Garrison MRA. The selection of the munition with the greatest fragmentation distance (MGFD) for the Future East Garrison area is based on the results of previous MEC investigations and removal actions in portions of the Future East Garrison MRA.

- The MGFD for the Future East Garrison MRA is the 37 millimeter (mm) MK I, Low Explosive (LE) projectile.

1.4.1 Maximum Fragmentation Distance MSD for Intentional Detonations

The maximum fragmentation distance (MFD) is in accordance with the Fragmentation Data Sheet for the 37mm MK I, LE projectile, and will be used for intentional detonations, as shown on Figure 3. The MFD for the 37mm MK I, LE projectile is 816 feet (ft). Engineering controls for intentional detonations, per the guidance set forth in HNC-ED-CS-S-98-7, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions, will be employed to reduce the MFD.

The withdrawal distance or MSD for intentional detonations using sandbags is 200 ft, as shown on Figure 3. Engineering controls will be utilized for single item detonations only. Any inhabited buildings that fall within the MSD will be evacuated during MEC operations. All roadways will be blocked with road guards (or equivalent) to ensure that nonessential personnel do not enter the MSD during MEC activities.

1.4.2 Hazardous Fragment Distance MSD for Nonessential Personnel for Unintentional Detonations

The MSD for nonessential personnel is as shown on Figure 3. The hazardous fragment distance (HFD) will be used for unintentional detonations based on the Fragmentation Data Sheet (Figure 7). The MSDs for intentional and unintentional detonations are provided in Table 1.

Table 1: Minimum Separation Distances

MEC Operation	MSDs (ft)	
	37mm MK I, LE	
	Essential Personnel	Nonessential Personnel
Unintentional Detonations	NA	68
Intentional Detonations with Engineering Controls	200	200
Intentional Detonations without Engineering Controls	816	816

Note: NA = not applicable (see team separation distance section below)

1.4.2.1 Authorization to Use Unintentional Detonation MSD HFD

United States Army Corps of Engineers (USACE) has intrusively investigated millions of surface MEC items and subsurface anomalies that have the potential to be UXO over the past 15 years on more than 1,000 project locations for Formerly Used Defense Sites (FUDS), BRAC, and active installations. These are extremely conservative estimates. On one project alone, USACE investigated over 3,000,000 anomalies, of which approximately 1.67% were UXO, with no accidents or unintentional detonations. For these reasons, the probability of an unintentional detonation, due to project activities, is assessed to be “Extremely Low,” and the use of the HFD, for unintentional detonations, is warranted and authorized.

1.4.3 Team Separation Distance

Team separation distance (TSD) will be in accordance with the Fragmentation Data Sheet K40 distance as shown on Figure 7. TSD is 10 ft for the 37mm MK I, LE.

1.4.4 Increase of MSD

If, during the course of operations, a munition with a greater fragmentation distance is encountered, the MSD will immediately be adjusted in accordance with DDESB Technical Paper 16, and operations will continue. In response, an amendment to this ESP will be expeditiously submitted.

1.5 Demolition Areas

No dedicated demolition area will be established at the Future East Garrison MRA. MEC identified within the Future East Garrison MRA will be blown-in-place using engineering controls to mitigate the hazard posed by fragments produced by the detonation.

1.6 Footprint Areas

There are no identified disposal areas.

1.6.1 Detonation Site and Blow-in-Place

Recovered MEC will be blown-in-place within the investigation area or transect found within the Future East Garrison MRA. Material Potentially Presenting an Explosive Hazard and items requiring demilitarization may be stored in the MEC explosive magazine and added to future planned demolition shots. Items that are unsafe to move will be disposed of in the location where they are encountered.

Prior to initiation of demolition operations, all nonessential personnel will be evacuated from the exclusion zone. Before the demolition charges are primed, all avenues of ingress will be physically blocked by guard personnel. Radio communications will be maintained between all involved parties at all times. Avenues of ingress are not to be opened without the permission of the Senior Unexploded Ordnance Supervisor (SUXOS). A constant state of vigilance will be maintained by all personnel to detect any intrusion into the fragmentation zone including over flights by aircraft. Upon completion of disposal operations, the disposal team's UXO Technician III (Demolition Supervisor) and the Unexploded Ordnance Safety Officer (UXOSO) will visually inspect each disposal shot. The Technician III will perform a visual inspection of the disposal site(s). The UXOSO will stand by at a safe distance and be prepared to render assistance in the event of an emergency. Upon completion of this inspection and providing that there are no residual hazards, the SUXOS will authorize the resumption of operations.

Prior to any detonation, the SUXOS will initiate the appropriate notification and approval procedure. The SUXOS will schedule the demolition to allow sufficient time to complete all notifications and approvals.

Notifications and approvals will be conducted as follows:

- Complete the MEC Disposal Checklists and notifications for each disposal operation.
- Request that local fire authorities perform an on-site fire risk assessment. The fire risk assessment may be performed by the Presidio of Monterey Fire Department (POM FD) or Monterey County Regional Fire District (MCRFD) dependent upon site conditions. For planned detonations, risk assessments require a 3-day notification and demolition shots require a 5-day notification. Fire authorities will expedite risk assessments for demolition shots that cannot be delayed. Complete a Detonation Approval Checklist/Risk Assessment and submit to the FORA Environmental Services Cooperative Agreement Remediation Program (ESCA RP) Manager for approval.

1.6.2 Collection Points

Collection points are not applicable to this project.

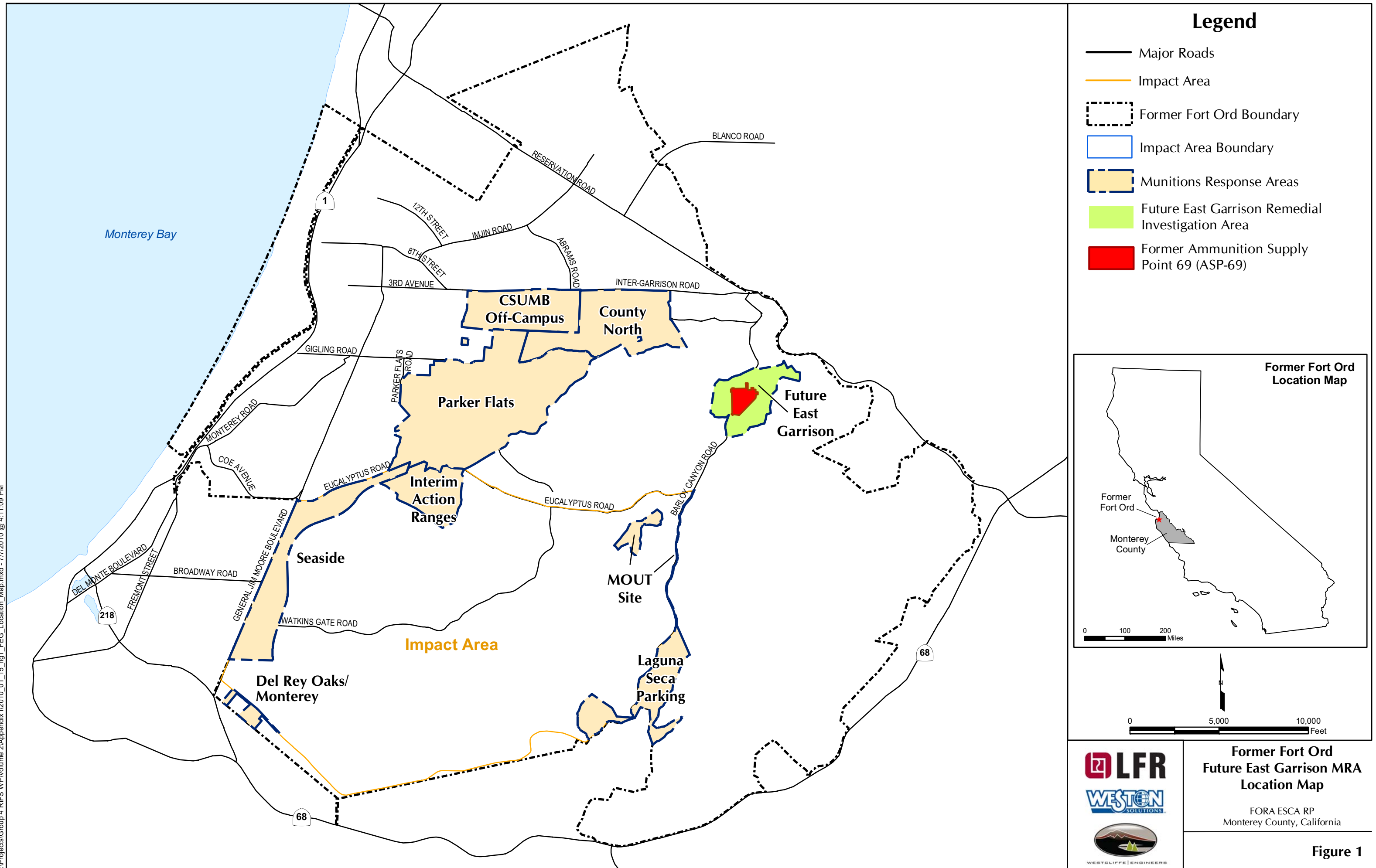
1.6.3 In-Grid Consolidated Shots

In-grid consolidated shots are not applicable to this project.

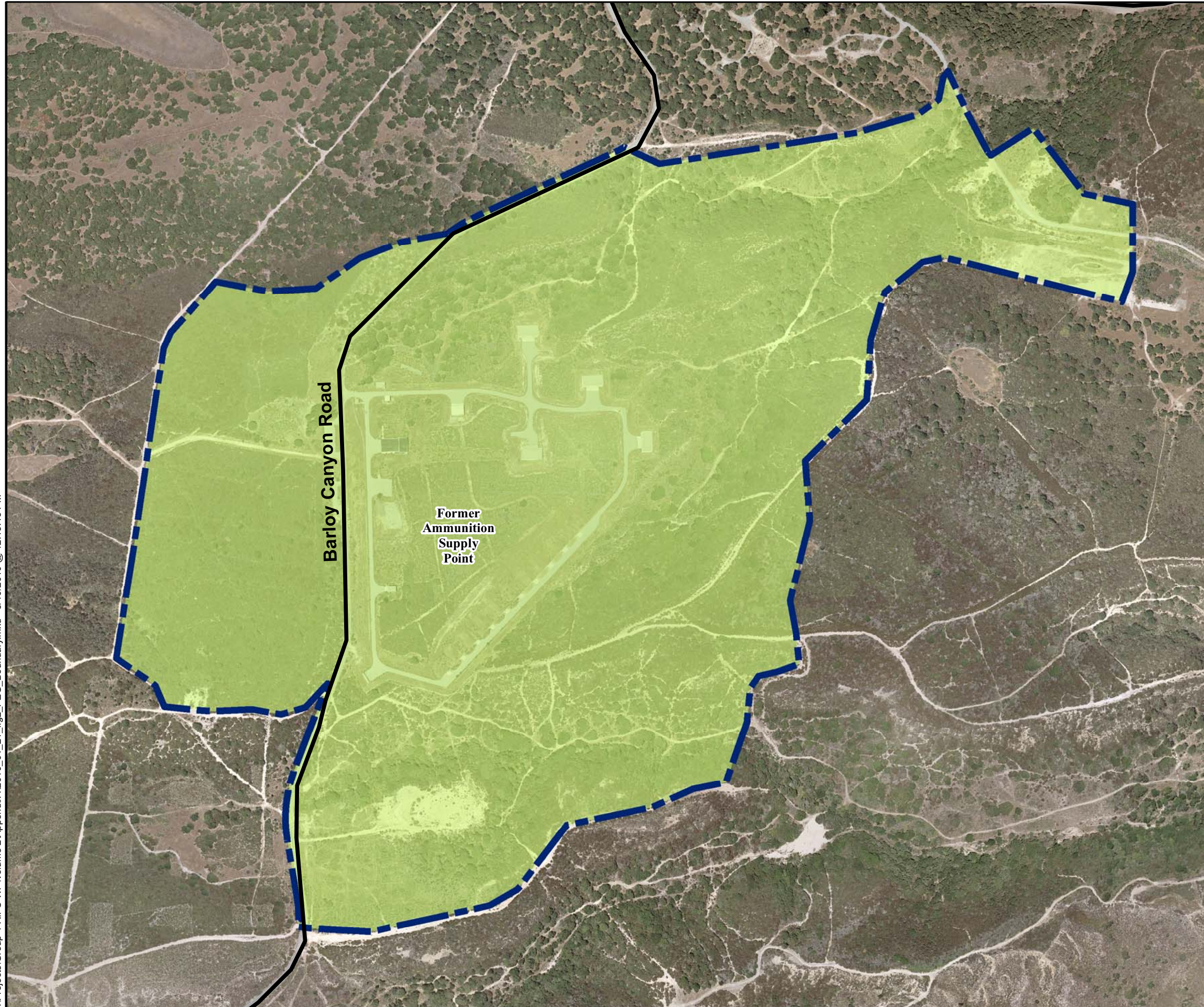
2.0 REFERENCES

Environmental Services Cooperative Agreement Remediation Program Team (ESCA RP Team). 2008. 2nd Addendum to the 3rd Amendment to the 17 Feb 94 Land Disposal Site Plan (LDSP) for BRAC of Fort Ord, California, Phase II Seaside Munitions Response Area (MRA) Removal Action, Former Fort Ord, Monterey County, California. January 14.

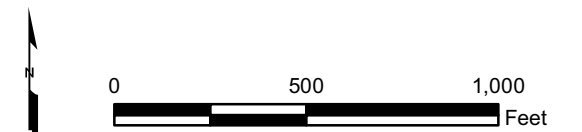
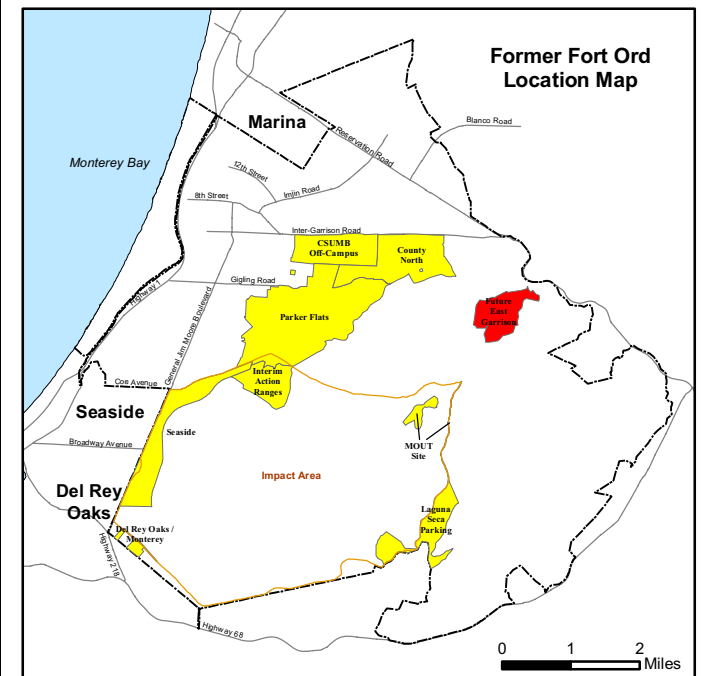
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- Legend**
-  Future East Garrison Remedial Investigation Area
 -  Major Road

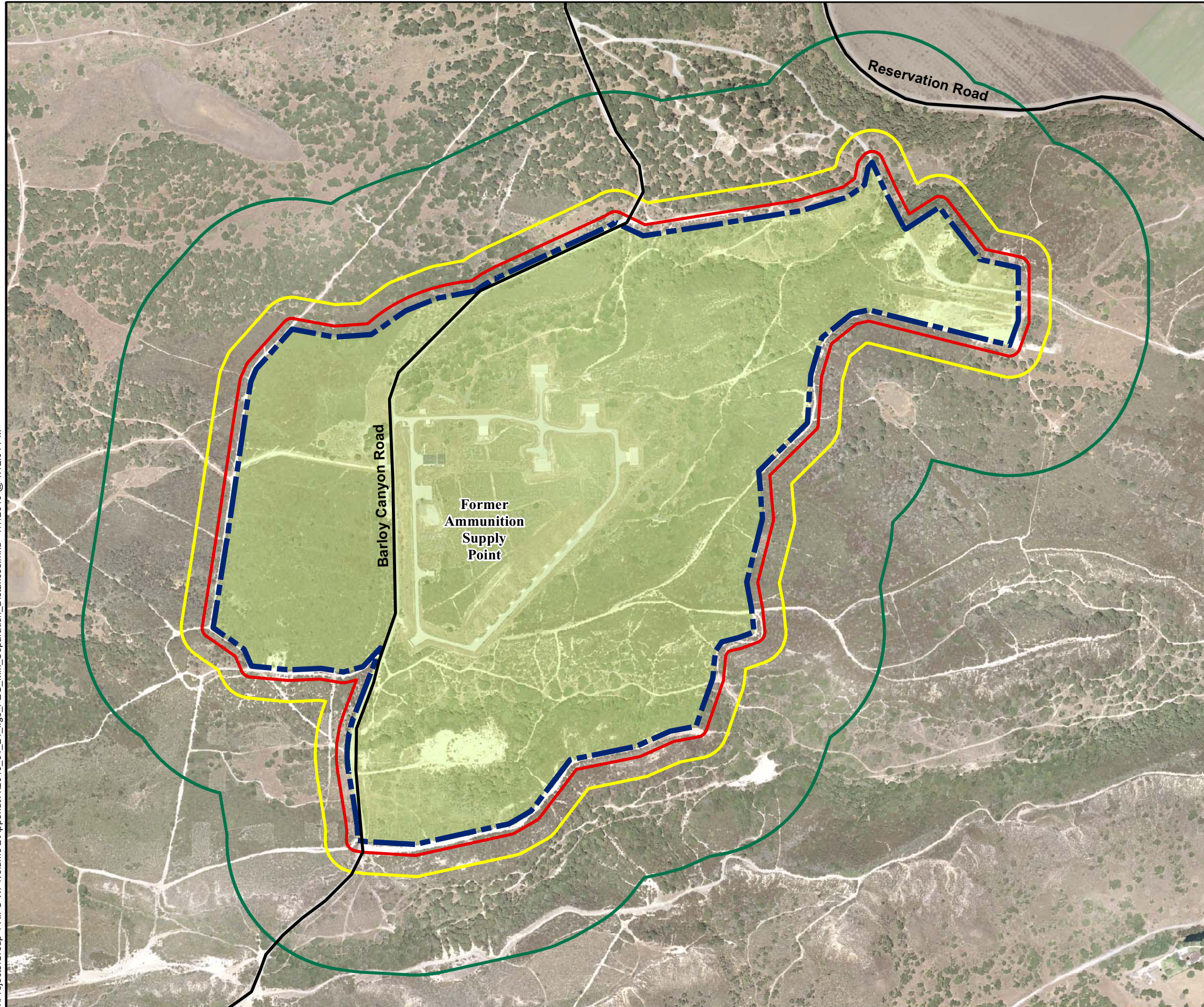


**Future East Garrison MRA
Remedial Investigation Area**

FORA ESCA RP
Monterey County, California

Figure 2

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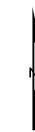
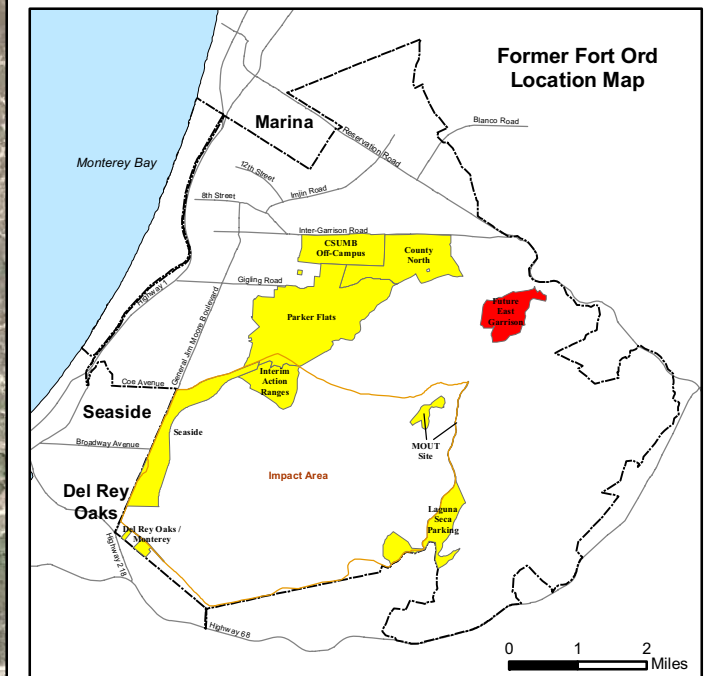


Legend

-  Future East Garrison Remedial Investigation Area
-  Major Road

Minimum Separation Distances

-  Hazardous Fragmentation Distance of 68 Feet for Projectile, 37mm, LE MK I
-  Minimum Separation Distance of 200 Feet for Sandbagged Detonations
-  Maximum Fragmentation Distance of 816 Feet for Projectile, 37mm, LE MK I



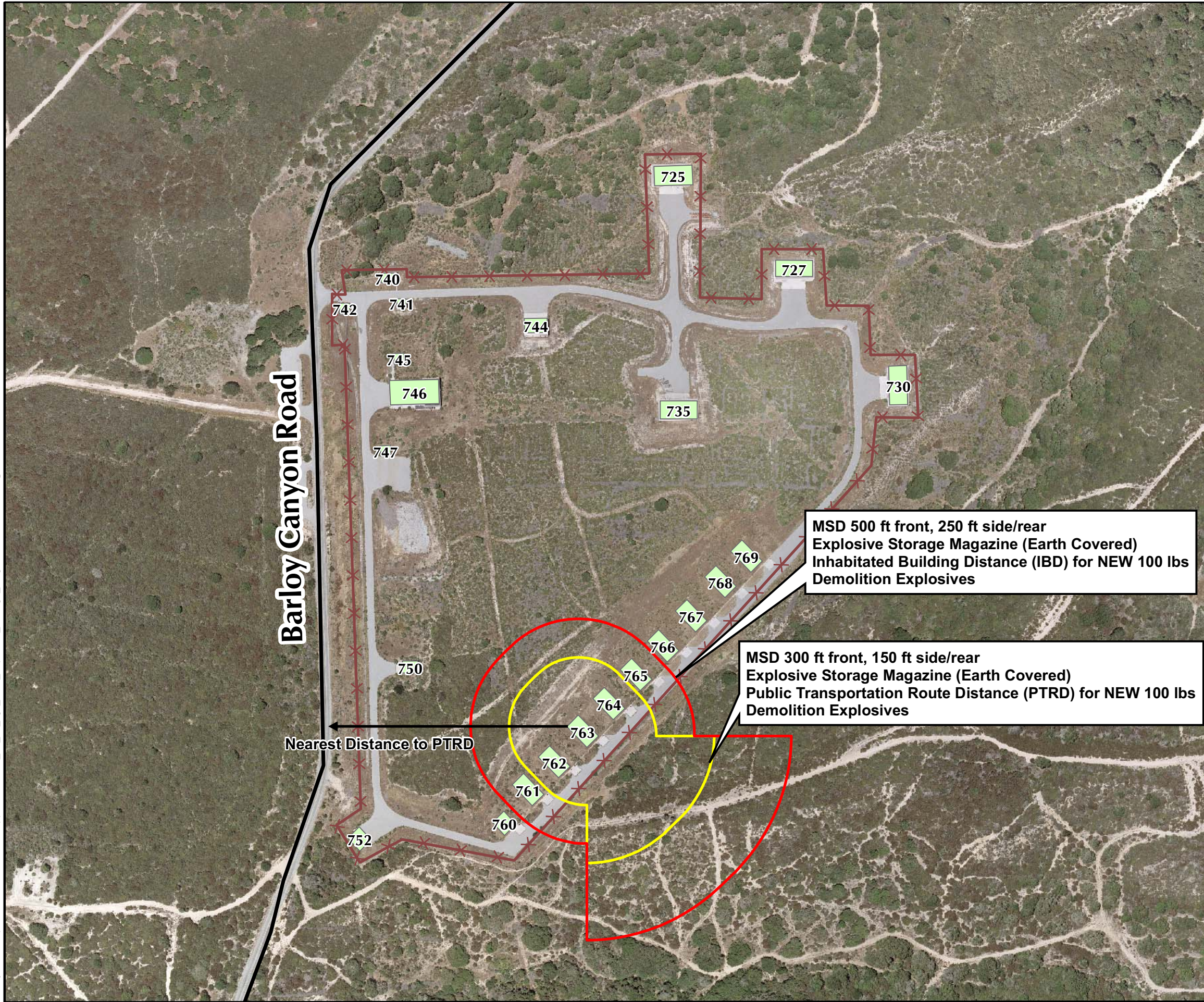
0 600 1,200 Feet



**Future East Garrison MRA
Remedial Investigation
Minimum Separation Distances**
FORA ESCA RP
Monterey County, California

Figure 3

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Legend

763 Structure

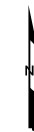
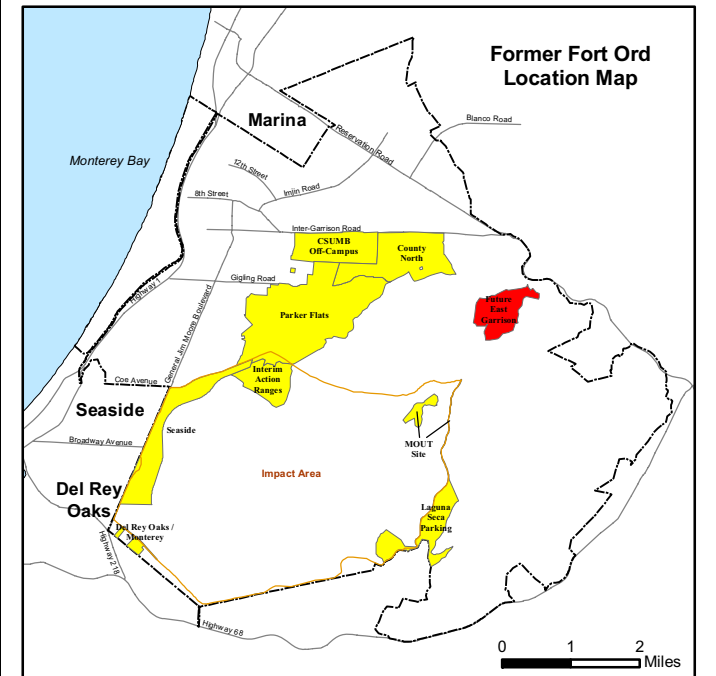
Major Road

Fence

Minimum Separation Distance (MSD)

Public Traffic Route

Inhabited Buildings



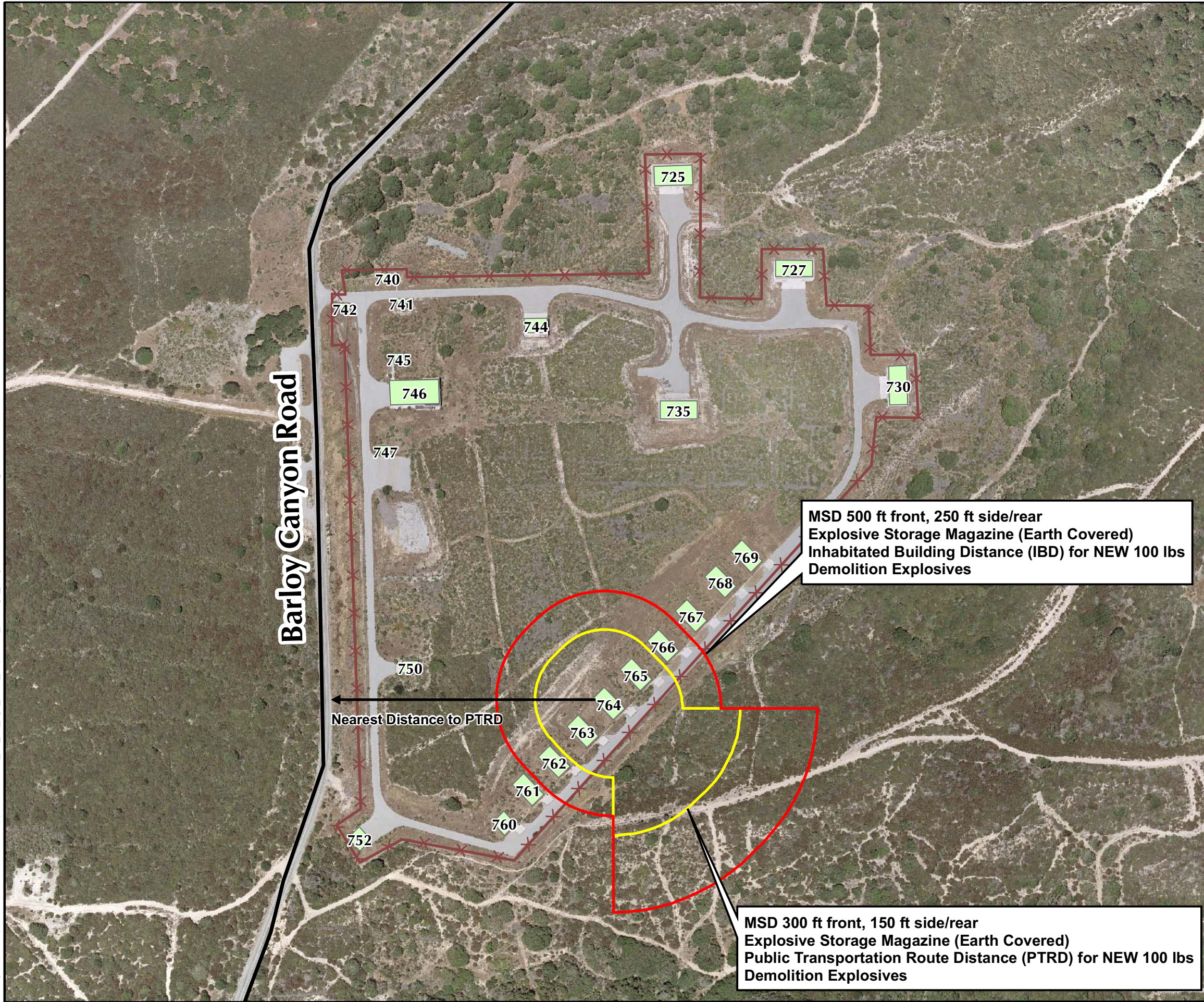
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**Explosive Storage Location
(Building 763)
Minimum Separation Distances
FORA ESCA RP
Monterey County, California**

Figure 4

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Legend

764 Structure

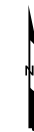
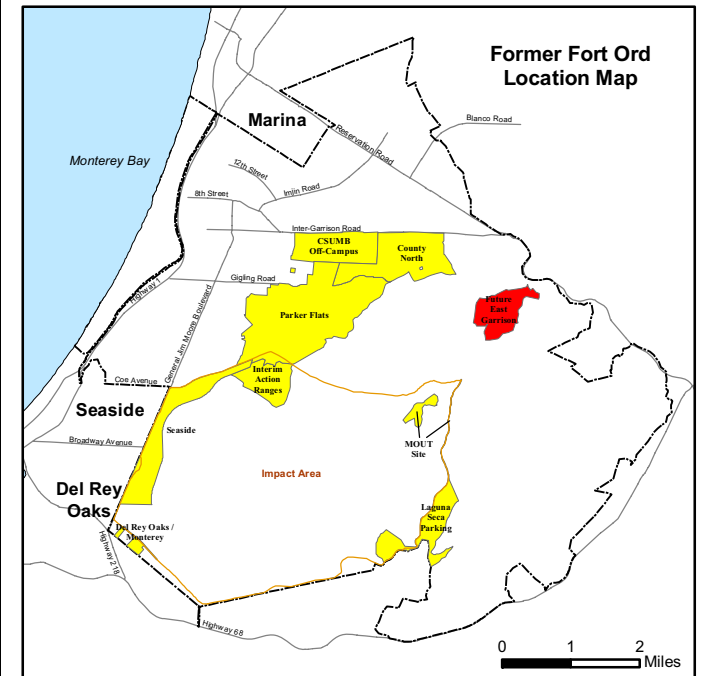
Major Road

Fence

Minimum Separation Distance (MSD)

Public Traffic Route

Inhabited Buildings



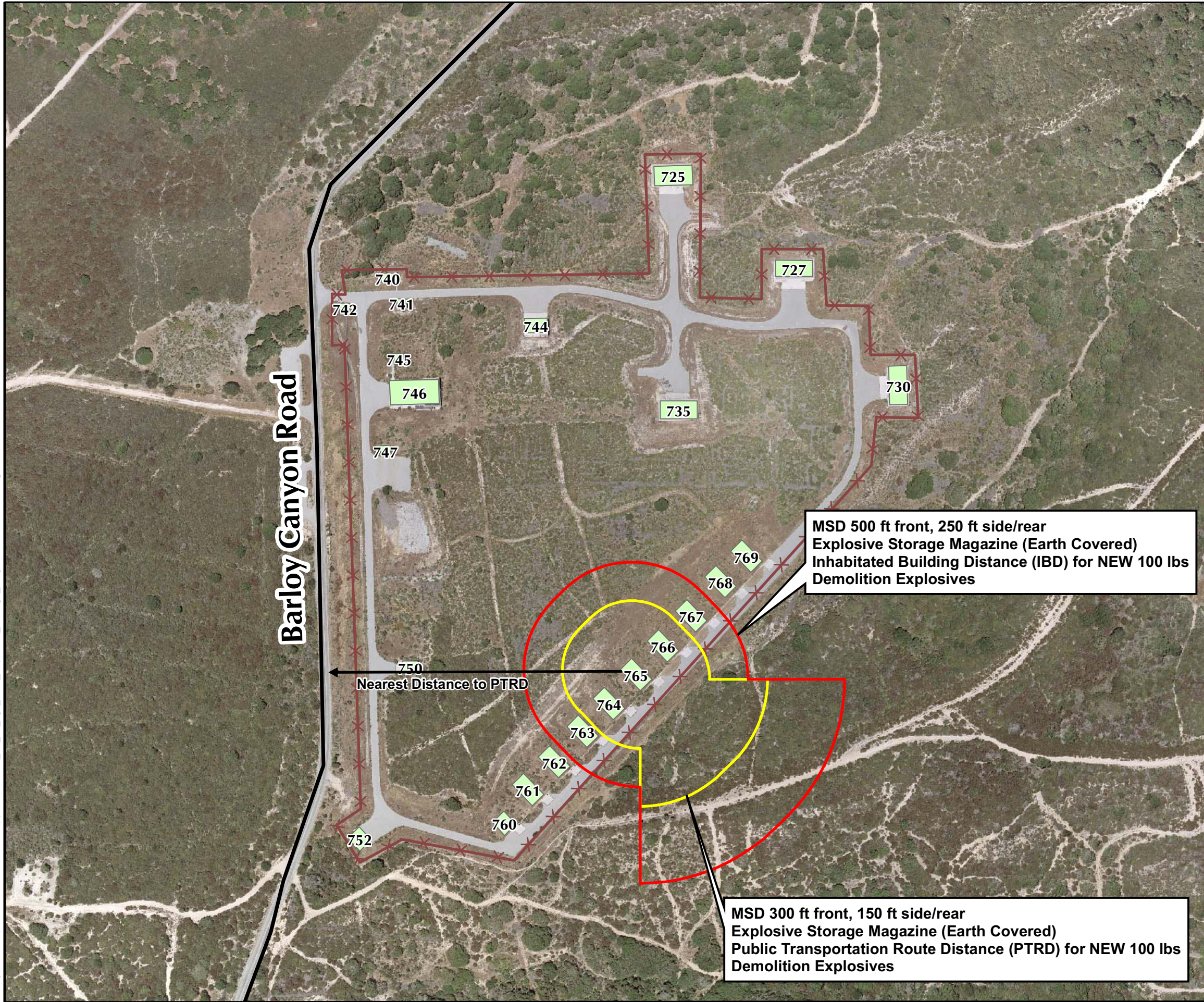
0 250 500 Feet



**Explosive Storage Location
(Building 764)**
Minimum Separation Distances
FORA ESCA RP
Monterey County, California

Figure 5

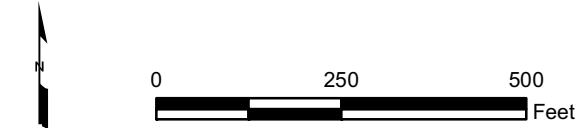
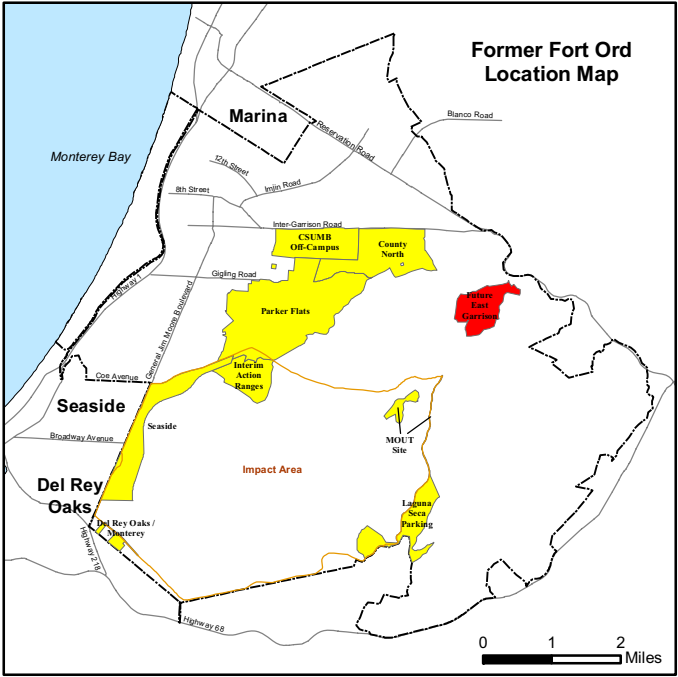
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Legend

- 765 Structure
- Major Road
- Fence
- Public Traffic Route
- Inhabited Buildings

Minimum Separation Distance (MSD)



Explosive Storage Location
(Building 765)
Minimum Separation Distances
FORA ESCA RP
Monterey County, California

Figure 6

FRAGMENTATION DATA REVIEW FORM			
Database Revision Date 12/31/07			
Category:	Black Powder Roun	DODIC:	
Munition:	37 mm Mk I, LE Practice	Date Record Created:	7/30/2004
Primary Database Category:	projectile	Last Date Record Updated:	7/9/2007
Secondary Database Category:	37 mm	Individual Last Updated Record:	Crull
Munition Case Classification:	N/A	Date Record Retired:	

Munition Information and Fragmentation Characteristics	Theoretical Calculated Fragment Range
Explosive Type: Black Powder	HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft): 68
Explosive Weight (lb): 0.03400	MFR-V [Vertical Range of Max Weight Fragment] (ft): 570
Diameter (in): 1.4567	MFR-H [Horizontal Range of Maximum Weight Fragment] (ft): 816
Max Fragment Weight (lb): 0.034207	
Critical Fragment Velocity (fps): 1368	

Overpressure Distances	Minimum Thickness to Prevent Perforation
Inhabited Building Distance (12 psi), K40 Distance: 10	4000 psi Concrete (Prevent Spall): 1.69
Inhabited Building Distance (09 psi), K50 Distance: 13	Mild Steel: 0.20
Intentional MSD (0065 psi), K328 Distance: 83	Hard Steel: 0.16
	Aluminum: 0.41
	LEXAN: 2.49
	Plexi-glass: 1.37
	Bullet Resist Glass: 1.07

Required Sandbag Thickness	Water Containment System and Minimum Separation Distance:
Max Fragment Weight (lb)SB: 0.034207	Max Fragment Weight (lb)W: 0.034207
Critical Fragment Velocity (fps)SB: 1368	Critical Fragment Velocity (fps)W: 1368
Kinetic Energy 106 (lb-ft ² /s ²)SB: 0.0320	Kinetic Energy 106 (lb-ft ² /s ²)W: 0.0320
Required Wall Roof Sandbag Thickness (in)SB: 12	Water Containment System: 5 gal carboys/ inflatable pool
Expected Maximum Sandbag Throw Distance (ft)SB: 25	Minimum Separation Distance (ft)W: 200/200
Minimum Separation Distance (ft)SB: 200	



MSDs and Fragmentation Characteristics for Projectile, 37 mm, Low Explosive MK I

FORA ESCA RP
Monterey County, California

Figure 7

APPENDIX H

Site Safety and Health Plan

FORA ESCA REMEDIATION PROGRAM

Appendix H: Site Safety and Health Plan

FINAL Group 4 Remedial Investigation / Feasibility Study Work Plan

Volume 2 - Sampling and Analysis Plan

Future East Garrison Munitions Response Area

Former Fort Ord
Monterey County, California

October 8, 2010

Prepared for:

FORT ORD REUSE AUTHORITY

100 12th Street, Building 2880
Marina, California 93933



Prepared Under:

Environmental Services Cooperative Agreement
No. W9128F-07-2-01621

and

FORA Remediation Services Agreement (3/30/07)

Document Control Number: 09595-09-079-045

Prepared by:



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APPENDIX

- A Site Compliance Checklist

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
DGM	Digital Geophysical Mapping
EOD	Explosive Ordnance Disposal
ESCA RP	Environmental Services Cooperative Agreement Remediation Program
EZ	exclusion zone
FLD	field operating procedure
FORA	Fort Ord Reuse Authority
G4 SAP	Group 4 Sampling and Analysis Plan
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
LFR	LFR Inc.
MEC	munitions and explosives of concern
MSD	minimum separation distance
MSDS	material safety data sheet
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSIC	On Scene Incident Commander
PHSM	Project Health and Safety Manager
POM	Presidio of Monterey
PPE	personal protective equipment
RMSF	Rocky Mountain Spotted Fever
RPM	Remediation Project Manager
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TLV	threshold limit value

UXO	unexploded ordnance
UXOSO	UXO Safety Officer
WESTON	Weston Solutions, Inc.
WP	white phosphorus

1.0 INTRODUCTION

This Site Safety and Health Plan (SSHP) is Appendix H of Volume 2, the Group 4 Sampling and Analysis Plan (G4 SAP), of the Group 4 Remedial Investigation / Feasibility Study Work Plan (“the work plan”). The purpose of this SSHP (also referred to as “the plan”) is to establish general guidelines and procedures to ensure protection of the Environmental Services Cooperative Agreement Remediation Program (ESCA RP) Team, subcontractor personnel, and the public while performing operations at the former Fort Ord. The SSHP assigns responsibilities, establishes procedures, and develops contingencies that may arise while operations are performed.

The provisions of this SSHP are mandatory for all on-site activities undertaken by the ESCA RP Team and its subcontractors. All site activities will comply with applicable federal and California requirements. As site conditions change, this plan may need to be modified. Such modifications will be submitted as SSHP addenda and will be numbered sequentially. All SSHP addenda must be reviewed and approved by the Project Health and Safety Manager (PHSM). All ESCA RP Team personnel and subcontractors must read and understand this SSHP and sign the Plan Acceptance Form prior to the start of work at the site.

1.1 Site Compliance Checklist

The Site Compliance Checklist presented in Appendix A of this SSHP will be used by the Unexploded Ordnance Safety Officer (UXOSO) to conduct the project’s monthly safety audit.

2.0 PROJECT TEAM RESPONSIBILITIES

Ensuring the safe and healthful conduct of site operations is the responsibility of everyone assigned to the site. The ESCA RP Team and subcontract personnel involved in site activities are responsible for the following:

- Complying with this SSHP and all other required safety and health guidelines
- Taking all necessary precautions to prevent injury to themselves and to their fellow employees
- Continually being alert to any potentially harmful situation and immediately informing the UXOSO of any such identified conditions
- Performing only those tasks that they have been trained to perform and believe they can do safely
- Preventing spillage and splashing of materials to the greatest extent possible
- Practicing good housekeeping by keeping the work area neat, clean, and orderly
- Immediately reporting all injuries, no matter how minor, to the UXOSO
- Maintaining site equipment in good working order and reporting defective equipment to the UXOSO

- Properly inspecting and correctly using the personal protective equipment (PPE)

2.1 Employee Safety Responsibilities

All operations and personnel having the potential for exposure to site hazards are subject to the requirements of this SSHP. Work will not be performed in a manner that conflicts with the safety, health, or environmental precautions outlined in this plan. All site personnel, including any ESCA RP Team subcontractors, who have the potential for exposure to site hazards, are subject to the requirements of this SSHP. Personnel violating safety procedures are subject to dismissal/removal from the project site. Roles and responsibilities for site personnel are summarized in the following subsections.

The following sections describe the roles and responsibilities of the key Weston Solutions, Inc. (WESTON) team members that will be responsible for field activities. These key team members are also shown on the ESCA RP Team Organization Chart presented in the G4 SAP (Figure 2-6).

2.2 Remediation Project Manager

Ms. Linda Temple will serve as the Remediation Project Manager (RPM) for the activities covered under this work plan. She has overall responsibility for the management and completion of the project, which includes resource allocation, financial reporting, schedule control, and review and approval of deliverables.

2.3 Project Health and Safety Manager

The PHSM for this project is Mr. Mike Stuart. The PHSM has the following responsibilities.

- Review and final approval of the SSHP.
- Ensure that the SSHP complies with all federal, state, and local health and safety requirements.
- If necessary, modify specific aspects of the SSHP to adjust for on-site changes that will affect safety.
- Evaluate and authorize any changes to the SSHP.
- Implementation and oversight of the Health and Safety Program.
- Assist in acting as liaison with government officials regarding health and safety-related issues.
- Maintain frequent communication with the UXOSO regarding site activities and implementation of the SSHP. Assist in training site personnel in the site-specific hazards.
- Ensure that both the site and site personnel comply with the Health and Safety Program and all other applicable plans.

2.4 Senior UXO Supervisor

Mr. Bruce Moe will serve as the Senior Unexploded Ordnance Supervisor (SUXOS) and will manage field operations in accordance with project requirements. The SUXOS is responsible for coordinating and supervising all site activities.

2.5 Unexploded Ordnance Safety Officer

The UXOSO will be responsible for implementing the SSHP and ensuring that all project personnel follow the requirements of the SSHP. In addition to overall site safety, the UXOSO will also be responsible for enforcing unexploded ordnance (UXO) safety as it applies to munitions and explosives of concern (MEC) operations.

The UXOSO will be responsible for conducting the morning safety meeting for all site personnel to discuss the day's activities, associated hazards, and MEC safety. He will also be required to report any incidents that occur on site to the PHSM. He will be required to implement safety corrective actions through training and reinforced awareness.

2.6 Subcontractors

Qualified subcontractors and associate personnel may be brought on site for specialty services that may include, but are not limited to: surveying, heavy equipment delivery and removal, vegetation removal, and demolition. These subcontractors will be under the ultimate direction of the SUXOS and are required to adhere to all aspects of the SSHP.

3.0 UNKNOWN FILLER

In the event munitions suspected of containing unknown filler are encountered, field activities should be conducted in accordance with the Standard Operating Procedure (SOP) for MEC with Unknown Filler presented in Appendix C of the G4 SAP.

4.0 FIELD ACTIVITIES

The fieldwork will generally consist of mobilization, site preparation, excavation operations, MEC operations, and demobilization. These major activities can be summarized as follows:

Activity 1: Preliminary Activities

This task includes the mobilization of personnel, equipment, and supplies to the project site and setup of office and storage areas.

Activity 2A: Site Preparation Activities

This task includes site surveying to delineate work areas, brush cutting, general surface debris removal, and building demolition.

Activity 2B: Biological Monitoring and Field Surveys

Vegetation monitoring activities occur primarily in advance of MEC remediation activities and include ingress to and egress from monitoring sites, marking of monitoring sites, and recording data. This will require walking, bending, and kneeling, occasional hammering of stakes, and operating Global Positioning System (GPS) units. The field biologists will use GPS units to map monitoring locations.

The UXOSO and the SUXOS will be coordinated with in advance of the biological monitoring activity to fully understand the field activities including: geographic location; type of field activities (i.e., intrusive or non-intrusive); and composition of team (i.e., subcontractors, on-staff biologist, etc.). The UXOSO and/or SUXOS will evaluate the proposed biological monitoring activities and make a determination as to the need for UXO escorts.

Activity 3: Excavation Activities

This task includes the movement of soil related to target anomaly investigation during MEC operations (Activity 5).

Activity 4: Geophysical Investigation Activities

This task includes the geophysical investigation of the Future East Garrison Munitions Response Area as described in Section 2 of the G4 SAP. This includes analog investigation and, if necessary, Digital Geophysical Mapping (DGM) investigation. The first step will be the implementation of the Instrument Verification Strip. Man-portable analog systems will be utilized. The DGM will be accomplished by using a towed array configuration. An all-terrain vehicle will be used to tow the DGM equipment across the survey area.

Activity 5: MEC Operations

This task includes MEC safety escort activities, excavation and removal of potential MEC anomalies, and destruction/disposal of MEC and scrap materials.

UXO Technicians II will inspect work areas prior to performing survey or clearing operations for hazardous MEC items as well as escort any visitors during work activities.

The UXOSO coordinates access control and security on site during all MEC operations. Except for low risk MEC escort activities, only essential personnel will be allowed in the work zone. The work zone is the work site, and encompasses an area large enough to prevent personnel injuries from fragmentation resulting from unintentional or intentional detonations.

During on-site operations, the SUXOS will order operations to cease if nonessential personnel are observed within the operating area. To ensure safety, site controls include the following:

- Eating, drinking, and smoking are prohibited except in designated areas.
- Hazardous MEC operations cease if nonessential personnel are present.
- The SUXOS, UXOSO, or their designee escorts authorized site visitors.

- All personnel entering the site, including visitors, will wear the proper PPE and sign in and out on the Site Visitors Log.
- The UXOSO maintains the Site Visitors Log to ensure accurate accountability of personnel on site.

The UXOSO provides a SSHP/MEC safety briefing to all personnel entering the site to inform them of potential site hazards. All personnel must acknowledge this briefing by signing the SSHP Plan Acceptance Form/Site Visitors Log.

In case of an emergency, personnel exit the site and move to a designated safe area. The UXOSO will determine the designated safe area that is located upwind of the site outside of the fragmentation area. The SUXOS will notify the site manager if an emergency warrants site evacuation.

Activity 6: Closeout Activities

This task includes the restoration of work areas and the demobilization of all remaining equipment, temporary structures, and other items from the project site after project completion.

5.0 HAZARD ANALYSIS AND RISK ASSESSMENT

Safety, biological, and physical hazards will present a risk to workers at former Fort Ord sites. The level of risk is dependent upon the type of work being done. The paragraphs that follow describe the safety, biological, and physical hazards associated with planned activities.

5.1 Safety Hazards

The major safety hazard for operations performed at former Fort Ord sites is the unintended detonation of ordnance. Other anticipated safety hazards include heavy equipment operation, excavation safety, slip hazards, and power tool use. Procedures to minimize these hazards are presented below.

5.1.1 MEC

Ordnance and ordnance-related items will be encountered at the former Fort Ord. Personnel must be alert for MEC and munitions debris. All field personnel must observe the following general safety precautions:

- DO NOT touch or move any potential MEC until positive identification has been determined, regardless of the markings or apparent condition.
- DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek appropriate shelter.

- DO NOT walk across an area where the ground cannot be seen. If dead vegetation or animals are observed, leave the area immediately due to potential contamination by chemical agent.
- DO NOT drive vehicles into areas suspected of MEC. Use clearly marked lanes.
- DO NOT rely on color code for positive identification of MEC or their contents.
- SMOKING will only be allowed in smoking areas designated by the SUXOS during the morning Tailgate Safety Briefing.
- Approach ordnance items from the side.
- Prohibit unnecessary personnel from visiting the site.
- Always assume MEC contain a live charge until it can be ascertained otherwise.

The following precautions are applicable to personnel performing MEC recovery and demolition operations.

- All MEC will be identified independently by two (2) UXO Technicians.
- All MEC operations will use the "Buddy" system.
- Demolition operations will at a minimum conform to TM 60A-1-1-31.
- DO NOT dismantle, strip, or handle any MEC unnecessarily.
- Avoid inhalation and skin contact with smoke, fumes, dust, and vapors of detonations and residue from MEC.
- DO NOT attempt to extinguish burning explosives or any fire, which might involve explosive materials.
- DO NOT manipulate external features of MEC unless specifically called for in an Explosive Ordnance Disposal (EOD) procedure.
- Incorporate appropriate property and personnel protective measures for shock and fragmentation when conducting MEC operations.
- DO NOT subject MEC to rough handling or transportation. Sand bag, chock, and block appropriately.
- Carry explosives in an appropriate container.
- Hand carry no more than two items (one in each hand) at a time and then only as required by the operation being performed.
- Destroy shaped charge munitions by crushing the cone to prevent formation of the explosive jet.
- Dispose of white phosphorus (WP) munitions in accordance with the direction of the UXOSO.
- DO NOT transport damaged WP munitions unless fully submerged in water.
- Avoid unnecessary movement of armed or damaged MEC.

- Avoid the forward portions of munitions employing proximity fusing.
- Assume unknown fuzes contain cocked strikers or anti-disturbance features.

5.1.2 Heavy Equipment

A portion of the work may involve the utilization of backhoes to perform excavation. Injuries can result from equipment hitting or running over personnel or from the overturning vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 Code of Federal Regulations (CFR) parts 1926.600 through 1926.602. In particular, the following precautions will be used to help prevent injuries:

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked by the vehicle operator at the beginning of each shift.
- Cabs will be kept free of all nonessential items, and all loose items will be secured.
- Glass in windshields, windows, and doors will be safety glass. Any cracked or broken glass will be replaced.
- Backhoes will be provided with necessary safety equipment (seat belts, rollover protection, emergency shutoff in case of rollover, and backup warning lights and audible alarms).
- Blades and buckets will be lowered to the ground, and parking brakes will be set before shutting off any heavy equipment or vehicle.
- Backhoes will not be backed up unless:
 - o The vehicle has a reverse signal alarm audible above the surrounding noise level
 - o The vehicle is backed up under the direction of a signalman
- The heavy equipment operator will be trained in the operation of the vehicle. Any person operating a motor vehicle will possess a permit valid for the equipment being used.

5.1.3 Excavation Safety

Prior to any excavation activity, efforts must be made to determine whether underground installations (i.e., sewers, telephone, water, fuel, electric lines, etc.) will be encountered and, if so, where such underground installations are located. The UXOSO or designee must contact the utility companies or owners involved and inform them, within established or customary local response times, of the proposed work. If the utility companies or owners do not respond within the period established by law or ordinance, or if they cannot identify the locations of utilities, the excavation may proceed with caution. In this situation, detection equipment or other safe and acceptable means to locate utilities may be used. If underground installations are exposed, the Occupational Safety and Health Administration (OSHA) requires that they be removed, protected, or properly supported.

No protective system is needed if the excavation is made entirely in stable rock, or if workers enter an excavation that is less than 5 feet in depth (provided that the competent person,

UXOSO, determines that there is no potential for a cave-in). If the depth of the excavation exceeds 5 feet, then the sides of the excavation will slope to an angle not steeper than one and one-half horizontal to one vertical (34° measured from the horizontal). Access to and exit from an excavation must comply with the following conditions:

- Trenches 4 feet or more in depth should be provided with a fixed means of egress.
- Spacing between ladders or other means of egress will be a minimum of 25 feet laterally.
- Ladders must be secured and extend a minimum of 36 inches above the landing.
- Metal ladders should not be used when electric utilities are present.

5.1.4 Slip, Trip, and Fall Hazards

Slip, trip, and fall hazards may be encountered at the site, including holes, pits, ditches, steep grades, and uneven grades. Personnel should use caution when traversing the site.

5.1.5 Power Tools

By their very nature, power tools have great capability for inflicting serious injury upon site personnel if they are not used and maintained properly. To control the hazards associated with power tool operation, the requirements outlined in EM 385-1-1 and the safe work practices listed below are observed when using power tools:

- Operations are conducted by authorized personnel familiar with the tool, its operation, and safety precautions. Power tools must be operated in accordance with the owner's manual.
- Power tools are inspected prior to use, and defective equipment is removed from service until repaired
- Power tools designed to accommodate guards have such guards properly in place prior to use.
- Loose fitting clothing or long hair is not permitted around moving parts.
- Hands, feet, etc., are kept away from all moving parts.
- Maintenance and/or adjustments to equipment are not to be conducted while the equipment is in operation.
- An adequate operating area is provided, allowing sufficient clearance and access for operation.
- Personnel use required protective equipment, such as gloves, chaps, and steel-toed boots when using chainsaws.

5.1.6 Confined Space Entry

Entry into permit-required confined spaces is not anticipated. Should entry into a permit-required confined space be required, the PHSM will be contacted to provide guidance and training.

5.2 Biological Hazards

Biological hazards that are usually found on site include ticks, spiders, poisonous snakes, vermin, and hazardous plants. Depending on the season and weather, the hazards at the former Fort Ord will vary. For instance, during cold weather many animals and insects are not active and most plants are dormant. The project may continue through several seasons, and the risks and hazards will change with the seasons. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

5.2.1 Hazardous Plants

A number of hazardous plants may be encountered during field operations. The ailments associated with these plants range from mild hay fever to contact dermatitis. Plants that present the greatest risk to site workers are those that produce allergic reactions and tissue injury.

Plants That Cause Skin and Tissue Injury

Contact with sharp leaves and thorns is of special concern to site personnel. This concern stems from the fact that punctures, cuts, and even minor scrapes caused by accidental contact may result in skin lesions and the introduction of fungi or bacteria through the skin. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes, will report immediately to the UXOSO for continued observation and care. Keeping the skin covered as much as possible (i.e., long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Plants That Cause an Allergic Reaction

The poisonous plants of greatest concern are poison ivy, poison oak, and poison sumac (Figure 1). Contact with the poisonous sap of these plants produces a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters. Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs with a single leaflet at the end. This plant grows in wooded,

swampy areas. The reaction associated with exposure to these plants will generally cause the following signs and symptoms:

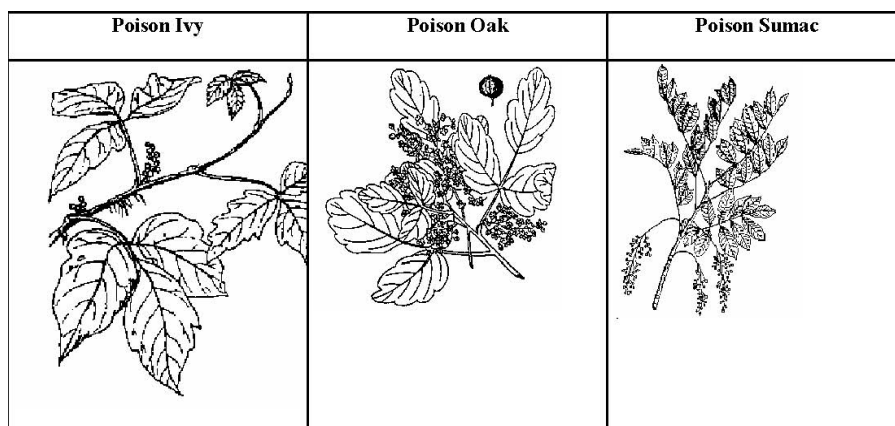
- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching, and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

If the rash is scratched, secondary infections can occur. Preventive measures that are effective for most site personnel include:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report, and mark poisonous plants found on site
- Wash hands, face, or other exposed areas at the beginning of each break period and at the end of each workday
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment, and clothing
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution

Keeping the skin covered as much as possible (i.e., long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Figure 1
Poison Ivy / Poison Oak / Poison Sumac



5.2.2 Tick Bites

The Center for Disease Control has noted the increase of Lyme Disease and Rocky Mountain Spotted Fever (RMSF), which are caused by bites from infected ticks that live in and near wooded areas, tall grass, and brush. Ticks are small, ranging from the size of a comma up to

about one quarter inch and are sometimes difficult to see (Figure 2). The tick season extends from spring through summer. When embedded in the skin, they may look like a freckle.

Figure 2
Tick



Lyme disease has been documented in 43 states with the heaviest concentrations in the northeast (Connecticut, Massachusetts, New Jersey, New York, and Pennsylvania), the upper Midwest (Minnesota and Wisconsin), and along the northern California coast and, more specifically, Monterey County. It is caused by deer ticks and lone star ticks that have become infected with spirochetes. Female deer ticks are about one quarter inch in size and are black and brick red in color. Male deer ticks are smaller and completely black. Lone star ticks are larger and chestnut brown in color.

RMSF has occurred in 36 states, with the heaviest concentrations in Oklahoma, North Carolina, South Carolina, and Virginia. It is caused by Rocky Mountain Wood Ticks and Dog Ticks that have become infected with rickettsia. Both are black in color.

The first symptoms of either disease are flu-like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur.

If you believe a tick has bitten you, or if any of the signs and symptoms noted above appear, contact the UXOSO, who will authorize you to visit a physician for an examination and possible treatment.

Protective Measures

Standard field gear (work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. However, even when wearing field gear, the following precautions will be taken when working in areas that might be infested with ticks:

- When in the field, check yourself often for ticks, particularly on your lower legs and areas covered with hair
- Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellant that contains permethrin or permethrin

- When walking in wooded areas, wear a hard hat and avoid contact with bushes, tall grass, or brush as much as possible
- If you find a tick, remove it by pulling on it gently with tweezers or tick removal tool. Do not squeeze the tick's body. Grasp it where the mouthparts enter the skin and tug gently, but firmly, until it releases its hold on the skin
- If the tick resists, cover the tick with salad oil/Vaseline for about 15 minutes to asphyxiate it, then remove it with tweezers or tick removal tool
- DO NOT use matches, a lit cigarette, or nail polish or any other type of chemical to "coax" the tick out
- Be sure to remove all parts of the tick's body and disinfect the area with alcohol or a similar antiseptic after removal
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area, frequently seen with a small welt in the center
- Also look for the signs of the onset of RMSF, such as an inflammation, which is visible in the form of a rash comprising many red spots under the skin, which appears 3 to 10 days after the tick bite

5.2.3 Insects

Contact with stinging insects may result in site personnel experiencing adverse health effects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Poisonous insects and insect-like creatures that may be encountered at the former Fort Ord include the following:

- Bees ("Killer" bees, honeybees, bumblebees, wasps, hornets, and wingless wasps)
- Scorpions
- Fire ants

Bees

Personnel should be very cautious of "killer" bees. They have the appearance of the typical honeybee; however, they are very aggressive. These Africanized honeybees defend their colonies much more vigorously than typical bees. The colonies are easily disturbed (sometimes just by being nearby). When they do sting, many more bees may participate, so there is a danger of receiving more stings. This can make them life threatening, especially to people allergic to stings, or with limited capacity to escape (the young, old, and handicapped).

Scorpions

The scorpions commonly found in California have the capacity to inflict a painful sting; however, they are not considered to pose a danger to humans. Stings by these scorpions can be managed by washing the wound with soap and water and by application of an ice pack for a few minutes. Medical attention is usually not needed unless the victim is displaying signs of an allergic reaction (rash, severe swelling, shortness of breath).

Fire Ants

Fire ants are aggressive, reddish-brown to black ants that are 1/8 inch to 1/4 inch long. They construct nests, which are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1 1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields, and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, and occasionally indoors.

Fire ants use their stingers to immobilize or kill prey and to defend ant mounds from disturbance by larger animals, such as humans. Any disturbance sends hundreds of workers out to attack anything that moves. The ant grabs its victim with its mandibles (mouthparts) and then inserts its stinger. The process of stinging releases a chemical, which alerts other ants, inducing them to sting. In addition, one ant can sting several times without letting go with its mandibles.

Once stung, humans experience a sharp pain that lasts a couple of minutes, then after a while the sting starts itching and a welt appears. Fire ant venom contains alkaloids and a relatively small amount of protein. The alkaloids kill skin cells; this attracts white blood cells, which form a pustule within a few hours of being stung. The fluid in the pustule is sterile, but if the pustule is broken, the wound may become infected. The protein in the venom can cause allergic reactions that may require medical attention.

Some of the factors related to stinging insects that increases the risk associated with accidental contact are:

- The nests for these insects are frequently found in remote wooded or grassy areas and hidden in cavities.
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling, which can leave the worker incapacitated and in need of medical attention.

- Some people are hypersensitive to the toxins injected by a sting and, when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock can, in some people, accumulate over time and exposure; therefore, even if someone has been stung previously and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again.

With these things in mind, and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp, or hornet stings, he must inform the UXOSO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the UXOSO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged off, and site personnel will be notified of its presence.
- If stung, site personnel will immediately seek shelter and stay there even if some bees come in with you (there are more outside the building or car). Do not jump in water (bees will still be in the area when you come up). Once safe, remove stings from your skin, it does not matter how you do it, but do it as quickly as possible to reduce the amount of venom they inject. Obtain first aid treatment and contact the UXOSO who will observe for signs of allergic reaction.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times.

5.2.4 Snakes

Snakes like to sun themselves on rocks during the day. Therefore, when site activities are conducted, extreme caution must be exercised around areas where snakes might be found (i.e., rocks, bushes, logs, or in holes, crevices, or abandoned pipes). The rattlesnake is the only type of snake in California that is dangerous to humans.

Western Rattlesnake

This is the only rattlesnake that can be encountered in Northern California. Its venom, which it uses to immobilize its prey and defend itself, contains both neurotoxins and hemotoxins. Neurotoxins affect the nervous system and hemotoxins affect the bloodstream. Its size can vary between 1.25 and 5.25 feet, and it can be identified by brownish blotches down the midline of the back; generally edged with dark brown or black.

The Western Rattlesnake is a biological hazard that may be encountered by field personnel. General information on this hazard is included in ESCA-wide QB Memo No. 2 on rattlesnake handling. This snake is typically most active between April and October and may be encountered in a variety of habitats and work sites. The occurrence of these animals is mainly determined by food availability and the need to regulate their body temperature (snakes are cold-blooded animals). The potential for encountering a rattlesnake in the open is increased when warm conditions follow a cool period. During these periods, they may be “sunning” on warm substrates to increase body temperature. Accordingly, the animals may be encountered on dark and heat-conductive materials such as rocks, asphalt, metal objects (including pipelines), dirt roads, etc. On the other hand, during extended warm periods, the animals may need to cool their bodies by seeking shade. During these periods, snakes may be encountered under tarps or wooden pallets, under metal or wooden sheds, in 2- to 3-foot-high brush and tall grasses, in pipe ends, or stretched out underneath the bottoms of pipes, trenches, in rock crevices and, in some cases, even under vehicles. Personnel should assume that these snakes may be encountered in any of these locations at all times.

During site field activities where there is an elevated potential for encountering a rattlesnake (e.g., when working in vegetation that is not sparse enough to see the ground between, or too thick to see the ground and leaf litter below), field personnel are to wear recommended PPE such as:

- Snake chaps that are either half or full leg length
- Double-layered pants (e.g., work pants under coveralls)

If field personnel observe a rattlesnake, they should immediately avoid (i.e., step away from) the animal until it leaves the area. Rattlesnakes are typically not aggressive and will usually avoid humans when possible. Striking distance is typically limited to several feet, so it is usually not necessary to retreat more than 8 to 10 feet from which location the movement of the snake may be observed. Work activity in the location where a snake is observed is not to be resumed until field personnel determine that the snake has left the immediate work area.

Treatment

A snake bite is usually characterized by extreme pain and swelling at the site of the bite, the presence of one or more puncture wounds created by the fangs, and a general skin discoloration. The manifestations of the bite include general weakness, rapid pulse, nausea and vomiting, shortness of breath, dimness of vision, tingling or numbness of the tongue, mouth or scalp, and shock.

Physical reactions are aggravated by acute fear, anxiety, the amount of venom injected, the speed of absorption of venom into the victim's circulation, the size of the victim, protection provided by clothing (including shoes and gloves), the amount of time before anti-venom therapy, and location of the bite.

First Aid

The rules to follow for a snake bite are:

- DO NOT cut "Xs" over the bite area, as this will intensify the effect of the venom.
- DO NOT apply suction to the wound since this has a minimal effect in removing venom.
- DO NOT apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area.
- DO NOT use cold compresses, ice, dry ice, chemical ice packs, spray refrigerants, or other methods of cold therapy.
- If possible, try to get a good look at the snake so it can be identified for proper selection of anti-venom.
- DO NOT allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body.
- Reassure and keep the victim calm, quiet, and immobile. Do not delay evacuation.
- Have the victim hold the affected extremity lower than the body while waiting for medical assistance.
- Transport the victim to medical attention immediately.

Identification Features

Nonpoisonous snakes are often erroneously identified as poisonous. The following features in Table 1 will assist in properly identifying a snake as poisonous or nonpoisonous.

Table 1
Snake Identification Features

Feature	Poisonous	Nonpoisonous
Eye Pupils	Elliptical or cat-like	Round
Sensing Pits	Pit between the eyelids and nostrils	No pit between the eyelids and nostrils
Teeth	Two enlarged teeth (fangs) in front of the upper jaw	All teeth are approximately the same size
Scales	Form a single row on the underside and below the tail	Arranged in a double row on the underside of the tail
Head	Head much wider than the neck	Head slightly wider than the neck
Tail	Single anal plate	Divided anal plate

5.2.5 Spiders

A large variety of spiders may be encountered during site activities. Extreme caution must be used when lifting logs and debris, since spiders are typically found in these areas.

While most spider bites merely cause localized pain, swelling, reddening, and, in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological effects caused by their venom, are dangerous. The UXOSO will brief site personnel as to the identification and avoidance of these dangerous spiders. These species include the black widow and the brown or violin spiders.

The black widow is a coal-black bulbous spider 3/4 to 1 1/2 inches in length, with a bright red hourglass on the underside of the abdomen (Figure 3). The black widow is usually found in dark, moist locations, especially under rocks, rotting logs, and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain is felt at the site of the bite, which spreads quickly and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of face and extremities

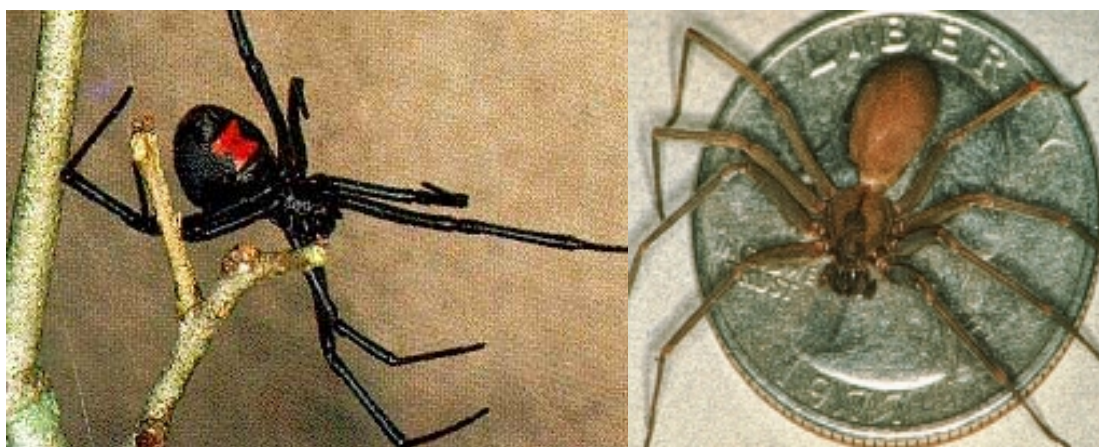
The brown or violin spider is brownish to tan in color, rather flat, and 1/2 to 5/8 inch long (Figure 3). However, unlike the typical species, the ones encountered at the former Fort Ord do not have a violin or “fiddle” shaped mark on the top of the head. There are three varieties of brown spider found in the United States that present a problem to site personnel. These are the brown recluse, the desert violin, and the Arizona violin. The brown recluse spider has not

been reported at or near the project area (Vetter 1999). These spiders may be found in a variety of locations including trees, rocks, or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, pustulating lesion with a bull's-eye appearance
- Systemic effects may include a generalized rash, joint pain, chills, fever, nausea, and vomiting
- Pain may become severe after 8 hours, with the onset of tissue necrosis

There is no effective first aid treatment for either of these bites. Except for very young, very old, or weak victims, spider bites are not considered to be life threatening. However, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Figure 3
Spiders



First aid should include:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification
- Clean the bitten area with soap and water or rubbing alcohol
- To relieve pain, place an ice pack over the bite
- Keep the victim quiet and monitor breathing
- Seek immediate medical attention

5.2.6 Rats, Mice, and Bats

Rats, mice, and bats may be found at the site. These animals may carry rabies and should be avoided. In addition, Hantavirus is also a concern when coming in contact with these animals.

Hantavirus is a disease spread primarily from infected rodent droppings. Hantavirus results from intimate contact with rodents, such as may occur in agricultural areas with dense human and rodent populations or during soil excavation. Hantavirus is not transferred from person to person. The overwhelming evidence is that spread is from rodent to humans through contact with infected rodent secretions or airborne transmission by infected dust particles.

Preventive measures should focus on cleaning all cuts and scratches with soap and water, followed by rinsing with hydrogen peroxide. Put liquid skin on the affected areas. The best preventive measure is to avoid all rodent nests during geophysical surveys. If rodent nests are discovered, field team members should be apprised of their locations and avoid working adjacent to the nests. If work must be performed at that location, a 10 percent bleach solution will be sprayed on the nest and adjacent areas to kill the virus. If work must be performed at a location where rodent infestation is evident, PPE should be worn in accordance with the SOP for Hantavirus Exposure Protection presented in Appendix C of the G4 SAP. The PPE ensemble will include:

- Half-face air purifying respirator with high efficiency particulate air filter cartridges (N/P/R99, 100) and non-vented goggles or high filtration dust mask with non-vented goggles
- Tyvek coveralls
- Tyvek boot covers or rubber boots
- Polyvinyl chloride or latex gloves

5.2.7 Bloodborne Pathogens

Bloodborne pathogens enter the human body and blood circulation system through punctures, cuts, or abrasions of the skin or mucous membranes. They are not transmitted through ingestion (swallowing), through the lungs (breathing), or by contact with whole, healthy skin. Examples of bloodborne pathogens are Human Immunodeficiency Virus, Hepatitis B, Malaria, Syphilis, and West Nile Virus. However, under the principle of universal precautions, all blood should be considered infectious, and all skin and mucous membranes should be considered to have possible points of entry for pathogens.

Potential bloodborne pathogen exposures that employees might face include:

- Contact with contaminated medical equipment or medical waste or sharp instruments
- Medical emergency response operations such as administering first aid or cardiopulmonary resuscitation (CPR)
- Contact with human wastes such as domestic sewage

5.3 Physical Hazards

Physical hazards that exist at the former Fort Ord include noise, heat and cold stress, and fire hazards. Procedures to protect workers from these hazards are presented below.

5.3.1 Noise Induced Hearing Loss

Planned activities will involve the use of heavy equipment, such as backhoes and generators. The unprotected exposure of site workers to this noise during activities can result in noise-induced hearing loss. Personnel working at this site will be enrolled in a hearing conservation program. The UXOSO will verify that each site worker has received hearing conservation training that entails proper use of hearing protectors. Additionally, the UXOSO will ensure that either earmuffs or disposable foam earplugs are made available to, and used by, all personnel near operating heavy equipment, or other sources of high intensity noise. Hearing protection is required any time the noise level reaches 85 dbA or greater. Double protection is required any time noise levels exceed 104 dbA.

Noise monitoring will be accomplished by field determination. If a person speaking in a normal voice cannot be heard at a minimum 3-foot distance, then hearing protection will be required.

5.3.2 Heat Stress

Heat stress is one of the most common (and potentially serious) illnesses that affect site workers. When site personnel are engaged in operations in hot environments, a number of physiological responses can occur that may seriously affect the health and safety of the workers. These effects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program.

Individuals vary in their susceptibility and degree of response to stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors, including environmental condition, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at MEC sites, regular monitoring and other preventive precautions are vital. Factors that may predispose a worker to heat stress include:

- Lack of physical fitness
- Lack of acclimatization to hot environments
- Degree of hydration
- Obesity
- Current health (i.e., having an infection, chronic disease, diarrhea, etc.)
- Alcohol or drug use
- The worker's age and sex

The amount and type of PPE worn influence the worker's heat tolerance. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (evaporation, convection, and radiation), and increases energy expenditure. Therefore, when selecting PPE, each item's benefit should be carefully evaluated in relation to its potential for

increasing the risk of heat stress. Once PPE is selected, the safe duration of work/rest periods should be determined based on:

- Anticipated work rate
- Ambient temperature and other environmental factors
- Type of protective ensemble
- Individual worker characteristics and fitness

Sweating does not cool the body unless moisture is removed from the body. The use of PPE reduces the body's ability to eliminate large quantities of heat because the evaporation of sweat is decreased. The body's effort to maintain an acceptable temperature may become impaired and this may cause heat stress. Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks. At the former Fort Ord sites, Level D PPE will be utilized, thus providing minimal increase in the potential for heat stress. Level D PPE is defined as standard work clothes with long pants, hard-hat (when overhead hazard is present), and safety boots (when working around heavy equipment).

Early Symptoms of Heat Stress

The early symptoms used to recognize heat-related illnesses include:

- Decline in task performance
- Lack of coordination
- Decline in alertness
- Unsteady walk
- Excessive fatigue
- Muscle cramps
- Dizziness

Heat Stress Disorders

The following paragraphs outline the major heat-related illnesses that may result from exposure to high heat environments, which include heat rash, fainting, heat cramps, heat exhaustion, and heat stroke (Table 2). For the purpose of this program, reference to “liquids” will indicate the use of water or an electrolyte replacement solution.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet, chafing clothing. This condition can decrease a worker's ability to tolerate hot environments. Symptoms include a mild red rash, especially in areas of the body that sweat heavily. Treatment of heat rash entails decreasing the amount of time in protective gear and using

baby powder to absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes as needed.

Heat Cramps

Heat cramps are caused by a profuse rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat-related cramps is often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke. Symptoms include acute, painful spasms of voluntary muscles such as the back, abdomen, and extremities. Treatment involves moving the victim to a cool area and loosening restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have the patient drink one to two cups of liquids immediately, with fluid intake repeated every 20 minutes thereafter. Consult with a physician if the condition does not improve. If available, an electrolyte replacement solution should be consumed.

Heat Exhaustion

Heat exhaustion occurs due to the large fluid and salt loss from profuse sweating. It is a state of very definite weakness or exhaustion caused by increased stress on various organs to meet increased demands to cool the body from excessive loss of fluids. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated, heat exhaustion can quickly develop into heat stroke. Symptoms include: pale and moist skin, profuse perspiration, and extreme weakness. Body temperature is basically normal or slightly elevated. The worker's pulse is weak and rapid, and breathing is often shallow. The individual may have a headache or experience nausea. Treatment for heat exhaustion involves removing the individual to a cool, air-conditioned place, loosening the victim's clothing, and elevating the victim's feet. Consult a physician, especially in severe cases. Have patient drink one to two cups of liquids immediately, and repeat every 20 minutes thereafter. Total liquid consumption should be about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, medical attention will be required.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by failure of the heat-regulating mechanisms of the body. The failure of the individual's temperature control system causes the perspiration system to stop working correctly. When this occurs, the body core temperature rises very rapidly to a point (+105°F) where brain damage and death will result if the person is not cooled quickly. The victim's skin is hot and often dry. Other symptoms include confusion, extremely high body temperature, rapid respiratory and pulse rate, delirium, convulsions, and unconsciousness or coma.

Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. The victim should be moved to a shady area; he should lie down and keep head elevated. Cool the victim by either sponging or immersing the victim in very cool water to reduce the core temperature to a safe level (<102°F). If conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not

give the victim caffeinated or alcoholic beverages. Heat stroke is considered a medical emergency. Medical help should be summoned immediately. **Early recognition and treatment of heat stroke are the only means of preventing brain damage or death.**

Preventive Measures

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat exhaustion, that person may become predisposed to additional heat injuries. In order to avoid heat-related illnesses, proper preventive measures will be implemented whenever environmental conditions dictate the need, normally whenever the temperature reaches at least 75°F. These preventive measures represent the minimal steps to be taken and will include the following procedures:

- The UXOSO will examine each site worker prior to the start of daily operations, and periodically throughout the day, to determine the individual's susceptibility to heat-induced stress. Evidence of extreme dehydration may require the UXOSO to restrict the worker's activities until such time as the worker is fit for duty. Personnel identified as being at high risk (obese, using diuretics, etc.) for heat stress who are allowed to participate in site operations will be monitored frequently by the UXOSO.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include recognizing the signs and symptoms of heat stress disorders and knowing proper treatment.
- In order to maintain workers' body fluids at normal levels, workers will be encouraged to drink, as a minimum, approximately 16 ounces of liquids prior to start of work in the morning, after lunch, and prior to leaving the site at the conclusion of the day's activities. Disposable four (4) to twelve (12) ounce cups and liquids will be provided on site. Liquids to be provided will include water and an electrolyte replacement solution, with the intake of each being equally divided. Liquids containing caffeine are to be avoided.
- When ambient conditions and site workload requirements dictate, as determined by the UXOSO, workers will be required to drink a minimum of 16 to 32 ounces of liquids during each rest cycle. The normal thirst mechanism is not sensitive enough to ensure that enough water will be ingested to replace lost sweat. When heavy sweating occurs, workers will be encouraged to drink even though they may not be thirsty.
- A shelter or shaded area will be provided where workers may be protected from direct sunlight during rest periods.
- Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and early detection of heat-induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this SSHP.
- Site workers will be given time to acclimatize to site work conditions, temperature, protective equipment, and workload. Acclimatization is the adaptive process that results in a decrease of the physiological response produced by the application of a constant environmental stress. On initial exposure to a hot environment, there is an impaired ability to work and evidence of physiological strain. If the exposure is repeated on several

successive days, there is a gradual return of the ability to work and a decrease in physiological strain. Acclimatization usually takes two to six days of continued work in hot environments, and allows the worker's body to become adjusted to this level and type of work. This process involves a gradual increase in the workload over the required period, the length of which depends upon the nature of the work performed, the ambient temperatures, and the individual's susceptibility to heat stress. The results of acclimatization include: subjective discomfort practically disappears; body temperature and heart rate are lower; there is a more stable blood pressure; and the sweat is more profuse and dilute.

- Work schedules will be adjusted as follows:
 - Modify work/rest schedules according to monitoring requirements
 - Mandate work slowdowns as needed
 - Rotate personnel: alternate job functions to minimize over-stress or overexertion at one task
 - Add additional personnel to work teams
 - Perform work during cooler hours of the day if possible
- Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have: less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.
- Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

Heat Stress Monitoring

Heat stress prevention is important because, once a person suffers from heat stroke or heat exhaustion, that person may be more likely to have additional heat-related illnesses (Table 3).

The following steps to prevent heat stress should be followed:

- Provide air conditioned shelter or shaded areas to protect personnel during rest periods
- Urge workers to drink water to keep their body fluids at normal levels
- Adjust work schedules according to monitoring requirements and perform work during cooler hours of the day
- Provide accurate verbal and written instructions, frequent training programs, and other information about heat stress and strain
- Permit self-limitation of exposures and encourage co-worker observation to detect signs and symptoms of heat strain in others
- Counsel and monitor those who take medications that may compromise normal cardiovascular, blood pressure, body temperature regulation, renal, or sweat gland

functions; and those who abuse or are recovering from the abuse of alcohol or other intoxicants

- Encourage healthy lifestyles, ideal body weight, and electrolyte balance
- Adjust expectations of those returning to work after absence from hot exposure situations and encourage consumption of salty foods (with approval of physician if on a salt-restricted diet)
- Ensure workers have current medical screening to identify those susceptible to systemic heat injury

Table 2
Signs and Symptoms of Heat Stress

Illness	Cause	Signs and Symptoms
Heat Rash	May result from continuous exposure to heat or humid air	Red rash on skin, intense itching and inflammation
Heat Cramps	Caused by heavy sweating with inadequate electrolyte replacement	Muscle spasms; pain in the hands, feet, and abdomen
Heat Exhaustion	Occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration	Pale, cool, moist skin; heavy sweating; dizziness; nausea; fainting
Heat Stroke	Most serious form of heat stress; temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur; competent medical help must be obtained	Red, hot, usually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma

Table 3
Suggested Frequency for Monitoring Fit and Acclimatized Workers ^a

Adjusted Temperature ^b	Normal Work Ensemble ^c	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°- 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°- 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°- 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Reference: NIOSH/OSHA/USCG/EPA 1985.

- a. For work levels of 250 kilocalories/hour.
- b. Calculate the adjusted air temperature (ta adj) by using the equation: $ta\ adj = ta + (13 \times \text{percent sunshine})$, where: ta is the air temperature in °F. Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow; zero percent sunshine = no shadows.)
- c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

For temperatures above 70°F (21°C), heat stress monitoring will be initiated for workers wearing semi-permeable or impermeable clothing. The monitoring will be as follows:

Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period.

- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
- If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

5.3.3 Cold-related illnesses

If work on this project is conducted in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Work will cease under unusually hazardous conditions (e.g., wind-chill less than 0°F, or wind-chill less than 10°F with precipitation). Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally labeled frostbite. Recognition of the symptoms of cold-related illness will be discussed during the health and safety briefing conducted prior to the onset of site activities. Refer to the 2000 American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices for additional information on cold stress prevention, monitoring, and protective measures.

Hypothermia

Hypothermia is a life-threatening condition in which the core body temperature falls below 95°F. Hypothermia can occur at temperatures above freezing, particularly when the skin or clothing becomes wet. During exposure to cold, maximum shivering occurs when the core temperature falls to 95°F (Table 4). As hypothermia progresses, depression of the central nervous system becomes increasingly more severe. This accounts for the progressive signs and symptoms ranging from sluggishness and slurred speech to disorientation and eventually unconsciousness. The ability to sustain metabolic rate and to reduce skin blood flow is diminished by fatigue. Thus, fatigue increases the risk of severe hypothermia by decreasing metabolic heat. Additionally, because blood flow through the skin is reduced to conserve heat, the skin and underlying tissues become more susceptible to frostbite.

Table 4
Progressive Clinical Symptoms of Hypothermia

Core Temperature (°F)	Clinical Signs
95°	Maximum shivering
87° - 89°	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated
84° - 86°	Progressive loss of consciousness; muscular rigidity; respiratory rate decreases
79°	Victim rarely conscious
70° - 72°	Maximum risk of ventricular fibrillation

Frostbite

Frostbite is both the general and medical term given to areas of cold injury. Unlike hypothermia, frostbite rarely occurs unless environmental temperatures are less than freezing and usually less than 20°F. Frostbite injuries occur most commonly on the distal parts of the body (nose, earlobes, hands, and feet) that are subject to intense vasoconstriction. The three general categories of frostbite are:

- Frostnip - A whitened area of the skin, which is slightly burning or painful
- Superficial frostbite - Waxy, white skin with a firm sensation but with some resiliency. Symptomatically feels “warm” to the victim with a notable cessation of pain
- Deep frostbite - Tissue damage deeper than the skin, at times, down to the bone. The skin is cold, numb, and hard

Preventing Cold-related Illnesses

Educate worker to recognize the symptoms of frostbite and hypothermia:

- Ensure the availability of an enclosed, heated environment within the vehicles. The nearest heated environment will be the interior of the vehicles at the site
- Ensure the availability of dry changes of clothes
- Record temperature readings
- Ensure the availability of warm beverages, preferably noncaffeinated

Cold Weather Monitoring and Hypothermia

Hypothermia is defined as a decrease in the body core temperature below 96°F (36°C). The following symptoms appear (in the order listed) as the body loses heat faster than it can be produced:

- Voluntary exercise to stay warm
- Involuntary exercise to stay warm (shivering)
- Loss of judgment and reasoning abilities
- Feelings of apathy, listlessness, and indifference
- Loss of control of the hands

The following steps should be taken to prevent hypothermia:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors
- Ensure the availability of dry changes of clothes
- Develop a capability for temperature recording at the site
- Ensure the availability of warm drinks

Monitoring the oral temperature on the job site can also be used to defend against hypothermia. This should be done at the supervisor's discretion based on changes in the worker's performance or mental status, or when the wind-chill is less than 20°F (-7°C), or a wind-chill is less than 30°F (-2°C) with precipitation. Any worker developing moderate hypothermia, defined as a core temperature of 92° (34°C), may not return to work for 48 hours.

5.3.4 Fire Hazards

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during the conduct of site activities, such as moving drums, mixing/bulking of site chemicals, and during refueling of heavy or handheld equipment. Some potential causes of explosion and fires include:

- Mixing of incompatible chemicals, which cause reactions that spontaneously ignite due to the production of both flammable vapors and heat
- Ignition of explosive or flammable chemical gases or vapors by external ignition sources
- Ignition of materials due to oxygen enrichment
- Agitation of shock or friction-sensitive compounds
- Sudden release of materials under pressure

Fire Prevention

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on site and members of the general public living or working nearby. Site personnel involved with potentially flammable material

or operations must follow the guidelines listed below and EM 385-1-1, Section 9, to prevent fires and explosions:

- Potentially explosive/flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator
- Prior to initiation of site activities involving explosive/flammable materials, all potential ignition sources must be removed or extinguished
- Non-sparking and explosion-proof equipment must be used whenever the potential for ignition of flammable/explosive gases/vapors/liquids exists
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive/flammable atmospheres
- Smoking is restricted to designated areas on MEC work sites
- Flammable and/or combustible liquids must be handled only in approved and properly labeled metal safety cans equipped with flash arresters and self-closing lids
- Transfer of flammable liquids from one metal container to another will be done only when the containers are electrically interconnected (bonded)
- The motors of all equipment being fueled will be shut off during the fueling operations
- Metal drums used for storing flammable/combustible liquids will be equipped with self-closing safety faucets, vent bung fittings, grounding cables, and drip pans, and will be stored outside buildings in an area approved by the UXOSO

Fire Protection

The following safe work practices are to be used to protect against fires:

- Vehicles and equipment will not be fueled while running
- Flammable/combustible liquid storage areas have at least one 4A:20B:C fire extinguisher located within 25 to 75 feet and marked with the appropriate fire symbol and no smoking signs
- All vehicles used in the transport of explosives are equipped with two fire extinguishers of not less than 2A:10B:C or higher, with one fire extinguisher mounted/placed inside the cab of the vehicle and one mounted outside, by the driver's side door, if possible
- Temporary offices will be equipped with a fire extinguisher of not less than 10:ABC
- At least one portable fire extinguisher having a rating of not less than 4A:20B:C will be located at each work site

5.3.5 Ionization Radiation

No radiological hazards are anticipated during operations at the former Fort Ord. If any radioactive sources are encountered by the ESCA RP Team personnel or their subcontractors,

work at that location will be stopped and the PHSM will be contacted to provide guidance on proper protective measures.

5.4 Chemical Hazards

Non-Chemical-Warfare-Material chemical hazards, such as lead-contaminated soils or lead-based paint, may be anticipated at former small arms ranges or during demolition of existing structures. Should contaminated soils be encountered, the PHSM will be contacted to provide guidance on appropriate safety precautions.

Chemical Warfare Munitions

Chemical Munitions, Chemical Warfare Material, or Radiological Contamination is not anticipated to be encountered during operations on the former Fort Ord; however, should personnel encounter a suspected toxic chemical munitions, Chemical Warfare Material, or any situation where radiological contamination could become a concern, all personnel will immediately withdraw upwind to a safe location outside of the fragmentation zone of the type of ordnance located and contact the UXOSO who will notify local law enforcement, which will, in turn, contact the Military EOD.

The site will be secured with two UXO Technicians (minimum of one UXO Technician II and one UXO Technician I) until the arrival of the Military EOD. The ESCA RP Team will assist the Military EOD as directed. Decontamination station setup and operation will be performed by fire department hazardous response personnel.

Ordnance Fillers

In the event of locating a Livens Projector, 4-inch Stokes, or a 4.2-inch mortar and positive identification of the filler remains unknown, the item will be left in place awaiting disposition by Military EOD who will identify the filler prior to final disposition. Activities related to ordnance with unknown fillers will be conducted in accordance with the SOP for MEC with Unknown Filler presented in Appendix C of the G4 SAP.

5.5 Hazard Analysis

The ESCA RP Team has analyzed the scope of work tasking to determine the work risk hazards associated with each task. The tasks consist of direct tasks and implied tasks, or sub tasks, to accomplish the work. Table 7, located at the end of this SSHP, presents each activity, the associated hazards, and the control measures planned to prevent accidents.

6.0 MEDICAL MONITORING

Personnel engaged in field activities must be enrolled in a medical surveillance program as required by 29 CFR Part 1910.120(f). Doctors on Duty, 2260 North Fremont Street, Monterey, CA 93940, (831) 372-6700, is used to provide the medical examinations for WESTON personnel. WorkCare Northern California, 1320 Harbor Bay Parkway, Suite 115,

Alameda, CA 94502, (510) 748-6900 / (800) 455-6155, provides medical surveillance and records management for LFR Inc. (LFR) personnel. The content of the examination must be designed to determine each individual's fitness for duty, including ability to work while wearing protective equipment (e.g., respirator, impermeable clothing, etc.).

Personnel performing on-site field activities on this project must present to the UXOSO a physician's certification of completion of a comprehensive medical monitoring examination within the 12 months prior to the beginning of field activities. Additionally, the UXOSO will ensure that workers remain current in their medical monitoring throughout the duration of the project.

7.0 TRAINING

All personnel performing field activities with the potential for disturbing MEC or hazardous waste at the former Fort Ord must have completed hazardous waste operations and emergency response (HAZWOPER) health and safety training in accordance with the provisions of 29 CFR 1910.120(e)(3) and must be current in their refresher training (if applicable). Site supervisors responsible for personnel engaged in field activities must have attended a site management training as required by OSHA in 29 CFR 1910.120(e)(4). At least one member of each field team must be current in first aid and CPR training. Copies of training certificates will be provided to the UXOSO.

Exceptions to the HAZWOPER requirements will be reviewed and determined by the UXOSO. There may be field personnel (either subcontractors or ESCA RP Team employees) who are required for certain field activities, but who have not received 40-hour HAZWOPER training or are not current (i.e., have not taken the 8-hour refresher within the prior 12-month period) with respect to the 40-hour HAZWOPER training; they may perform fieldwork at the site if the following conditions are adhered to:

- 1) They have proof from a Medical Physician that identifies their fitness to perform field services. They do not have to meet medical monitoring requirements.
- 2) They are in compliance with all other provisions in the applicable SSHP.
- 3) They have submitted a signed acknowledgement that they have read and understand the applicable SSHP.
- 4) The specific work to be performed is defined in advance.
- 5) The period during which they will perform the work is limited and specified in advance.
- 6) They will conduct fieldwork only under the direct supervision of and accompanied in the field by an LFR or WESTON employee who is current on the 40-hour HAZWOPER training.
- 7) They have received UXO Recognition Training in advance of the field effort.
- 8) They have received LFR's Environmental Awareness Training.
- 9) The operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards.

7.1 Site-Specific Training

In addition to the HAZWOPER training and 8-hour refresher training, site-specific training will be conducted. The UXOSO is responsible for developing a site-specific occupational hazard training that will be provided to all ESCA RP Team personnel and subcontractors prior to the start of field operations, as required. This training will cover the following topics:

- Names of personnel responsible for site safety and health
- Safe work practices
- Site history
- Safety, health, and other hazards at site
- Work zones and other locations
- Emergency procedures, evacuation routes, emergency phone numbers
- PPE for anticipated task
- Safe use of engineering controls and equipment on the site
- Bloodborne pathogens
- Ordnance recognition and reporting
- Prohibitions in areas and zones, including:
 - o Site layout
 - o Procedures for entry and exit of work areas and zones

In addition, site-specific training may include Lead Awareness Training.

7.2 Tailgate Safety Meetings

The SUXOS will conduct tailgate safety briefings for field personnel. This training must as a minimum cover the following topics:

- Tasks to be performed
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, or danger signals
- Emergency procedures (emergency equipment, emergency communications, and route to hospital)
- Rallying points and safe refuge areas

7.3 Supervisor Meetings

Weekly meetings will be held for all supervisors. The agenda will include the past week's operations, safety issues/problems, corrective actions required or taken, and the upcoming week's activities.

7.4 Training Documentation

The UXOSO will maintain copies of training certificates (HAZWOPER, EOD School Certificate, and CPR/first aid) for personnel participating in field operations. The UXOSO will document site-specific initial training, lead awareness training, tailgate training/subjects, and any other special or additional training.

7.5 Hazard Communication Training

All project work will be conducted in accordance with standard policies for hazard communication. Copies of material safety data sheets (MSDSs) for any hazardous chemicals brought on site will be maintained at the field office. Employees who are exposed to hazardous chemicals brought to the site must receive training on:

- The physical and health hazards of the chemicals in the work area
- Methods and observations that may be used to detect the presence or release of the hazardous chemicals in the work area
- The measures workers can take to protect themselves from these hazards

7.6 Bloodborne Pathogens Training

Personnel working on this project will be provided with bloodborne pathogen training review. This training will be given initially at the same time as the site-specific training. The topics covered in the training will include the following:

- An overview of the Bloodborne Pathogen Standard
- Epidemiology and symptoms of bloodborne diseases
- Modes of transmission of bloodborne pathogens
- Discussion of Exposure Control
- Tasks that may involve exposure to blood and other potentially infectious materials
- Review of the methods that will prevent or reduce exposure
- Selection and use of PPE
- Information on the post-exposure evaluation and follow-up program

7.7 Visitor Training

All visitors to the site will be given a health and safety briefing prior to gaining access to the site. Following this briefing, visitors will be asked to sign the SSHP Plan Acceptance Form/Site Visitors Log. The UXOSO will also ensure that visitors have applicable health and safety equipment, medical surveillance, and training for the activities/areas they will be visiting. Should questions arise as to whether or not specific training or equipment is needed, the PHSM will be contacted.

7.8 Ergonomic Training

An Industrial Training Program will be implemented and documented in accordance with OSHA and the California Code of Regulations.

8.0 PERSONAL PROTECTION EQUIPMENT

PPE required at the site will be at a level necessary to protect personnel. No contamination is anticipated; therefore, a level D ensemble will be worn.

8.1 Level D Protection Ensemble

The minimum level of protection for all personnel at this site is level D. A level D ensemble consists of:

- Short- or long-sleeved coveralls or work clothing
- Kevlar chaps (when operating chainsaw)
- Leather work boots (steel toe if a foot hazard exists [brush cutting/clearing and excavation])
- Safety glasses or goggles when an eye hazard exists (brush cutting/clearing and hand or mechanical excavation operations)
- Hard hat, when a head hazard exists (brush cutting/clearing and around heavy equipment)
- Work gloves, leather or rubber as appropriate
- Hearing protection when working around heavy equipment or powered hand tools
- Respirator when clearing/grubbing rodent nests
- Sun block and insect repellent as needed
- Demolition operations PPE
- Reflective safety vest usage

8.2 Upgrading PPE

The level of protection is based on what is known about the site. Protection levels may change as site conditions change. The UXOSO monitors site conditions and provides information to the PHSM and RPM as necessary. The UXOSO may increase the levels of protection when necessary but cannot downgrade them without approval from the PHSM. Should contaminated soils be encountered, the PHSM will be contacted to provide guidance on appropriate safety precautions.

9.0 SITE CONTROL

The UXOSO will coordinate access control and security on site. Due to the hazardous nature of MEC, only authorized personnel will be allowed in the exclusion zone (EZ). The EZ is the

work site, encompassing an area large enough to prevent personnel injuries as a result of MEC operations. The boundary of the EZ will be appropriately identified. During intrusive operations, the boundary will be established by the UXOSO based on minimum separation distance (MSD). The MSD is the minimum separation distance for unrelated personnel given unintentional detonation of conventional ordnance items. The MSD for all unrelated personnel for an unintentional detonation will be determined by the greatest distance: 200 feet or the K50 distance. During intrusive operations, only essential trained personnel are allowed in the EZ.

Visitors must check-in at the field office to gain access to work sites. The UXOSO or a designee will escort visitors to and from work sites. During all operations on site, the field supervisors can cease operations if unescorted personnel are observed within the operating area. During work hours, ESCA RP Team personnel provide security at the site. Equipment is secured at the end of the workday.

Representatives from regulatory agencies are permitted to enter the site at any time during business hours or any other reasonable time with an escort. Regulatory agencies will be allowed to perform their oversight functions during MEC operations, and are considered essential personnel. Site controls to ensure their safety are included in Table 7, Activity 5: MEC Operations.

In the case of an emergency, personnel will exit the site and move to the designated safe area. The safe area will be located upwind of the site. The UXOSO will determine the severity of the emergency. If the emergency warrants site evacuation, the UXOSO or SUXOS will notify the applicable police and/or fire departments.

10.0 DECONTAMINATION AND PERSONNEL HYGIENE

In general, no hazardous, toxic, or radiological waste materials are anticipated; thus decontamination for constituents will not be required. Site sanitation will be established and maintained in compliance with 29 CFR 1926.51 and EM 385-1-1, Section 2.

10.1 Potable Water

An adequate supply of drinkable water will be provided on site during work activities.

10.2 Toilet Facilities

As the former Fort Ord work sites are not provided with a sanitary sewer system, temporary toilet facilities will be used (Table 5). Each temporary toilet will be naturally lighted, ventilated, and lockable from the inside.

Table 5
Minimum Number of Facilities

Number of Employees	Number of Facilities
20 or fewer employees	One toilet with seat
More than 20, less than 200 employees	One toilet with seat and one urinal per 40 employees
More than 200 employees	One toilet with seat and one urinal per 50 employees

10.3 Washing Facilities

Washing facilities in the EZ will consist of water containers, buckets, soap, and drying towels. Workers exiting the EZ must wash hands and face prior to eating, drinking, or smoking.

11.0 ENVIRONMENTAL AND PERSONAL MONITORING

Exposure to hazardous airborne substances is anticipated only in areas where lead hazards may exist (i.e., small arms ranges, or during structure demolition). Should contaminated soils be encountered, the PHSM will be contacted to provide guidance on appropriate safety precautions.

12.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

The frequency and severity of emergency situations can be dramatically reduced through proper implementation of the SSHP. However, if an emergency does occur, quick, decisive action will be required since delays in minutes can create or escalate life-threatening situations. In an emergency situation, site personnel involved in emergency response and rescue must be prepared to respond immediately and all required equipment must be on hand, in proper working order, and ready to use. To ensure rapid, effective response to a site emergency, the procedures and contingency plans outlined in this section will be implemented prior to and during the conduct of any site activities involving exposure to safety and health hazards.

12.1 Identifying Potential Emergencies

Contingency plans for responding to the potential emergency situations have been developed and are presented below. Potential emergencies that may occur include:

- Injury or illness
- Fire/explosion
- Inclement weather

12.2 Emergency Response Responsibilities

In the event of an emergency, the UXOSO will assume the responsibility of being the On Scene Incident Commander (OSIC). The alternate person to assume this role, in the event that the UXOSO is unavailable or incapacitated, will be the SUXOS. The OSIC will have the responsibility of directing all on-site and off-site response personnel. Upon arrival of First Responders (i.e., fire department) and upon determination that no ordnance or explosives hazard exists, the role of OSIC will be turned over to the senior responding member of the fire department.

12.3 On-Site Emergency Response Services

WESTON personnel will provide first aid treatment for minor injuries up to the limits of their qualifications and training. At least one person per team will be First Aid and CPR certified. If necessary, the OSIC will contact medical personnel to determine if additional treatment is required. If further treatment is required, the fire department providing fire services to the former Fort Ord will be notified and the injured person will be transported to the Community Hospital of the Monterey Peninsula. If transport by the WestMed ambulance is required, an escort will meet the ambulance at the corner of Parker Flats Road and Eucalyptus Road and guide them to the accident site.

12.4 Off-Site Emergency Response Services

Off-site emergency response services may include local fire and law enforcement personnel. Emergency phone numbers for off-site response organizations are presented in Table 6.

Table 6
Emergency Contacts

Emergency Contact	Telephone Number
MEDEVAC, Cal Star	(800) 252-5050
Community Hospital of the Monterey Peninsula	(831) 624-5311
WestMed	(831) 655-4040
Presidio of Monterey (POM) Fire Department	(831) 242-7851 / 7852
POM Police	(831) 242-7853
Military EOD – 60 th Civilian Engineer Squadron	(707) 424-2040
Monterey County Regional Fire District	(831) 455-1828
Monterey County Sheriff	(831) 755-3801
WESTON PHSM – Mike Stuart	(505) 837-6566
WESTON RPM – Linda Temple	(831) 384-3221
Poison Control	(800) 222-1222

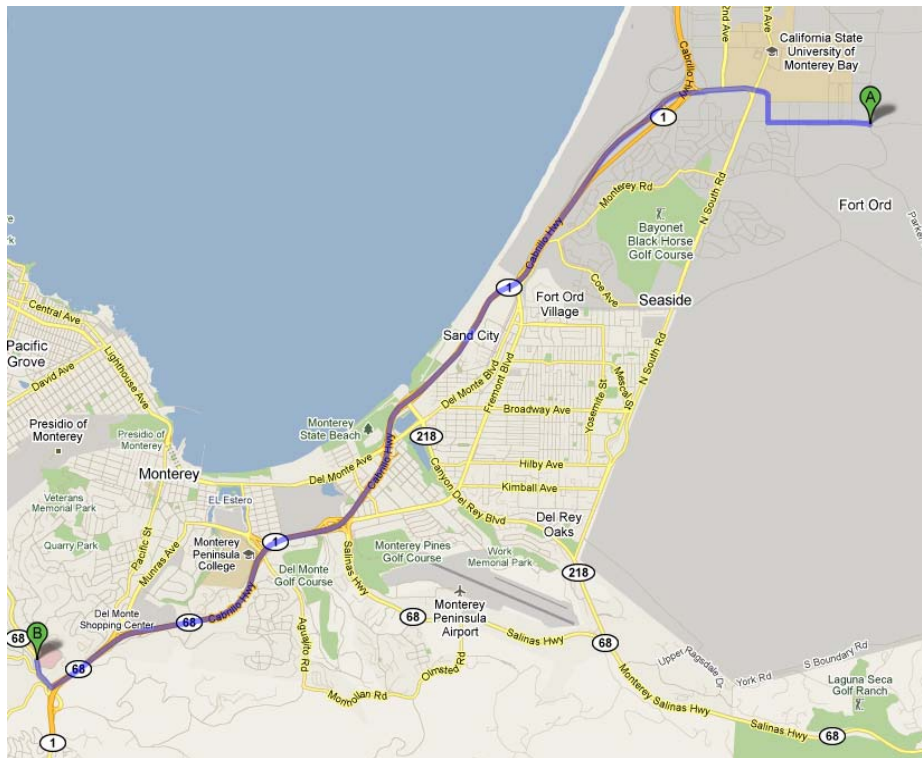
12.5 Route to Hospital

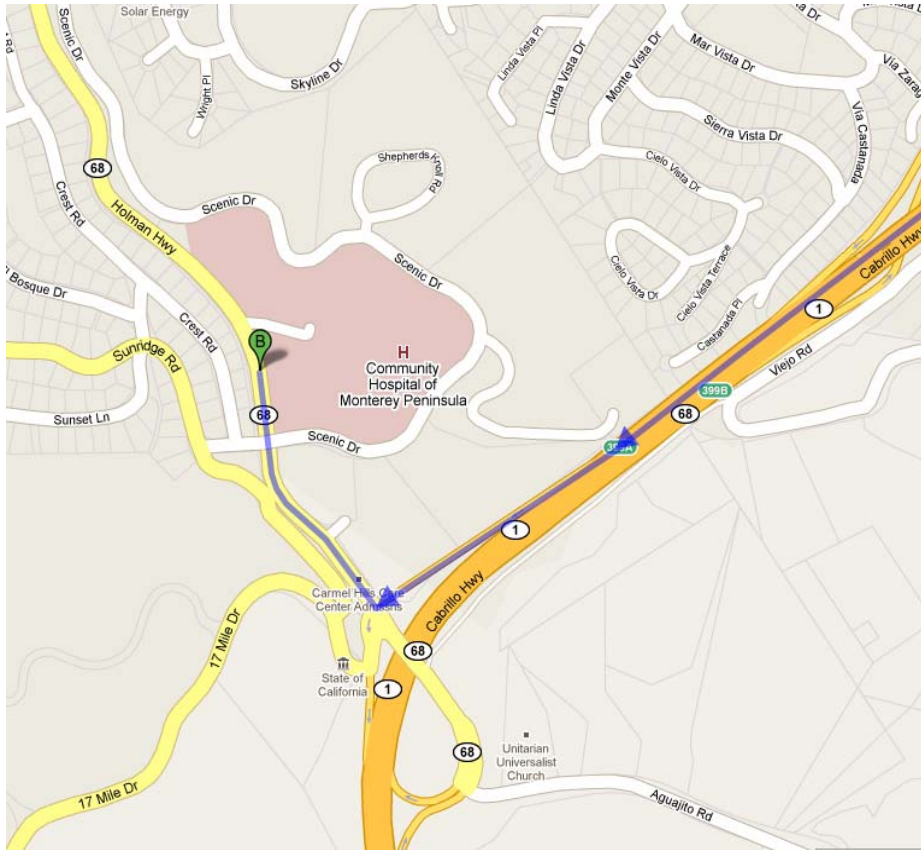
The evacuation route map to the Community Hospital of the Monterey Peninsula from the former Fort Ord is presented below (Figure 4). The map will be kept in all vehicles. Directions for evacuation are printed with the map below.

Directions to: Community Hospital of Monterey Peninsula
23625 Holman Highway, Monterey, California 93940
(831) 624-5311

1. From Gigling Road, head northwest to 8th Avenue
2. Turn right at Malmedy Road
3. Continue on to Lightfighter Drive
4. Turn right to merge onto CA- 1 South.
5. Take exit 399A for CA-68 West toward Pacific Grove/Pebble Beach.
6. Turn right at CA-68 West.
7. The hospital will be on the right.

Figure 4
Route to Hospital





12.6 Emergency Response Training

All site personnel will receive specialized training that will be given by the UXOSO prior to initiating site activities involving safety and health hazards. The content of this training will include the items listed below and will be documented using the site Training Log.

- Emergency chain-of-command
- Communication methods and signals
- Emergency equipment and PPE
- Removing injured personnel from the site
- Emergency contacts, phone numbers, and hospital route

12.7 Emergency Equipment

During intrusive operations, the UXOSO will maintain emergency equipment containing the following: an eyewash station, first-aid kit, a fire extinguisher, a portable cellular telephone, and a radio. Copies of pertinent figures including emergency phone numbers and maps to emergency facilities will be included with this equipment.

For non-intrusive operations, such as geophysical surveying, a first-aid kit, fire extinguisher, and radio will be provided.

12.7.1 Fire Extinguishers

Portable fire extinguishers approved by a nationally recognized testing laboratory, and labeled to identify the labeling organization and the fire test and performance standard, will be provided at each individual job site. Extinguishers will be fully charged and in operable condition.

A dry-chemical type 4A:20B:C extinguisher will be available at each work site. Each piece of heavy equipment, site trailer, and each vehicle will be equipped with at least a 2A:10B:C fire extinguisher.

12.7.2 First-Aid Equipment

First aid kits will be the 16-unit first aid kits and comply with American National Standards Institute Z308.1. A kit will be located in each field team vehicle and at the field office. Kits will be inspected on a weekly basis and missing components replaced immediately.

12.8 Communication Devices

Site communication devices will include portable, handheld two-way radios for communication between teams and the field office. Cellular telephones will be used to communicate with off-site individuals and organizations. Radios will be distributed to the SUXOS, the UXOSO, and to each field team supervisor.

12.9 General Emergency Procedures

Emergency response procedures include all steps to be taken for notifying, evaluating, reacting to, documenting, and following up on a given emergency situation. To ensure all necessary elements are covered, the procedural steps outlined in this paragraph will be implemented for each emergency, regardless of its nature.

12.9.1 Notification

Once the OSIC has been informed of an emergency, the OSIC will alert site personnel to the presence of the emergency by radio. This will be done to:

- Notify personnel and to get their attention
- Stop all work activity as required
- Lower noise levels in order to speed and simplify communication
- Initiate emergency or evacuation procedures

If on-site ESCA RP Team personnel or off-site emergency personnel are to enter the site in response to the emergency, the OSIC will, to the extent possible, notify the response personnel about the nature of the emergency, to include:

- What happened and when it happened
- Where on site the emergency situation occurred
- Who is involved and, if possible, the cause of the emergency
- The extent of damage and what hazards may be involved
- What actions should be taken

12.9.2 Assessing the Emergency

Available information related to the emergency and the on-site response capabilities should be evaluated and the information listed below obtained to the extent possible:

- What happened:
 - Type of incident
- Casualties involved:
 - Victims (number, location, and condition)
 - Treatment required
 - Missing personnel
- Cause of incident
- Extent of damage to structures, equipment, and terrain
- What could happen from this point:
 - Potential for fire or explosion
 - Location of all personnel in relation to hazardous areas
 - Potential for emergency affecting the general public or the environment
- What can be done to remedy the situation:
 - Equipment and personnel needed for rescue and hazard mitigation
 - Number of uninjured personnel available for response
 - Resources available on site
 - Resources available from off-site response groups and agencies
 - Time needed for off-site response resources to reach the site
 - Hazards involved in rescue and response

12.9.3 Rescue and Response Actions

Based on the information collected during the emergency assessment, the general actions listed below will be taken, with some actions being conducted concurrently. No one will attempt emergency response/rescue until the situation has been assessed and the appropriate response outlined by the OSIC.

- Enforce the Buddy System:
 - Allow no one to enter a hazardous area without a partner
 - Personnel in the EZ should be in line-of-sight or in communication with the OSIC or his designee
- Survey Casualties:
 - Locate all victims and assess their condition
 - Determine resources needed for stabilization and transport
- Assess Existing and Potential Hazards and Determine:
 - Whether and how to respond
 - The need for evacuation of site personnel and off-site population
 - The resources needed for evacuation and response
- Contact the required off-site/on-site personnel or facilities, such as ambulance, fire department, police, etc.
- Allocate on-site personnel and equipment to rescue and initiate incident response operations
- Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency, i.e., control fire, secure site, etc.
- Remove or assist victims from the area
- Stabilize:
 - Administer any medical procedures that are necessary before the victims can be moved
 - Stabilize or permanently fix the hazardous condition
 - Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks)
 - Transport using either on-site or off-site assets
- Casualty Logging-Record: who, time, destination, and condition upon transport
- Evacuate:
 - Move site personnel to the rally point, a safe distance upwind of the incident
 - Monitor the incident for significant changes; the hazards may diminish, permitting personnel to re-enter the site, or hazards may increase and require public evacuation

- Casualty Tracking-Record: disposition, condition, and location

12.9.4 Post Emergency Follow Up

Before normal site activities can resume, the site and personnel must be prepared and equipped to handle another emergency. It is also imperative that all federal, state, and local regulatory agencies be notified of the emergency. Therefore, the following activities must be conducted prior to resumption of site activities:

- Notify all appropriate governmental agencies as required (i.e., OSHA must be notified if there have been any fatalities or three or more personnel hospitalized)
- Restock and clean all equipment and supplies utilized or damaged in the emergency
- UXOSO should conduct an accident investigation to determine the cause of the emergency and what preventive measures could be taken to ensure the emergency does not occur again
- Review and revise, as needed, the SSHP to reflect the new procedures

12.10 Contingency Plans

The following paragraphs contain emergency specific contingency plans. These plans outline the procedures for mitigating potential emergency situations. Any changes to these plans must be approved by the PHSM.

12.10.1 Injury or Illness

In the event of an emergency involving personal injury or illness, immediate response will be key in preventing further harm and providing comfort to the affected party. When personnel are injured or overcome by illness, the following procedure will be followed:

- Upon notification of the occurrence and nature of the injury/illness, the OSIC will, if deemed necessary, summon emergency personnel
- The OSIC or SUXOS will assess the severity of the injury/illness and direct personnel to provide CPR/first aid as needed
- If immediate life support is not required, or once the victim is stabilized, and, if required, transport victim to the appropriate medical facility for further attention

12.10.2 Fire and Explosion

Small Fire

A small fire is defined as a fire that can be extinguished with a 4A:20B:C type fire extinguisher. In the event of a small fire, site personnel will take the following actions:

- All unnecessary personnel will be evacuated from the immediate area to an upwind location
- Extinguish the fire using portable fire extinguishers or by smothering from an upwind location
- Request emergency response assistance (ambulance, fire, police) as needed
- Do not attempt to extinguish a fire, even a small one, involving explosives
- Notify the UXOSO, SUXOS, and RPM

Large Fires

In the event of a large fire (or small fire that cannot be extinguished), the following actions will be taken:

- All unnecessary personnel will be evacuated from the site to an upwind location
- The Local Fire Department and/or other emergency response services (police, ambulance, hospital, etc.) will be notified as needed by the OSIC
- OSIC will meet Fire Department and direct them to location of fire
- After the Fire Department has arrived, OSIC will notify the Project Manager and RPM

Explosion

In the event of an explosion, all nonessential personnel will evacuate and help secure the site; the OSIC will request the required support equipment and personnel. It is essential that the site be evacuated and no one is allowed to re-enter, except to possibly save a life, until at least 30 minutes, or longer if necessary, after the explosion. The OSIC will determine what actions are appropriate.

12.10.3 Chemical Spills

A spill kit will be maintained at the site in case a chemical being used at the site (such as oil or gasoline) is spilled. The kit will include spill absorbers (spill socks, pads, and pillows) and disposable bags. Approximately 18 gallons of spilled oil, coolants, fuels, or water can be absorbed using the contents of the kit.

All spills will be immediately reported to the UXOSO.

13.0 LOGS, REPORTS, AND RECORD KEEPING

13.1 Logbook

The SUXOS will keep a log recording the following aspects related to safety at the site:

- Training (initial site specific training, tailgate meetings, etc.)

- Site visitors
- Safety issues or problems encountered
- Accidents
- Emergencies

13.2 Safety Logs

The UXOSO will maintain a daily safety log of all safety-related activities. The following information will be maintained in the safety log:

- Date and recorder of log
- Tailgate safety briefing (time conducted, material discussed, etc.)
- Weather conditions
- Significant site events relating to safety
- Accidents
- Stop-work events related to safety
- Safety inspections

13.3 Training Logs

The UXOSO will maintain a training log documenting the following information:

- Date of training
- Type of training (initial, tailgate briefing, visitor)
- Workers or visitors attending training
- Signature of UXOSO

13.4 Equipment Maintenance

The SUXOS will document the results of daily check of heavy equipment using the Heavy Equipment Daily Inspection List.

13.5 Record Keeping

The UXOSO will establish and maintain a filing system on site for health and safety records, reports, and information concerning individual training, medical surveillance, etc. Sections in this filing system will include:

- Training Records - Certificates for training required by 29 CFR1910.120 (40-hour initial HAZWOPER, 8-hour refresher, and supervisory training) will be maintained at the site. Additionally, documentation of CPR and First Aid training will be available at the site

- Medical Monitoring - Documentation of current enrollment (within last 12 months) in a medical monitoring program will be available for each employee working at the site. Documentation will consist of the employee's Health Status Report that is written and signed by the examining physician
- Accident Reports - Copies of any accident/incident reports and follow-up reports
- Plan Acceptance Forms - Copies of the Plan Acceptance Forms documenting that employees have read and understand the SSHP will be maintained at the site

13.6 Accident Reporting

If an injury occurs on site, the UXOSO is responsible for completing a WESTON accident report form. The UXOSO must submit a copy of this form to the PHSM within 24 hours of the injury. All accidents/incidents must be investigated by the UXOSO. The purpose of the investigation is to determine the causal factors that led to the accident/incident and to establish corrective actions to prevent recurrence.

14.0 STANDARD OPERATING PROCEDURES, ENGINEERING CONTROLS, AND SAFE WORK PRACTICES

14.1 General Safety

The following are standard practices for work on the former Fort Ord:

- Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters are prohibited in a contaminated or potentially contaminated area or where the possibility of contamination transfer exists
- Field crew members should be alert to all potentially dangerous situations (i.e., presence of strong, irritating, unusual, or nauseating odors)
- Field crew members will be familiar with the physical characteristics of a site during intrusive investigations, including:
 - Wind direction in relation to nearby buildings
 - Accessibility to associates, equipment, vehicles, communication
 - Hot zone (areas of known or suspected contamination)
 - Site access
 - Nearest water sources
- Protective equipment as specified in this SSHP will be used by workers while on the former Fort Ord
- Use of heavy equipment on site (i.e., trucks and bobcats) presents additional hazards for site workers. For example, the vision of a backhoe operator is limited, so all field crew members should stay clear when backhoe is operating

- Wearing PPE can result in an impairment of the ability to operate site equipment. All field crew members should pay specific attention to decreased performance capabilities resulting from the use of PPE, such as poor tactile skills when wearing certain types of gloves. Prior knowledge of limitations imposed by the use of such equipment and clothing will allow the worker to assess the decrease in his or her capability to perform field operations in a safe manner
- Wearing of jewelry, such as loose bracelets and necklaces, is prohibited in order to avoid its entanglement in site machinery

15.0 PROCEDURES AND PROGRAMS

15.1 Hearing Conservation Program

The purpose of this Hearing Conservation Program is to provide protection for employees from adverse health effects associated with occupational exposure to noise. The program consists of annual audiometric testing of workers, annual employee training, selection and use of hearing protection, and noise monitoring. All employees and subcontractors must comply with this program.

Audiometric Testing Program

Audiometric testing will be made available to all employees whose exposures equal or exceed an 8-hour time-weighted average of 85 decibels. Audiometric tests will be performed by a licensed or certified audiologist, otolaryngologist, or physician who is certified by the Council of Accreditation in Occupational Hearing Conservation. Each employee assigned to noisy operations must receive a baseline audiogram prior to assignment and yearly testing thereafter for as long as that employee is exposed to excessive noise levels (8-hour time-weighted average of 85 decibels or greater). Each employee's annual audiogram is compared to that employee's baseline audiogram to determine if the audiogram is valid and if a standard threshold shift has occurred. (A standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hertz in either ear.) This comparison should be done by a physician.

If a comparison of the annual audiogram to the baseline audiogram indicates a standard threshold shift has occurred, the employee will be informed of this fact in writing, within 21 days of the determination. The following steps are taken by the UXOSO when a standard threshold shift occurs:

- Employees not using hearing protectors will be fitted with hearing protectors, trained in their use and care, and required to use them
- Employees already using hearing protectors will be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary
- The employee will be referred for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary

- The employee is informed of the need for an otological examination if a medical pathology of the ear that is unrelated to the use of hearing protectors is suspected

Audiometric tests will be pure tone, air conduction, hearing threshold examinations, with test frequencies including at a minimum 500, 1000, 2000, 3000, 4000, and 6000 Hertz. Tests at each frequency will be taken separately for each ear. Audiometric tests will be conducted with audiometers (including microprocessor audiometers) that meet the specifications of, and are maintained and used in accordance with American National Standard Specification for Audiometers S3.6-1969. The functional operation of the audiometer will be checked before each day's use by testing a person with known, stable hearing thresholds, and by listening to the audiometer's output to make sure that the output is free from distorted or unwanted sounds. Audiometer calibration will be checked acoustically at least annually in accordance with OSHA requirement 29 CFR 1910.95, Appendix E.

Hearing Protectors

The UXOSO will make hearing protectors available to all ESCA RP Team and subcontract employees exposed to an 8-hour time-weighted average of 85 decibels or greater. Hearing protection for this project will consist of earmuffs or foam fitting earplugs. The selection of hearing protector will be based upon noise attenuation requirements for the task and worker comfort.

Employee Training

The UXOSO will develop a hearing conservation training program for all employees assigned to noisy work. This training will be a component of the initial site safety training. As a minimum the training will consist of:

- The effects of noise on hearing
- The purpose of hearing protectors; the advantages, disadvantages, and attenuation of various types; and instructions on selection, fitting, use, and care
- The purpose of audiometric testing, and an explanation of the test procedures

Noise Monitoring

When operations are anticipated to exceed the 8-hour time-weighted average of 85 decibels, the UXOSO will implement a noise monitoring program. The monitoring will be used to:

- Verify that appropriate hearing protection is being used by employees
- Identify the boundaries of the noise hazard area in accordance with Section 05.C.07 of EM 385-1-1
- Instruments used to measure employee noise exposure will be calibrated to ensure accuracy

15.2 Hazard Communication Program

The OSHA Hazard Communications Standard (29 CFR 1910.1200) was promulgated to ensure that all chemicals would be evaluated and information regarding the associated chemical hazards would be communicated appropriately. The goal of the standard is to reduce the number of chemically related occupational illnesses and injuries.

In order to comply with the OSHA Hazard Communication Standard, this written program has been established for work at the former Fort Ord. All ESCA RP Team and subcontractor personnel working at the former Fort Ord are included in this program.

Hazardous Chemical Inventory List

Hazardous chemicals used at the former Fort Ord include industrial chemicals such as fuels, oils, and greases. The UXOSO will maintain an inventory of hazardous chemicals brought onto the former Fort Ord.

Material Safety Data Sheets

MSDSs are prepared by manufacturers or producers to provide specific information on the safety precautions and health effects of a particular chemical or mixture. The MSDS contains at a minimum the following information:

- Chemical and common names
- Physical and chemical characteristics
- Physical hazards
- Health hazards
- Primary routes of entry
- Exposure limits
- Carcinogenic potential
- Handling and protective precautions
- Control measures
- Emergency and first aid procedures
- Date of MSDS preparation
- Name and address of manufacturer

When chemicals are ordered, the UXOSO or his designee will specify on the purchase order that chemicals are not to be shipped without corresponding MSDSs. When chemicals and MSDSs arrive, they will be reviewed for completeness by the UXOSO or his designee. Should any MSDS be incomplete, a letter or facsimile will be sent immediately to the manufacturer requesting the additional information. The ESCA RP Team or its

subcontractors will not accept any shipped chemical materials to the former Fort Ord without an MSDS.

A complete file of MSDSs for all hazardous chemicals to which an employee of the ESCA RP Team may be exposed will be kept in labeled files on site. In the event that an MSDS is missing, the employee should immediately contact the UXOSO or PHSM.

MSDSs at this site will be reviewed during periodic audits by the PHSM or designee. Should there be an MSDS that has not been updated within the past year, a new MSDS will be requested.

Labels and Other Forms of Warning

The Hazard Communication Standard requires that hazardous chemicals be labeled by manufacturers. The label must contain the following:

- Chemical identity
- Appropriate warnings
- Name and address of manufacturer, importer, or other responsible party.

If the labels are incomplete or missing, ESCA RP Team personnel will refuse the shipment.

When chemicals are transferred from the manufacturer's containers to secondary containers, the UXOSO will ensure that the containers are labeled with the identity of the chemicals and appropriate hazard warnings. Labels for secondary containers can be obtained from the UXOSO.

The entire labeling procedure will be reviewed at least annually and changed as necessary.

Employee Information and Training

Prior to starting work, the ESCA RP Team and its subcontractors' employees will attend a site-specific safety and health training course. This course will include Hazard Communication Training to review the contents of this program and learn the hazards associated with each listed hazardous chemical. The training will be performed by the UXOSO. The format will be classroom training.

Training Topics

The site training will include:

- An overview of the requirements of the Hazard Communication Standard
- The labeling system and how to use it
- How to review MSDSs and where they are kept
- Chemicals present in work operations

- Physical and health effects of hazardous chemicals
- Methods and observation techniques used to determine the presence or release of hazardous chemicals in the area
- PPE and work practices to reduce or prevent exposure to chemicals
- Steps to be taken to prevent or reduce exposure to chemicals
- Safety-emergency procedures to follow if exposure occurs
- Location and availability of written program and MSDSs
- Equipment training (Table 8)

Following the training session(s), each employee will sign and date the training record. Additional training may be provided by the UXOSO, with the introduction of each new hazardous chemical. Records of additional training will be maintained.

On-Site Contractors and Visitors

WESTON understands that at times other persons may be on the work site. New contractors, subcontractors, and visitors will be required to attend site health and safety training to familiarize them with the contents of this document and the specific hazards associated with the former Fort Ord. New contractors, subcontractors, and visitors will be provided with the following information:

- Hazardous chemicals to which the contractor's employees or visitors may be exposed
- Precautions necessary to protect employees during normal operating conditions and foreseeable emergencies
- Labeling system used in the work place

It is the responsibility of the UXOSO to ensure that all MSDSs of chemicals to which the contractor's employees or visitors may be exposed are made available at a central location in the work place along with an example of the labeling system in use. Visitors and subcontractors will be informed of the availability of this information and its location.

Program Review

This written hazard communications program for the ESCA RP Team will be reviewed by the PHSM at least annually and updated as necessary.

16.0 REFERENCES

National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and U.S. Environmental Protection Agency (NIOSH/OSHA/USCG/EPA). 1985. Occupation Safety and Health Guidance Manual for Hazardous Waste Site Activities. October.

Vetter, Rick. 1999. Identifying and Misidentifying the Brown Recluse Spider, Dermatology Online Journal 5(2):7,
<http://dermatology.cdlib.org/DOJvol5num2/special/recluse.html> (accessed 12/3/07).

Table 7
Hazard Analysis by Site Activity, Activity 1 - Preliminary Activities

Activity	Hazards	Hazard Control
Mobilization of personnel, equipment, and supplies to the project site, setup of office and storage areas	Chemical Hazards - Non-intrusive activities; therefore, the risk level of exposure to site contaminants during this activity is low. Focus on hazard awareness and change of conditions.	No intrusive measures allowed during this activity. Wear appropriate PPE for skin protection and to prevent dermal contact. Avoid liquid pools and stained areas if possible. An initial visual survey will be conducted to confirm the levels of protection are correct for the activity.
	Physical Hazards - Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	The work area will be visually inspected. Housekeeping - Slip, trip, and fall hazards will be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; and ice, snow, and mud will be cleared from steps to reduce slip hazards. Work to be completed in adequate natural light or assure sufficient illumination is maintained. Site personnel will conduct an initial walkover, and the “buddy system” will be implemented. Fall protection (railing or Fall Arrest Systems) will be installed if work is to be conducted at a level higher than 6 feet. See field operating procedure (FLD) 02, FLD 11, FLD 12, and FLD 39.
	Manual lifting	Use proper lifting techniques such as keeping straight back, lifting with legs; avoid twisting back; use mechanical equipment or get help from others whenever possible. Heavy loads will be split into smaller loads and/or assistance sought. The path of travel should be cleared prior to the lift. See FLD 10.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. See FLD 31 and 32.
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel will be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects.

Table 7
Hazard Analysis by Site Activity, Activity 1 - Preliminary Activities

Activity	Hazards	Hazard Control
Mobilization of personnel, equipment, and supplies to the project site, setup of office and storage areas (continued)	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35, and 38.
	Moving/heavy equipment operations.	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel restricted in area of operation. Back up alarms functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Hand tools, manual and power.	Tools will be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Use tools properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter. All personnel will be trained on the proper use of all power tools. Lockout/ tagout procedures will be implemented per FLD 42 and 29 Occupational Safety and Health Administration (OSHA) 1910. Also see FLD 38.
	Caught in/between/struck by or against an object.	Workers will stay out of the swing area of all equipment and will not walk, work or stand near equipment being loaded or unloaded. No personnel will ride on the equipment unless seats are provided. See FLDs 20, 23, and 24. Ground personnel near operating heavy equipment will wear hard hats and traffic vests. The handling and placement of heavy equipment will be carefully coordinated. Materials and objects will be inspected for rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. Backup alarms will be in operable condition. Unnecessary backing will be avoided. Safety toe footwear will be required. Tools will be properly used.

Table 7
Hazard Analysis by Site Activity, Activity 1 - Preliminary Activities

Activity	Hazards	Hazard Control
Mobilization of personnel, equipment, and supplies to the project site, setup of office and storage areas (continued)	Inclement weather, heat/cold stress	Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH), National Institute for Occupational Safety and Health (NIOSH) guidelines, and FLDs 05 and 06. Personnel will be monitored. Salt will be applied to walkway and roadway surfaces where ice is a problem. As determined by the UXOSO, operations are to cease during severe weather conditions, see FLD 02 – Inclement Weather.
	Traffic	Work areas will be clearly barricaded using existing gates and appropriate signs displayed. Traffic will be rerouted as necessary. Persons working in traffic area, near roadways or directing traffic will wear high visibility (reflective) vests. Posted speed limit of 15 miles per hour. See FLD 20.
	Biological - Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid poisonous plants and avoid contact. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan— First Aid Procedures FLD 43.
	Radiation - Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sunblock as appropriate. Avoid direct exposure to sun for long periods of time. There is no known source of radioactive material at this site.

Table 7

Hazard Analysis by Site Activity, Activity 2 - Site Preparation Activities

Activity	Hazards	Hazard Control
Site surveying to delineate work areas	Chemical Hazards - The potential for exposure to petroleum and diesel products exist for this task.	Vehicles will not be over-filled, and caution will be used whenever refueling. Refueling will not be conducted within 100 feet of an open flame.
	Physical Hazards - Slip, trips, falls; tools, terrain or vegetation, uneven walking surfaces; weather hazards; poor visibility.	The work area will be visually inspected. Housekeeping - Slip, trip, and fall hazards will be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized and ice, snow, and mud will be cleared from steps to reduce slip hazards. Work to be completed in adequate natural light or assure sufficient illumination is maintained. Site personnel will conduct an initial walkover, and the “buddy system” will be implemented. Fall protection (railing or Fall Arrest Systems) will be installed if work is to be conducted at a level higher than 6 feet. See FLD 02, FLD 11, FLD 12, FLD 39.
	Manual lifting	Use proper lifting techniques such as keeping straight back, lifting with legs; avoid twisting back; use mechanical equipment or get help from others whenever possible. Heavy loads will be split into smaller loads and/or assistance sought. The path of travel should be cleared prior to the lift. See FLD 10.
	Inclement weather, heat/cold stress	Personnel will be dressed according to weather conditions. Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to ACGIH, NIOSH guidelines, and FLDs 05 and 06. Personnel will be monitored. Salt will be applied to walkway and roadway surfaces where ice is a problem. As determined by the UXOSO, operations are to cease during severe weather conditions, see FLD 02 – Inclement Weather.

Table 7
Hazard Analysis by Site Activity, Activity 2 - Site Preparation Activities

Activity	Hazards	Hazard Control
Site surveying to delineate work areas (continued)	Moving/heavy equipment operations	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel restricted in area of operation. Back up alarms functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel will be made aware of potential hazards and will coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for ice and rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. See FLD 10.
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH threshold limit values (TLVs) will be used. Personnel operating chainsaws will use hearing protection. Hearing control program, which consists of audiometric examination; training; use of hearing protection; and sound level pressure monitoring when and where necessary. See FLD 01.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. See FLDs 31 and 32.
	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35 and 38.

Table 7

Hazard Analysis by Site Activity, Activity 2 - Site Preparation Activities

Activity	Hazards	Hazard Control
Site surveying to delineate work areas (continued)	Biological - Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid poisonous plants and avoid contact. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan—First Aid Procedures FLD 43.
	Radiation - There are no radiological hazards expected because past uses do not indicate the use of radioactive material. Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sunblock as appropriate. Avoid direct exposure to sun for long periods of time. There is no known source of radioactive material at this site.

Table 7
Hazard Analysis by Site Activity, Activity 3 - Excavation Activities

Activity	Hazards	Hazard Control
Excavation Activities	Chemical Hazard - The potential for exposure to petroleum and diesel products exist for this task.	Vehicles will not be over-filled, and caution will be used whenever refueling. Refueling will not be conducted within 100 feet of an open flame.
	Physical Hazards - Slip, trips, falls; tools, terrain or vegetation, uneven walking surfaces; weather hazards; poor visibility.	The work area will be visually inspected. Housekeeping - Slip, trip, and fall hazards will be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized and ice, snow, and mud will be cleared from steps to reduce slip hazards. Work to be completed in adequate natural light or assure sufficient illumination is maintained. Site personnel will conduct an initial walkover, and the “buddy system” will be implemented. Fall protection (railing or Fall Arrest Systems) will be installed if work is to be conducted at a level higher than 6 feet. See FLD 02, FLD 11, FLD 12, FLD 39.
	Manual lifting	Use proper lifting techniques such as keeping straight back, lifting with legs; avoid twisting back; use mechanical equipment or get help from others whenever possible. Heavy loads will be split into smaller loads and/or assistance sought. The path of travel should be cleared prior to the lift. See FLD 10.
	Inclement weather, heat/cold stress	Personnel will be dressed according to weather conditions. Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to ACGIH, NIOSH guidelines, and FLDs 05 and 06. Personnel will be monitored. Salt will be applied to walkway and roadway surfaces where ice is a problem. As determined by the UXOSO, operations are to cease during severe weather conditions, see FLD 02 – Inclement Weather.

Table 7
Hazard Analysis by Site Activity, Activity 3 - Excavation Activities

Activity	Hazards	Hazard Control
Excavation Activities (continued)	Moving/heavy equipment operations	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel restricted in area of operation. Back up alarms functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel will be made aware of potential hazards and will coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for ice and rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. See FLD 10.
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH TLVs will be used. Personnel operating chainsaws will use hearing protection. Hearing control program, which consists of audiometric examination; training; use of hearing protection; and sound level pressure monitoring when and where necessary. See FLD 01.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. See FLDs 31 and 32.
	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35 and 38.

Table 7
Hazard Analysis by Site Activity, Activity 3 - Excavation Activities

Activity	Hazards	Hazard Control
Excavation Activities (continued)	Biological - Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid poisonous plants and avoid contact. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan—First Aid Procedures FLD 43.
	Radiation - There are no radiological hazards expected because past uses do not indicate the use of radioactive material. Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sunblock as appropriate. Avoid direct exposure to sun for long periods of time. There is no known source of radioactive material at this site.

Table 7

Hazard Analysis by Site Activity, Activity 4 - Geophysical Investigation Activities

Activity	Hazards	Hazard Control
DGM surveying to delineate areas with potential MEC. Surveying accomplished via towed array methods	Chemical Hazards —The potential for exposure to petroleum and diesel products exist for this task.	Vehicles will not be over-filled, and caution will be used whenever refueling. Refueling will not be conducted within 100 feet of an open flame.
	Physical Hazards —Slip, trips, falls; tools, terrain or vegetation, uneven walking surfaces; weather hazards; poor visibility.	The work area will be visually inspected. Housekeeping - Slip, trip, and fall hazards will be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized and ice, snow, and mud will be cleared from steps to reduce slip hazards. Work to be completed in adequate natural light or assure sufficient illumination is maintained. Site personnel will conduct an initial walkover, and the “buddy system” will be implemented. Fall protection (railing or Fall Arrest Systems) will be installed if work is to be conducted at a level higher than 6 feet. See FLD 02, FLD 11, FLD 12, FLD 39.
	Manual lifting	Use proper lifting techniques such as keeping straight back, lifting with legs; avoid twisting back; use mechanical equipment or get help from others whenever possible. Heavy loads will be split into smaller loads and/or assistance sought. The path of travel should be cleared prior to the lift. See FLD 10.
	Inclement weather, heat/cold stress	Personnel will be dressed according to weather conditions. Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to ACGIH, and NIOSH guidelines, and FLDs 05 and 06. Personnel will be monitored. As determined by the UXOSO, operations are to cease during severe weather conditions. An adequate supply of drinking water will be provided in all places of work. Cool water will be provided during hot weather. Portable drinking water dispensers will be serviced to ensure sanitary conditions and be clearly marked “drinking water.” Water will not be dipped from containers. See FLD 02 – Inclement Weather.

Table 7
Hazard Analysis by Site Activity, Activity 4 - Geophysical Investigation Activities

Activity	Hazards	Hazard Control
DGM surveying to delineate areas with potential MEC. Surveying accomplished via towed array methods (continued)	Moving/heavy equipment operations	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel access will be restricted in area of operation. Back up alarms will be functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. The ground spotter will wear an OSHA approved hard hat. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel will be made aware of potential hazards and will coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for ice and rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. See FLD 10.
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH TLVs will be used. Personnel operating small gas engine equipment will use hearing protection. Hearing control program, which consists of audiometric examination; training; use of hearing protection; and sound level pressure monitoring when and where necessary. See FLD 01.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association 30, 30A and carried out under the supervision of a qualified person. Only labeled/listed containers and portable tanks will be used for the storage of flammables and/or combustibles. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. See FLDs 31 and 32.

Table 7

Hazard Analysis by Site Activity, Activity 4 - Geophysical Investigation Activities

Activity	Hazards	Hazard Control
DGM surveying to delineate areas with potential MEC. Surveying accomplished via towed array methods (continued)	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35 and 38.
	Biological —Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid poisonous plants and avoid contact. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan—First Aid Procedures FLD 43.
	Radiation —There are no radiological hazards expected because past uses do not indicate the use of radioactive material. Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sunblock as appropriate. Avoid direct exposure to sun for long periods of time. There is no known source of radioactive material at this site.

Table 7
Hazard Analysis by Site Activity, Activity 5 - MEC Operations

Activity	Hazards	Hazard Control
UXO safety escort activities, mag & flag operations to locate potential buried MEC, excavation and removal of potential MEC anomalies, and destruction/disposal of UXO and scrap materials	Ordnance	All ordnance items will be positively identified prior to movement. Positively identify any fuzing associated with munition item. If found fuzed, do not handle. If unfuzed, may be moved to central location with approval of UXOSO. MEC operations will be conducted during daylight hours only. If an unknown ordnance item is found, the SUXOS will be notified. Do not approach a smoking white phosphorus munition; the burning white phosphorus may detonate the explosive burster at any time. Do not transport white phosphorus munitions unless they are immersed in water, mud, or wet sand.
	Demolition Operations-Unintentional Detonations.	All demolition activities will be performed in accordance with 60A-1-1-31.
	Chemical Hazards — White Phosphorus, Explosives.	Avoid movement of a white phosphorus munition. Avoid inhalation of and skin contact with smoke, fumes, and vapors of explosives and related hazardous materials.
	Physical Hazards —Slip, trips, falls, equipment, materials, tools, terrain, uneven walking surfaces; weather hazards; poor visibility.	The work area will be visually inspected. Housekeeping – Slip, trip, and fall hazards will be either removed or marked and barricaded. Geophysical teams will be dealing with uneven terrain. Slips, trips, and fall hazards will be the most prevalent. Sufficient illumination will be maintained to ensure a safe working environment and weather conditions to be continuously monitored. The “buddy system” will be implemented. See FLD 02, FLD 11, FLD 12, FLD 39.
	Manual lifting.	Use proper lifting techniques such as keeping straight back, lifting with legs; avoid twisting back; use mechanical equipment or get help from others whenever possible. Heavy loads will be split into smaller loads and/or assistance sought. The path of travel should be cleared prior to the lift. See FLD 10.
	Inclement weather, heat/cold stress.	Personnel will be dressed according to weather conditions. Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to ACGIH, NIOSH guidelines, and FLDs 05 and 06. Personnel will be monitored. Salt will be applied to walkway and roadway surfaces where ice is a problem. As determined by the UXOSO, operations are to cease during severe weather conditions, see FLD 02 – Inclement Weather.

Table 7
Hazard Analysis by Site Activity, Activity 5 - MEC Operations

Activity	Hazards	Hazard Control
UXO safety escort activities, mag & flag operations to locate potential buried MEC, excavation and removal of potential MEC anomalies, and destruction/disposal of UXO and scrap materials (continued)	Moving/heavy equipment operations	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel restricted in area of operation. Back up alarms functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel will be made aware of the hazard and will coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. See FLD 10.
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH TLVs will be used. Personnel operating chainsaws will use hearing protection. Hearing control program, which consists of audiometric examination; training; use of hearing protection; and sound level pressure monitoring when and where necessary. See FLD 01.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. All explosives to be stored in an approved Bureau of Alcohol, Tobacco, Firearms, and Explosives Type 2 Magazine. See FLDs 31 and 32.
	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35, and 38.

Table 7
Hazard Analysis by Site Activity, Activity 5 - MEC Operations

Activity	Hazards	Hazard Control
UXO safety escort activities, mag & flag operations to locate potential buried MEC, excavation and removal of potential MEC anomalies, and destruction/disposal of UXO and scrap materials (continued)	Biological —Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid and identify poisonous plants, insects, and snakes. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan—First Aid Procedures FLD 43.
	Radiation —There are no radiological hazards expected because past uses do not indicate the use of radioactive material. Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sun block as appropriate. Avoid direct exposure to sun for long periods of time. There is no known source of radioactive material at this site.

Table 7
Hazard Analysis by Site Activity, Activity 6 - Closeout Activities

Activity	Hazards	Hazard Control
Restoration of work areas and the demobilization of all remaining equipment, temporary structures, and other items from the project site after project completion	<i>Chemical Hazards</i> —Contaminated source areas will have been removed, therefore, the risk level associated with these activities is low.	No intrusive measures allowed during this activity. Wear appropriate PPE for skin protection and to prevent dermal contact. Avoid liquid pools and stained areas if possible. An initial visual survey will be conducted to confirm the levels of protection are correct for the activity.
	<i>Physical Hazards</i> —Slip, trips, falls, equipment, materials, tools, terrain, uneven walking surfaces; weather hazards; poor visibility.	The work area will be visually inspected. Housekeeping – Slip, trip, and fall hazards will be either removed or marked and barricaded. Geophysical teams will be dealing with uneven terrain. Slips, trips, and fall hazards will be the most prevalent. Sufficient illumination will be maintained to ensure a safe working environment and weather conditions to be continuously monitored. The “buddy system” will be implemented. See FLD 02, FLD 11, FLD 12, and FLD 39.
	Caught in/between/struck by or against an object.	Workers will stay out of the swing area of all equipment and will not walk, work or stand near equipment being loaded or unloaded. No personnel will ride on the equipment unless seats are provided. See FLD 20, FLD 23, and FLD 24. Workers operating equipment and/or exposed to traffic hazards will wear traffic/reflectorized vests and hard hats. The handling and placement of heavy equipment will be carefully coordinated. A traffic control system for positioning and moving haul vehicles will be established. Heavy vehicle operators may remain in their vehicles only if they have cab over protection. If operators must check loads, loading will cease until the operator is back in the cabin or away from the vehicles in a safe location. Materials and objects will be inspected for rough or sharp edges, and appropriate precautions will be taken to avoid contact. Personnel will wear work gloves and avoid placing hands between objects. Backup alarms will be in operable condition. Unnecessary backing will be avoided. Safety toe footwear will be required. Tools will be properly used.

Table 7
Hazard Analysis by Site Activity, Activity 6 - Closeout Activities

Activity	Hazards	Hazard Control
Restoration of work areas and the demobilization of all remaining equipment, temporary structures, and other items from the project site after project completion (continued)	Moving/heavy equipment operations.	Only trained, experienced operators will operate equipment. Equipment will be inspected daily. Personnel will be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel restricted in area of operation. Backup alarms functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Always use appropriate PPE. See FLDs 20, 22, 23, and 24.
	Fire	Flammable liquids will be stored in safety containers and flammable storage cabinets. Propane cylinders will be stored outside in secured areas. Fuel storage tanks will be placed in impermeable dikes. Properly rated fire extinguishers will be placed within 50 feet of the fuel storage area, in construction equipment, and strategically in the construction area. See FLDs 31 and 32.
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH TLVs will be used. Personnel operating chainsaws will use hearing protection. Hearing control program, which consists of audiometric examination; training; use of hearing protection; and sound level pressure monitoring when and where necessary. See FLD 01.
	Traffic	Work areas will be clearly barricaded using existing gates and appropriate signs displayed. Traffic will be rerouted as necessary. Persons working in traffic area, near roadways or directing traffic will wear high visibility (reflective) vests. Posted speed limit of 15 miles per hour. See FLD 20.
	Electric hazards	Generators will be grounded unless self-grounded. Extension cords will be properly rated for intended use. Prior to any intrusive activity, authorities will be contacted for permits. Elevated parts of machinery, ladders, and antennas will be kept at least 10 feet from overhead electric lines. Electrical installations will be made by qualified electricians. A lockout/tagout program consistent with FLD 42 will be used for equipment maintenance. Also refer to FLDs 34, 35, and 38.

Table 7
Hazard Analysis by Site Activity, Activity 6 - Closeout Activities

Activity	Hazards	Hazard Control
Restoration of work areas and the demobilization of all remaining equipment, temporary structures, and other items from the project site after project completion (continued)	Inclement weather, heat/cold stress.	Personnel will be dressed according to weather conditions. Workers will be briefed and cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers. Work rest periods will be established according to ACGIH, NIOSH guidelines, and FLDs 05 and 06. Personnel will be monitored. Salt will be applied to walkway and roadway surfaces where ice is a problem. As determined by the UXOSO, operations are to cease during severe weather conditions, see FLD 02 – Inclement Weather.
	Biological —Possibility of stinging and biting insects, poisonous snakes; possibility of exposure to poison ivy, sumac.	Use appropriate insect repellants. Training to avoid and identify poisonous plants, insects, and snakes. Adhere to WESTON Bloodborne Pathogens Exposure Control Plan—First Aid Procedures FLD 43.
	Radiation —There are no radiological hazards expected because past uses do not indicate the use of radioactive material. Potential sun burn/sun poisoning hazard on bright, sunny days.	Use sunblock as appropriate. Avoid direct exposure to sun for long periods of time.

Table 8
Equipment and Training Requirements

Task/Activity	Equipment	Inspection	Training
Preliminary Activities: Mobilization of personnel, equipment, and supplies to the project site, setup of office and storage areas, and implementation of explosive storage area security upgrades	Magazine security upgrade equipment to be brought by subcontractor	Subcontractors will be required to conduct daily inspections and necessary maintenance for the equipment. Follow WESTON Inspection requirements per WESTON Health & Safety Program.	Equipment will be operated by qualified operators. An initial site-specific training will be conducted. Daily safety meetings will be conducted before beginning the work. Safe work practices and good housekeeping will be followed. Personnel will be informed of the contaminants and chemicals at the site and availability of Material Safety Data Sheet (MSDS).
Site Preparation Activities: Site surveying to delineate work areas and clearing of brush and small vegetation less than 4 inches in diameter in work areas	Survey equipment to be brought by subcontractor Weedwhackers and Chainsaws Schonstedt GA52/72	Subcontractors will be required to conduct daily inspections and necessary maintenance for the equipment. Follow WESTON Inspection requirements per WESTON Health & Safety Program. Weedwhacker and chainsaw operators will wear face mask, leg protection, hand protection, American National Standards Institute-approved footwear, and hearing protection. All equipment will be properly stored, inspected, maintained, and/or calibrated on a daily basis.	Workers involved in the clearing operation will be qualified and conduct activities in accordance with OSHA 29 CFR-1910.266 and U.S. ACE EM 385-1-1 Section 31. Daily safety meetings will be conducted before beginning the work to stress the importance of conducting all activities in a safe manner. Safe work practices and good housekeeping will be followed. Personnel will be informed of the contaminants and chemicals at the site and availability of MSDSs. Schonstedt's will be operated by qualified operators with 40-hr training with 8-hr refresher course.

Table 8
Equipment and Training Requirements

Task/Activity	Equipment	Inspection	Training
MEC Operations: mag & flag operations to locate potential buried MEC, excavation and removal of potential MEC anomalies, and destruction/ disposal of UXO and scrap materials	Hand tools and earth moving machinery, as necessary. Schonstedt GA52/72.	All equipment will be properly stored, inspected, maintained, and/or calibrated on a daily basis.	Daily safety meetings will be conducted before beginning the work to stress the importance of conducting all activities in a safe manner. Safe work practices and good housekeeping will be followed. Personnel will be informed of the contaminants and chemicals at the site and availability of MSDSs. Schonstedt's will be operated by qualified operators with 40-hr training with 8-hr refresher course.
Closeout Activities: Restoration of work areas and the demobilization of all remaining equipment, temporary structures, and other items from the project site after project completion	Hand tools and earth moving machinery, as necessary.	All equipment will be properly stored, inspected, maintained, and/or calibrated on a daily basis.	Daily safety meetings will be conducted before beginning the work to stress the importance of conducting all activities in a safe manner. Safe work practices and good housekeeping will be followed. Personnel will be informed of the contaminants and chemicals at the site and availability of MSDSs.

APPENDIX A

Site Compliance Checklist

SITE COMPLIANCE CHECKLIST

	In Compliance?		
	Yes	No	N/A
1. SITE SAFETY AND HEALTH PLAN (SSHP)			
• Corporate Safety and Health Program (CSHP) available upon request.			
• Relevant CSHP Attachments, Programs, and Standard Operating Procedures (SOPs) on site and being followed.			
• Approved Work Plan on site, and SSHP Review Form signed by all site personnel.			
• Work Plan being followed in compliance with Data Item Descriptions (DIDs).			
2. HAZARD ASSESSMENT			
• Personal protective equipment (PPE) selected and provided for initial entry if potential for exposure above permissible exposure limits (PELs) exists.			
• A task hazard assessment has been conducted to identify the hazards associated with each task.			
• A certificate of task hazard assessment has been completed, which identifies the appropriate PPE and mitigation to be used to protect personnel from task hazards.			
3. SITE CONTROL			
• Site control plan is being implemented (i.e., buddy system, communication, site security, etc.).			
• Exclusion, contamination reduction, or support zones established and posted as per SSHP.			
• Site personnel following the standing orders for each zone.			
4. TRAINING PROGRAM			
• All personnel have received the required 40-hour Occupational Safety and Health Administration (OSHA) HAZWOPER training (or its equivalent), 8-hour refreshers, and supervisors course, if applicable.			
• Personnel have received three-day supervised training and the Three-Day Training form has been signed by all personnel.			
• Copies of all training certificates are on site.			
• Emergency response personnel have been designated and trained to handle anticipated emergencies.			
• Employees informed of potential risks and hazards identified for each task they are to perform.			
• Employees notified of chemical, physical, biological, and toxicological properties of identified or suspected contaminants.			
• Hazard Communication Training has been given to personnel who work with products containing hazardous substances, to include a review of the relevant Minimum Separation Distances.			
• Site personnel given OSHA required, hazard-specific training, such as PPE, Hearing Conservation, etc., and training forms completed.			

	In Compliance?		
	Yes	No	N/A
• At least two site personnel are trained in First Aid/CPR.			
5. MEDICAL SURVEILLANCE			
• Medical surveillance provided, as a minimum, to personnel who: are exposed at or above the PEL/threshold limit value (TLV), use respirators, or are a member of the emergency response team.			
• Provisions made for medical surveillance of personnel who receive a documented, unprotected over-exposure or develop signs and symptoms of exposure.			
• Site-specific medical tests, as required by the SSHP, have been conducted prior to site personnel participating in site activities where exposure can occur.			
• Physician's statement retained in employees' records on site.			
• Personnel with potential occupational exposure to blood or other potentially infectious body fluids have been given the opportunity to be vaccinated against Hepatitis B Virus (HBV), and personnel who decline have signed the HBV Vaccination Declination Form.			
6. ENGINEERING CONTROLS, EQUIPMENT, WORK PRACTICES, AND PPE			
• Engineering controls and safe work practices (SWPs) being used whenever feasible.			
• Equipment required by the work practices (WP) is on site, inspected, and in proper working order.			
• PPE has been selected according to the limitations of the PPE, site hazards, and the level and type of hazard.			
• Self-contained breathing apparatus (SCBA) or positive pressure supplied air line, including an emergency escape respirator, provided when known or potential immediately dangerous to life or health (IDLH) conditions exist.			
• All PPE is being inspected, used, cleaned, stored, and maintained in accordance with (IAW) the SSHP.			
• Respiratory protection being issued only to personnel who have been trained and medically approved to use respiratory protective equipment.			
• Personnel using respirators have been tested for the respirator being used.			
7. MONITORING			
• Monitoring equipment being calibrated, operated, and maintained IAW manufacturer's requirements, and calibration, monitoring, and maintenance records available.			
• Monitoring being conducted IAW the WP to:			
– Identify potential IDLH or explosive conditions.			
– Assess personal exposures to chemical and physical hazards.			
– Evaluate exposures when a change in tasks or location occurs.			
– Assess exposures when previously unidentified materials/hazards are identified.			
• High-risk workers monitored initially and all workers monitored if levels indicate the need.			
• Work area and perimeter monitoring being conducted IAW the WP.			

	In Compliance?		
	Yes	No	N/A
• Site monitoring log being completed for all personnel and area monitoring.			
8. HANDLING DRUMS AND CONTAINERS			
• Drums and containers used on site meet Department of Transportation (DOT), OSHA, and Environmental Protection Agency (EPA) regulations.			
• Drums and containers found on site are being inspected prior to being moved or handled.			
• All unlabeled drums and containers being handled as hazardous waste until identified as nonhazardous.			
• Drum and container movement being minimized.			
• Drums/containers opened IAW approved methods listed in the WP.			
• Drum sampling performed IAW the approved sampling plan to classify contaminants in drums/containers prior to bulking, temporary storage, and shipping.			
• Staging of drums and containers being conducted IAW the WP, and staging areas provided with adequate ingress/egress.			
• DOT salvage drums and adequate spill response materials available, and written spill containment program available.			
• Materials are assessed for compatibility prior to being bulked together.			
• Shock-sensitive waste being identified and handled appropriately.			
• Lab packs are opened by properly trained personnel.			
• Tanks and vaults containing hazardous substances handled IAW the WP and confined space procedures, if needed, are being used for entry.			
• Drums and containers being transported off site by a licensed hazardous waste hauler.			
9. DECONTAMINATION PROGRAM			
• Site workers properly trained and complying with the written decontamination procedures.			
• All potentially contaminated equipment, clothing, and PPE are being properly decontaminated.			
• All decontamination solutions are being containerized into approved storage containers at the end of each day.			
• Decontamination procedures evaluated for effectiveness.			
• On-site showers and change houses comply with 29 CFR 199.141.			
10. EMERGENCY RESPONSE			
• Written emergency response plan incorporated in the WP.			
• Written procedures for reporting incidents to local, state, and federal agencies.			
• Emergency response plan rehearsed and amended as needed.			

	In Compliance?		
	Yes	No	N/A
• First aid, burn, and eye wash kits available on site and in each vehicle, with a blood-borne pathogen control kit located with each first aid kit.			
• Adequate type, number, and size fire extinguishers appropriately located on site and inspected weekly.			
• Flammable storage areas properly posted.			
• Employee alarm system IAW the WP and practiced.			
11. ILLUMINATION			
• Adequate light levels provided in all office, storage, and work locations.			
12. SANITATION AND HOUSEKEEPING			
• Adequate supply of potable water available from labeled containers or outlets.			
• Non-potable water sources appropriately labeled, and no open or potential cross connection to potable sources exists.			
• Appropriate type and adequate number of toilets available.			
• Personnel wash facilities provided and located near site, but away from exposure potentials.			
• Shower/change facilities located away from exposure potentials and designed to comply with the requirements of 29 CFR 1910.141.			
• Site being maintained in a neat and orderly fashion, free of trash and debris.			
• Adequate number of trash cans with lids are located on site and emptied regularly.			

REMARKS, OBSERVATIONS, AND RECOMMENDATIONS	
Signature of Auditor:	Date:

APPENDIX I

Response to Comments

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009

Review Comments provided by Gail Youngblood of the Army, dated October 29, 2009

No.	Comment Type / Report Section	Comment/Response
1	Specific Comment, p. 2-3, Section 2.2 Physical Setting	Comment: Third paragraph notes that the total acreage of the Future East Garrison MRA has been revised to reflect the final property transfer boundaries. The Army is pleased that the MRA boundary was updated to include all of the East Garrison property that was transferred to Fort Ord Reuse Authority (FORA) in connection with the Environmental Services Cooperative Agreement (ESCA). However, the report does not describe the designated future land use and habitat type (HMP category) for the additional acreage. Please update the text and/or figures to provide this information. Response: The following text has been added to the end of the first paragraph in Section 2.3.2, Future Land Use, explaining the future land use of the additional acreage: <i>“The additional land incorporated into the Future East Garrison MRA due to the revised property transfer boundaries is identified as a habitat reserve area.”</i> In addition, the following text has been added to the end of the third paragraph in Section 2.2, Physical Setting, to provide clarification: <i>“The revised property transfer boundary incorporated approximately 8 additional acres of land in the northeastern portion of the MRA. The physical setting for the additional land is consistent with the remainder of the MRA.”</i> The figures included in Appendix A depicting future land use and habitat types in the Future East Garrison MRA are presented as an excerpt from the Final Summary of Existing Data Report (SEDR). Therefore, these figures have not been updated for the Group 4 RI/FS Work Plan. In response to the comment, the following text was added to the end of Section 2.2 to provide clarification: <i>“The revised property transfer boundary of the Future East Garrison MRA incorporated additional land in the northeastern portion of the MRA. This area was not incorporated at the time the SEDR was completed, and is therefore not included in Appendix A.”</i> Also, the last sentence in Section 2.3 has been revised as follows: <i>“The CSM for the Future East Garrison MRA prior to the revised property transfer boundaries from the SEDR is provided as Appendix A of this work</i>

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Review Comments provided by Gail Youngblood of the Army, dated October 29, 2009

No.	Comment Type / Report Section	Comment/Response
		plan.”
2	Specific Comment, p.2-5, Section 2.2 Physical Settings	Comment: The fourth last sentence states “For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b).” Because Chapter 3 of the HMP requires many more mitigation measures during environmental investigation and remediation activities within habitat reserve areas, we recommend inserting text “, but are not limited to” to read “...these measures include, but are not limited to, conducting habitat monitoring...” Response: The cited sentence has been revised as follows: “For habitat areas, these measures include, but are not limited to, conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b).”
3	Specific Comment, p.4-1, Section 4.1 Summary of Approach for Group 4	Comment: The first paragraph discusses that additional data collection is not necessary because the existing data are of sufficient quantity to characterize the Future East Garrison MRA. As described elsewhere in the document, the Army has conducted several munitions response investigations and removal actions within the Future East Garrison MRA, resulting in a significant quantity of data being available for the RI/FS evaluation. However, it should be noted that in previous investigations, a portion of the subject MRA directly adjacent to munitions response sites (MRSs) 48 and 19, where RI/FS evaluation has not been completed, was not readily accessible due to dense vegetation. Please include an evaluation of adjacent site conditions as part of the detailed analysis of the MRA in the RI/FS as it may provide additional relevant data. Response: An evaluation of the investigations conducted in MRS-19 and MRS-48 and their respective site conditions will be included as part of the detailed analysis in the Group 4 RI/FS Report. In addition, due to the portion of the Future East Garrison MRA that has not undergone MEC investigation, additional field investigation activities are now planned for selected areas of the MRA. Therefore, the Group 4 RI/FS Work Plan has been modified to include two volumes: Volume 1 provides a rationale for the work plan approach; and the newly-added Volume 2 presents the sampling and analysis plan for the investigation. Volume 1 was revised in numerous areas to reflect the addition of a sampling and analysis plan (Volume 2).

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Review Comments provided by Gail Youngblood of the Army, dated October 29, 2009

No.	Comment Type / Report Section	Comment/Response
		In response to the specific comment, the first paragraph of Section 4.1 has been revised as follows: <i>“The Army has previously conducted investigations and removal actions within the Future East Garrison MRA. A portion of the Future East Garrison MRA was not accessible at the time of these previous investigations and removal actions due to the presence of dense vegetation. Information from the evaluations of site conditions in MRS-19 and MRS-48, located immediately adjacent to the southwestern portion of the MRA, will therefore be included in the Group 4 RI/FS Report. The data obtained during previous Army actions within the Future East Garrison MRA were reviewed during the development of the SEDR. The initial evaluation of previous munitions response actions within the MRA indicated that the existing data are of sufficient quantity to characterize the MRA. However, a portion of the Future East Garrison MRA has not undergone investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report. Therefore, additional field data will not be collected to complete the RI for this MRA. Data quality review will be performed during the RI for the MRA to confirm that the munitions response data and data collected during field activities are usable for the purposes of the risk assessment and FS.”</i> A summary of the previous investigations and removal actions has also been added to Section 2.1, MEC-Related History, and Section 3.0, Initial Evaluation, as follows: <u>Section 2.1 (new paragraph)</u> <i>“A portion of the Future East Garrison MRA was not previously investigated due to the presence of dense vegetation. Previous investigations and removal actions have, however, been conducted immediately adjacent to these areas, which included MRS-19 and MRS-48 located to the southwest of the MRA. These previous actions included a SS/GS sampling investigation performed by USA Environmental Inc. (USA) on MRS-48 (USA 2001d), a removal action by CMS Environmental, Inc (CMS) on MRS-19 (CMS 1996), and a sampling survey by Human Factors Applications, Inc.(HFA) on MRS-19 (HFA 1994).”</i> <u>Section 3.0 (added to the end of the third paragraph)</u> <i>“Previous investigations and removal actions in MRSs adjacent to the Future East Garrison MRA included a sampling survey performed in MRS-19 (HFA 1994); removal action in MRS-19 (CMS 1996); and a SS/GS sampling investigation in MRS-48 (USA2001d).”</i>

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No.	Comment Type / Report Section	Comment/Response
		Section 3.0 (added to the end of the last paragraph) <i>“However, a portion of the Future East Garrison MRA has not undergone previous investigation; therefore, additional field investigation activities are planned for selected areas of the MRA. The results of the investigation activities will be incorporated into the Group 4 RI/FS Report.”</i>
4	Specific Comment, p.4-11, Section 4.9.3 Implementation of Community Relations Activities	Comment: The third last bullet indicates that public notices would be issued in local newspapers to announce the availability of RI-related documents and opportunities for public comment. Please note that, unlike the Proposed Plan, newspaper public notices of availability of RI/FS reports and associated work plans are not required under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the National Contingency Plan (NCP). The Army utilizes a variety of other methods to communicate with the public with regard to the development and review of these types of documents, as described in the current Community Relations Plan for the former Fort Ord. Without further clarification, a reader may erroneously conclude that similar notices would be provided by the Army on other Fort Ord RI/FSs that may be developed in the future. Please provide a clarification on this point or delete the text regarding public notices. Response: The cited bullet has been revised as follows: “Publish public notices in local newspapers, and provide press releases to the media announcing the availability of <i>applicable decision</i> ~~RI-related~~ documents and opportunities for public comment.”

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study, dated October 9, 2009

Review Comments provided by Judy Huang of EPA, dated December 10, 2009

No.	Comment Type / Report Section	Comment/Response
1	General Comment	Comment: The Draft Group 4 Remedial Investigation/Feasibility Study Work Plan, Future East Garrison Munitions Response Area, Former Fort Ord, Monterey, California, dated October 9, 2009 (hereinafter referred to as the Draft Group 4 RI/FS WP), contains a number of questionable entries concerning munitions and explosives of concern (MEC) discovered on the MRS. Section 3.0, Initial Evaluation, notes in the last paragraph on page 3-1 that, "During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training (M228 practice hand grenade fuzes and M117 explosive booby trap simulators). A total of 243 of the 336 MEC items were recovered from these burial pits." Common practice and logic indicates that it is very unlikely that all 243 of the items were unexploded ordnance (UXO), since the failure to function of 243 munitions items would be cause for a Department of Defense (DoD)-wide malfunction investigation of the munitions lots involved. Also, it is unlikely that supervisory personnel would agree with the collection and burial of 243 munitions items classed as UXO due to the potential hazards involved. It would, therefore, appear that all or a majority of the items discovered in the burial pits were most likely discarded military munitions (DMM) and not UXO. However, the same section lists more or all of these items as UXO in the first bullet on page 3-2. This categorization is repeated in Appendix A, Future East Garrison MRA Conceptual Site Model, in Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, where the same items are obviously listed as UXO, since there are no items classified as DMM found in the table. This table does, however, contain a nomenclature footnote explaining the reason for the apparent erroneous categorization of the MEC. To avoid potential confusion as to the correct categories of the MEC items found in the cited burial pits, it would be advisable if a footnote or other explanatory text were provided at the initial mention of the buried MEC discovered in the two pits found on the MRS. Please make this correction at the noted locations and elsewhere in the Draft Group 4 RI/FS WP as deemed necessary. Response: Based on review of available information, the Army has revised the classification for these items in the MMRP Database from UXO to DMM. Therefore, the following revisions have been made to the above-referenced paragraph of Section 3.0:

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Review Comments provided by Judy Huang of EPA, dated December 10, 2009

No.	Comment Type / Report Section	Comment/Response
		“During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training (~~M228 practice hand grenade fuzes and M117 explosive booby trap simulators~~). A total of 243 of the 336 MEC items were recovered from these burial pits. One burial pit contained 183 M228 practice hand grenade fuzes and the other burial pit contained 60 M117 explosive booby trap simulators; these munitions items are classified as DMM in the MMRP Database.” In addition, the first bullet on Page 3-2 has been revised to two bullet items as follows: • ~~83326~~ UXO items • 243 DMM items Lastly, Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, in Appendix A, Future East Garrison MRA Conceptual Site Model, is presented as an excerpt from the SEDR and will not be updated for the Group 4 RI/FS Work Plan.
1	Specific Comment, Page vii, Glossary	Comment: The definition of Construction Support found here does not match that found in the Department of Defense Ammunition and Explosives Safety Standards (DoD 6055.09-STD). The correct definition is as follows: Construction Support. Assistance provided by DoD explosive ordnance disposal (EOD) or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards. In addition, the definition provided in the Glossary section of Volume 1 indicates that “qualified UXO personnel” may provide this support, which is not always the case. Care must be taken in the use of the terms “UXO Personnel,” “UXO Technicians,” “qualified UXO personnel,” and “UXO-Qualified Personnel,” as they are not necessarily interchangeable. In some instances, they appear to be used in a manner that may conflict with Department of Defense Explosives Safety Board (DDESB) Technical Paper

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No.	Comment Type / Report Section	Comment/Response
		18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel). The following are the related definitions presented in that document: • UXO-Qualified Personnel: Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist or Senior UXO Supervisor. • UXO Technician: Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III. The term “UXO Sweep Personnel” is not formally defined, although the training and functions thereof are outlined in the DDESB Technical Paper 18. However, it is listed under the heading of “UXO Related Position Titles and Tasks” in that Technical Paper, as are the UXO Technician I, UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist and Senior UXO Supervisor. These positions are UXO personnel per the title of Technical Paper 18. The term “qualified UXO personnel” can mean any of these individuals that are qualified to perform their UXO related functions (including UXO Technician I and UXO Sweep Personnel). However, the term “UXO-Qualified” does not include UXO Sweep Personnel or UXO Technician I by definition. Care must be exercised in the use of these terms to avoid the presentation of incorrect information by their misuse. This could result in individuals performing functions that they are not fully qualified to perform. This issue is compounded by the use of the term “unexploded ordnance (UXO) personnel” in the definition of “Anomaly Avoidance” that is found in the Glossary. As this definition does not match that found in DoD 6055.09-STD, it should be replaced by the official definition, which does not use the term “unexploded ordnance (UXO) personnel.” Please replace the noted definitions found in the Glossary Section with those found in the current version of DoD 6055.09-STD. Also, please review the use of the noted UXO Personnel terms in the remainder of the Draft GP 4 RI/FS WP and correct them as necessary to comply with the definitions found in DDESB Technical Paper 18.

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No.	Comment Type / Report Section	Comment/Response
		Response: The definition for Construction Support provided in the glossary of the Group 4 RI/FS Work Plan has been replaced with the DoD standard definition as stated above. The definition for Anomaly Avoidance has also been revised to agree with the DOD standard definition as follows: Anomaly Avoidance Techniques employed on property known or suspected to contain unexploded ordnance (UXO), other munitions that may have experienced abnormal environments (e.g., discarded military munition (DMM)), munitions constituents in high enough concentrations to pose an explosive hazard, or chemical agent (CA), regardless of configuration, to avoid contact with potential surface or subsurface explosive or CA hazards, to allow entry to the area for the performance of required operations. The terms “UXO Personnel,” “UXO Technician,” “qualified UXO personnel,” and “UXO-Qualified Personnel,” have been reviewed throughout the Group 4 RI/FS Work Plan and have been revised where necessary to comply with the definitions stated in the Department of Defense Explosives Safety Board (DDESBS) Technical Paper 18. Given the revision of the definition in the glossary for Anomaly Avoidance, the term “unexploded ordnance (UXO) personnel” is no longer used in the document.
2	Specific Comment, Section 3.0, Initial Evaluation, Page3-2	Comment: The first two paragraphs of this section on the cited page state that, “In total, the removal actions in the Future East Garrison MRA resulted in the removal of the following: • 326 UXO items • 10 Insufficient Data (ISD) items (material potentially presenting an explosive hazard [MPPEH] that could not be classified as UXO, DMM, or MD) • 4,107 pounds of MD (includes MD [expended] and MD [fragmented] items if weights were documented) According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury), 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual

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No.	Comment Type / Report Section	Comment/Response
		if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities)." There are some issues with the cited verbiage. These include: • The 10 items categorized as "MPPEH" should not be classified as such if they are to be included in the 336 MEC items recovered, particularly since it is stated that they could be MD. If the intent is to state that these items were MEC of an undetermined category (see definition of MEC found in the Glossary section), then do not call them MPPEH. MEC by definition always presents an explosive hazard, not a potential one as MPPEH does by definition. List them as MEC items with insufficient data (ID) to place them in a subclass (i.e., UXO, DMM, or MC present in high enough concentrations to present an explosive hazard). • The statement that, "According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury),..." By definition, there is no such thing as inert MEC. MEC is explosive; therefore, it cannot be inert. This should be explained in the text or in a footnote, as is done in the previously cited Table 12.3-3 of Appendix A. Please correct the cited text as noted. Response: In response to the first bulleted comment, there is agreement that "MPPEH" is inappropriately used when referring to munitions items with Insufficient Data (ISD). The term ISD was created to identify munitions items that could not be definitively classified as UXO, DMM, or MD. Where there was uncertainty, the item was classified as ISD. Therefore, the bullet description of the munitions items with ISD has been revised as follows: • 10 Insufficient Data (ISD) items (~~material potentially presenting an explosive hazard [MPPEH] that~~ could not be definitively classified as UXO, DMM, or MD) For the purposes of reporting for the ESCA, the ISD items will be considered MEC.

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No.	Comment Type / Report Section	Comment/Response
		In response to the second bulleted comment, the two items designated as MEC with a hazard classification of 0 is incorrect. The two MEC items were not assigned a hazard classification in the Army's MMRP database. However, in the SEDR, a default hazard classification of zero was entered into the table summarizing the data if a value was not specified in the Army's MMRP database (Table 12.3-3; ESCA RP Team 2008a). Table 12.3-3, provided in the SEDR (and reproduced in Appendix A of this report), contains hazard classifications of zero that were not specified for items in the Army's MMRP database. As part of the Group 4 remedial investigation and risk assessment activities, items with unassigned hazard classifications in the Army's MMRP database will be further evaluated by the ESCA RP and the most conservative hazard classifications will be assigned to the items. Therefore, the text for the paragraph in Section 3.0 referenced in the second bulleted comment has been revised as follows: "According to the Fort Ord MMRP database, of the 336 MEC items, two items ~~were not assigned~~ had a hazard classification of 0 (inert munitions item that will cause no injury), 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual's activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual's activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual's activities)."
3	Specific Comment, Appendix A, Future East Garrison MRA Conceptual Site Model, Page 12-19	Comment: This CSM contains a Table 12.3-3, East Garrison MRA – Types of MEC Removed and Hazard Classification, which lists a "Flare, type unknown" as UXO and assigns a hazard class of 0 (zero). This cannot be correct, as an item classified as UXO cannot be inert by definition, and the hazard classification of 0 is reserved for inert items. Please review the cited table and correct the noted listing as necessary. Response: The hazard classifications of one, two, and three presented in Table 12.3-3 are consistent with the Army's MMRP Database. In the SEDR, a default hazard classification of zero was entered into the table summarizing the data if a value was not specified in the Army's MMRP database (Table 12.3-3; ESCA RP Team 2008a). Table 12.3-3, provided in the SEDR (and reproduced in Appendix A of this report), contains hazard classifications of zero that are not specified for items in the Army's MMRP database. A footnote is provided with the table that states that discrepancies in the data are a result of misinformation from the data sources, however a footnote was not included in the SEDR to clarify that the hazard classification of zero was assigned to items where no hazard classification was included in the Army's

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study, dated October 9, 2009

Review Comments provided by Judy Huang of EPA, dated December 10, 2009

No.	Comment Type / Report Section	Comment/Response
		MMRP database. Given that Table 12.3-3 is presented as an excerpt from the SEDR, no changes have been made to the table. As mentioned in the response to Specific Comment No. 2, a statement referring to the two items with a hazard classification of zero (flare, type unknown and Projectile, 4.2-inch) has been added to Section 3.0 to clarify that the hazard classification of zero was assigned to these items as a default hazard classification.

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009

Review Comments provided by Mike Weaver of FOCAG, dated December 11, 2009

No.	Comment Type / Report Section	Comment/Response
1	General Comment	Comment: The rationale for dividing the Fort Ord Superfund Site into nine group areas, this report focusing on group 4, isn't clear. However, perhaps it has something to do with LFR's advertised "Wide Area Assessment Technology"? The area here is a stated 244 acres. It lies within the unincorporated area of Monterey County. We see no distribution of this document to the Monterey County Planning Department. Response: The nine MRAs were developed based on property transfer parcels and were categorized into four groups (Group 1 through Group 4) based on an evaluation of the available data, Conceptual Site Models, preliminary assessments of risk, and regulatory pathway requirements. Each group consists of one or more MRAs that have similar pathway-to-closure characteristics. This explanation was presented in Section 1.4, Preliminary RI/FS Scoping and Implementation, of the Group 4 RI/FS Work Plan and in greater detail in Section 13.0, Program Implementation, of the Summary of Existing Data Report (SEDR). The draft, draft final, and final versions of the SEDR were provided directly to you using a package tracking delivery service and posted to the Administrative Record in February, June, and November 2008, respectively, for public review. There is no requirement to provide the Group 4 RI/FS Work Plan to the Monterey County Planning Department. No changes have been incorporated into the report based on this comment.
2	General Comment	Comment: Data from previous site sampling from approximately the years 1996 to as late as the year 2000 (in some cases) is used as justification for your conclusion on page 5-1 that "...no additional field investigation activities are anticipated for the Future East Garrison MRA prior to conducting the RI/FS." Response: The Group 4 RI/FS Work Plan has been revised to include additional investigation in selected areas of the Future East Garrison MRA as part of the development of a RI/FS report. The initial evaluation of data for the Future East Garrison MRA conducted as part of the SEDR indicated that existing data was of sufficient quantity and quality to characterize the MRA for the purpose of completing the RI/FS. However, due to the portion of the Future East Garrison MRA that has not undergone previous investigation, additional field investigation activities are planned for selected areas of the MRA. A second volume has been added to the Group 4 RI/FS Work Plan to present the Group 4 Sampling and Analysis Plan and Quality Assurance Project Plan.

Response to Comments
Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009
Review Comments provided by Mike Weaver of FOCAG, dated December 11, 2009

No.	Comment Type / Report Section	Comment/Response
		The results of the additional investigation activities will be incorporated into the RI/FS report for Group 4.
3	General Comment	Comment: Old sampling, done with Schonstadt's, and some sample digging to respective depths of one foot and four feet, are apparently being considered adequate for anointing approximately 68 acres of the area as being ok for residential housing. How dense this housing is to be, or the type of housing anticipated, is not disclosed. Response: The adequacy of the geophysical instruments used during investigation activities on the Future East Garrison MRA (i.e., Schonstedt magnetometers) will be evaluated in the Group 4 RI/FS report as described in Section 4.3.2.1, Equipment Evaluation, of the Group 4 RI/FS Work Plan. In addition, the Group 4 RI/FS Work Plan focuses on MEC investigation in support of a RI/FS, Proposed Plan, and Record of Decision. The ESCA Remediation Program does not determine housing density and types. No changes have been incorporated into the report based on this comment.
4	General Comment	Comment: The printed, anticipated project schedule, located at the back of this document is presumptuous for a "draft work plan". It's pre-determined, or, also known as reverse engineering. Response: The anticipated project schedule is a required element of the Group 4 RI/FS Work Plan as outlined in Section 2.3.1 of the EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (APE/540/G-89/001). No changes have been incorporated into the report based on this comment.
5	General Comment	Comment: Has the baseline risk assessment as required by CERCLA statute been completed for your Group 4 designated area? How can an RI/FS process go forward without such essential information? Response: This subject was raised in the FOCAG Position Paper dated August 12, 2008. The response from the Army, DTSC, EPA, and FORA to this concern and

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009

Review Comments provided by Mike Weaver of FOCAG, dated December 11, 2009

No.	Comment Type / Report Section	Comment/Response
		others was presented to FOCAG in a letter from the Army, dated November 17, 2008 (Fort Ord Administrative No. ESCA-0126). The potential presence of soil contamination at known or suspected small arms ranges, multi-use ranges, and military munitions training areas were evaluated by the Army and reported in the Final Comprehensive Basewide Range Assessment Report, Former Fort Ord, California, Revision 1, June 9 (Fort Ord Administrative Record No. BW-2300J). No changes have been incorporated into the report based on this comment.
6	General Comment	Comment: The areas of Group 4 are in the vicinity of the portion of Fort Ord first purchased by the Army in 1919. There is little information on training uses, and no maps at all are available that we are aware of, showing pre-1945 uses. Group 4 is just east of, and in proximity to listed Combat Ranges on a 1945 map we are including as an attachment. Response: As presented in the Group 4 RI/FS Work Plan, the Group 4 RI/FS report will include a review of site historical records (including historical aerial photographs and facility training maps), military history, and archives search reports to determine the documented historical land use and known historical military practices conducted on and surrounding the Future East Garrison MRA. No changes have been incorporated into the report based on this comment.
7	General Comment	Comment: We find the ordnance sampling done to be minimal, and used the sub-standard Schonstadt. There has been no investigation of deeply buried penetrating ordnance. Two burial pits are revealed as having been found in this draft work plan report. From my visits as a boy to former Fort Ord, when it was an active Army training base, burial pits were up to ten feet deep. Indeed they would often be dug about ten feet deep and the bulldozer would be left nearby, unmanned, until such time as the bulk of the most current training exercise was dumped or pushed into the burial pit, then it would be covered up and over with dirt. Some of these large burial pits I witnessed were about half filled, approximately five feet deep. Response: The adequacy of the geophysical instruments used during investigation and removal action activities on the Future East Garrison MRA (i.e., Schonstedt magnetometers) will be evaluated in the Group 4 RI/FS report as described in Section 4.3.2.1, Equipment Evaluation, of the Group 4 RI/FS Work Plan. The adequacy of investigations and removal actions will also be evaluated in the

Response to Comments

Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, dated October 9, 2009

Review Comments provided by Mike Weaver of FOCAG, dated December 11, 2009

No.	Comment Type / Report Section	Comment/Response
		Group 4 RI/FS report as described in Section 4.3.2.2 of the Group 4 RI/FS Work Plan. No changes have been incorporated into the report based on this comment.
8	General Comment	Comment: Regarding residual chemical contamination, aka, COC's Chemicals of Concern: Where is the risk assessment? Of the approximately 200 potential constituents, what was looked for? Where was it specifically looked for? When was it looked for? Who did the sampling? Response: This subject was raised in the FOCAG Position Paper dated August 12, 2008. The response from the Army, DTSC, EPA, and FORA to this concern and others was presented to FOCAG in a letter from the Army, dated November 17, 2008 (Fort Ord Administrative No. ESCA-0126). This comment is outside of the intended scope of the Group 4 RI/FS Work Plan under the AOC. The purpose of the Group 4 RI/FS Work Plan as defined under Task 3 of the AOC Scope of Work is to propose methodology to obtain the necessary information identified in the SEDR to characterize the nature and extent of MEC in order to propose a preferred remediation alternative pursuant to CERCLA. No changes have been incorporated into the report based on this comment.

Response to Comments

Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
1	Volume 2 – Sampling and Analysis Plan, p. 2-3, Section 2.2.1 Future East Garrison MRA Remedial Investigation Areas	Comment: Rationale for selecting Grids 1 and 2 for investigation. The text suggests that these grids were located to the south of an area identified by the Army as a potential practice mortar range. However, no such area was previously identified in the suggested location. A suspected stokes mortar range was identified "to the east of MRS-42" and "between Barloy Canyon Road and Crescent Bluff Road" in Final Site Assessment East Garrison Area 4 Site Report (Administrative Record number: OE-0556J) based on the finding of expended MKI practice Stokes trench mortars (munitions debris [MD]). Therefore, it is suggested to replace text "to the south of" with "in the vicinity of" to avoid potential confusion. Response: The bulleted text has been revised as follows: Grids 1 and 2 were selected at the top and bottom of a ridge in the northern portion of the MRA. These grids are ~~to the south~~ in the vicinity of an area identified by the Army as a potential practice mortar range. The grids are placed to capture data in potential impact areas.
2	Volume 2 – Sampling and Analysis Plan, p.2-8, Section 2.3.2 Analog Investigation	Comment: The fourth paragraph includes a sentence "MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians." The statement is followed by paragraphs that provide for collection of additional data on MD that may be recovered during intrusive investigation. The text is currently unclear as to what information will be recorded for recovered MD. Please clarify. Response: The section has been revised as follows: ~~"MEC items encountered on the surface will be immediately reported to the SUXOS, surveyed with a GPS unit for documentation purposes, and handled in accordance with the proper handling procedures. MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians."~~ <i>If the anomaly is a MEC item or MD that can be identified, the type of munitions, approximate weight, and inclination and declination of the item will be recorded in accordance with the QAPP presented in Appendix D of this G4 SAP. If the anomaly yields a non-military munitions item or fragments or pieces of MEC items that are not intact and cannot be positively identified, then the approximate total weight and depth</i>

Appendix I

Response to Comments

Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		<i>of the item(s) will be recorded, but the type of MEC item(s) and the inclination and declination of MEC item(s) will not be recorded.</i> The UXO Teams will be provided with the appropriate forms to record relevant data related to their ~~intrusive~~ investigation and will be provided information needed to excavate the “mag and dig” anomalies. Annotations will be recorded for MEC and MD that can be positively identified. Annotations will include site name, instrument used, easting and northing coordinates (in local NAD 1983 State Plane Coordinates, California Zone IV, U.S. survey feet), grid number, instrument response and units, source type of response, description, weight, depth, and subsequent actions taken. ~~If the anomaly yields a non-military munitions item or fragments or pieces of MEC items that are not intact and cannot be positively identified, then the approximate total weight and depth of the item(s) will be recorded, but the type of MEC item(s) and the inclination and declination of MEC item(s) will not be recorded.~~ ~~If the anomaly is an MEC item or MD that can be identified, the type of munitions, approximate weight and inclination and declination of the item will be recorded in accordance with the QAPP presented in Appendix D of this G4 SAP.~~ The MEC items encountered will be initially classified as materials potentially presenting an explosive hazard (MPPEH) until the items are fully inspected and can be identified as MEC, MD, or metal scrap. MD and metal scrap will be transported from the investigation area and stored until it can be disposed of by a foundry and/or recycler, where it will be processed through a smelter, shredder, or furnace prior to resale or release. Prior to leaving the MRA, the MD and metal scrap will be inspected by a SUXOS and a UXOQCS to verify that it is FFE. The MD will be shredded and recycled at an authorized recycler.
3	Volume 2 – Sampling and Analysis Plan, p.2-11, Section 2.4.2 DGM Surveys	Comment: In this section, the use of EM61-MK2 mounted on FORA ESCA Sled is proposed as the instrument of choice in the event that digital geophysical investigation is desired in a portion of the investigation areas. Previous uses of the FORA ESCA Sled in other MRAs within the ESCA required extensive site preparation, such as vegetation removal to the extent beyond what would

Response to Comments

Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		be typically conducted to support analog investigation. Please provide a brief description of additional site preparation that may be expected to be required if the FORA ESCA Sled were to be used as part of the investigation in the Future East Garrison MRA. Response: No additional site preparation is expected for use of the FORA ESCA Sled in the Future East Garrison MRA. Based on sled weight and design, past experience has shown that the FORA ESCA Sled can be effectively employed in brush as high as 6 inches above the ground surface; therefore, vegetation will be cut using the methods described in Section 2.3.1.4 of the work plan to within 6 inches or less of the ground surface in areas that are easily accessible and relatively flat, leaving the ground surface and root structure intact. These areas would typically include roads and trails provided a GPS signal lock can be achieved and open areas that have been more heavily used for military training, such as portions of the grids selected in the hand grenade training area and the demolition training area of MRS-11 (Grids 19 through 23). No changes have been incorporated into the report based on this comment.
4	Volume 2 – Sampling and Analysis Plan, p.2-13, Section 2.4.6 Soil Screening Operations	Comment: This section describes that, in the event that soil containing high density of small metallic debris or other sources that cause noise interference for the digital geophysical investigation is encountered, intrusive investigation would utilize soil excavation in 3-inch lifts and soil screening. Soil screening in habitat reserve areas will require preparation of a habitat restoration and monitoring plan to ensure the success criteria outlined in the Installation-wide Multispecies Habitat Management Plan (HMP) will be met. Please include this information in appropriate section(s) of the document. Response: The following text has been added to the end of Section 2.4.6: <i>“In habitat reserve parcels, excavated areas will be allowed to revegetate naturally. Soil screening will be implemented under this G4 SAP only if extensive metal debris is encountered that prevents a specific location from being cleared by “mag and dig” technique. It is anticipated that few, if any, of the areas to be investigated will contain extensive metal debris. If soil screening is implemented, it is not expected to exceed 10,000 square feet of area in any one location. The total area affected by soil disturbance in the Future East Garrison MRA is expected to be less than 1% of the total area of the MRA. Soil disturbance of areas equal to or less than 10,000 square</i>

Appendix I

Response to Comments

Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
		<i>feet is considered "de minimis" relative to the total area in the habitat parcel; furthermore, many of the areas being investigated are within or along already disturbed areas (i.e., trails or roads) that do not contain fully developed vegetation. An exception to this general statement is the known locations of sand gilia and Monterey spineflower within or alongside trails and roads, where appropriate mitigation measures (i.e., replacement of surface soil) will be implemented as discussed elsewhere in Section 12.3.5.3 of this G4 SAP. Given that these investigation areas are surrounded by unaffected robust vegetation, passive (i.e., natural) recruitment into them is expected to occur from adjacent plants.</i> <i>The information presented above satisfies the requirements of the HMP regarding monitoring and restoration. The Army's vegetation monitoring protocol specifically excludes trails and roads from shrub monitoring. Focus species (i.e., sand gilia and Monterey spineflower) areas that are disturbed will be monitored to confirm that the mitigation measures are implemented in the field."</i> Section 12.3.3 Post-Fieldwork Monitoring on Page 12-3 describes the activities for monitoring habitat restoration in consultation with the Fort Ord BRAC Wildlife Biologist.
5	Volume 2 – Sampling and Analysis Plan, p. 12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds	Comment: The second numbered paragraph. The listed requirement is based on the Site 39 habitat restoration plan. Please revise the first sentence to read "In habitat reserve parcels, excavated areas will" Response: The numbered paragraph has been revised as follows: 2. ~~Per the HMP, i~~In habitat reserve parcels, excavated areas will be allowed to revegetate naturally. If the excavation disturbs an area more than 1 acre and more than 100 feet in width, passive and active restoration with follow-up monitoring will be conducted.
6	Volume 2 – Sampling and Analysis Plan, p.12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive	Comment: The third numbered paragraph states that excavations that result in steep-sided depressions in vicinity of potential California tiger salamander breeding sites will be filled with soil. Please note that regrading is preferred, and that no fill soil is required. Response: The numbered paragraph has been revised as follows:

Response to Comments

Draft Final Group 4 Remedial Investigation / Feasibility Study Work Plan, dated August 11, 2010
Review Comments provided by Gail Youngblood of the Army, dated September 3, 2010

No.	Comment Type / Report Section	Comment/Response
	Weeds	3. ~~If excavations that result in steep-sided depressions without a gently sloping egress area that occur within 2 kilometers of a potential CTS breeding site, the edges of the excavations will be filled with soil to approximately match adjacent ground level to prevent trapping or breeding of CTS during the wet season.~~ <i>the edges of the excavations will be sloped</i>



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
FORT ORD OFFICE, ARMY BASE REALIGNMENT AND CLOSURE
P.O. BOX 5008, BUILDING #4463 GIGLING ROAD
MONTEREY, CALIFORNIA 93944-5008

OCT 29 2009

Base Realignment and Closure

Stan Cook
ESCA Remediation Program Manager
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Subject: *Draft Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area(MRA)*, dated October 9, 2009, received on October 12, 2009.

Dear Mr. Cook:

Thank you for an opportunity to review and comment on the subject document. The Army's comments are enclosed. Please note our comments are focused on "big picture" issues such as the consistency with documents previously produced under the Army's cleanup program. A copy of this letter will be furnished to U.S. Environmental Protection Agency (Judy Huang) and California Department of Toxic Substances Control (Roman Racca).

Sincerely,

Gail Youngblood
BRAC Environmental Coordinator
Fort Ord Field Office

Enclosure

DRAFT Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)

Dated October 9, 2009

Army Comments:

1. p.2-3, Section 2.2 Physical Setting. Third paragraph notes that the total acreage of the Future East Garrison MRA has been revised to reflect the final property transfer boundaries. The Army is pleased that the MRA boundary was updated to include all of the East Garrison property that was transferred to Fort Ord Reuse Authority (FORA) in connection with the Environmental Services Cooperative Agreement (ESCA). However, the report does not describe the designated future land use and habitat type (HMP category) for the additional acreage. Please update the text and/or figures to provide this information.
2. p.2-5, at the end of Section 2.2 Physical Setting. The fourth last sentence states "For habitat areas, these measures include conducting habitat monitoring in compliance with Chapter 3 of the HMP (USACE 1997b)." Because Chapter 3 of the HMP requires many more mitigation measures during environmental investigation and remediation activities within habitat reserve areas, we recommend inserting text ", but are not limited to" to read "...these measures include, but are not limited to, conducting habitat monitoring..."
3. p.4-1, Section 4.1 Summary of the Approach for Group 4. The first paragraph discusses that additional data collection is not necessary because the existing data are of sufficient quantity to characterize the Future East Garrison MRA. As described elsewhere in the document, the Army has conducted several munitions response investigations and removal actions within the Future East Garrison MRA, resulting in a significant quantity of data being available for the RI/FS evaluation. However, it should be noted that in previous investigations, a portion of the subject MRA directly adjacent to munitions response sites (MRSs) 48 and 19, where RI/FS evaluation has not been completed, was not readily accessible due to dense vegetation. Please include an evaluation of adjacent site conditions as part of the detailed analysis of the MRA in the RI/FS as it may provide additional relevant data.
4. p. 4-11, Section 4.9.3 Implementation of Community Relations Activities. The third last bullet indicates that public notices would be issued in local newspapers to announce the availability of RI-related documents and opportunities for public comment. Please note that, unlike the Proposed Plan, newspaper public notices of availability of RI/FS reports and associated work plans are not required under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the National Contingency Plan (NCP). The Army utilizes a variety of other methods to communicate with the public with regard to the development and review of these types of documents, as described in the current Community Relations Plan for the former Fort Ord. Without further clarification, a reader may erroneously conclude that similar notices would be provided by the Army on other Fort Ord RI/FSs that may be developed in the future. Please provide a clarification on this point or delete the text regarding public notices.



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105**

December 10, 2009

Mr. Stan Cook
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Re: EPA Comments on the Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, Future East Garrison Munitions Response Areas, Former Fort Ord, Monterey County, California, Dated October 9, 2009

Dear Stan:

Attached are EPA's comments on the *Draft Group 4 Remedial Investigation / Feasibility Study Work Plan, Future East Garrison Munitions Response Areas, Former Fort Ord, Monterey County, California*, dated October 9, 2009.

If you have any questions, please do not hesitate to call me at (415) 972-3681 or e-mail me at huang.judy@epa.gov.

Sincerely,

A handwritten signature in black ink, which appears to read "Judy C. Huang". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Judy C. Huang, P.E.
Remedial Project Manager

cc:

Roman Racca (DTSC)
Site Mitigation/Office of Military Facilities
8800 Cal Center Drive
Sacramento, CA 95826

Kristie Reimer, AICP
Principal Planner
BRAC / Federal Programs
LFR Inc.
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Ms. Gail Youngblood
Fort Ord Base Realignment and Closure Office
P.O. Box 5008
Monterey, CA 93944-5004

Mr. Thomas Hall (via E-mail)

**REVIEW OF THE DRAFT GROUP 4
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
FUTURE EAST GARRISON MUNITIONS RESPONSE AREAS
FORMER FORT ORD, CALIFORNIA
OCTOBER 9, 2009**

GENERAL COMMENTS

1. The Draft Group 4 Remedial Investigation/Feasibility Study Work Plan, Future East Garrison Munitions Response Area, Former Fort Ord, Monterey, California, dated October 9, 2009 (hereinafter referred to as the Draft Group 4 RI/FS WP), contains a number of questionable entries concerning munitions and explosives of concern (MEC) discovered on the MRS. Section 3.0, Initial Evaluation, notes in the last paragraph on page 3-1 that, "During the removal actions, two burial pits were encountered in MRS-42 EXP. The MEC found in the burial pits appeared to be related to troop training (M228 practice hand grenade fuzes and M117 explosive booby trap simulators). A total of 243 of the 336 MEC items were recovered from these burial pits." Common practice and logic indicates that it is very unlikely that all 243 of the items were unexploded ordnance (UXO), since the failure to function of 243 munitions items would be cause for a Department of Defense (DoD)-wide malfunction investigation of the munitions lots involved. Also, it is unlikely that supervisory personnel would agree with the collection and burial of 243 munitions items classed as UXO due to the potential hazards involved. It would, therefore, appear that all or a majority of the items discovered in the burial pits were most likely discarded military munitions (DMM) and not UXO.

However, the same section lists most or all of these items as UXO in the first bullet on page 3-2. This categorization is repeated in Appendix A, Future East Garrison MRA Conceptual Site Model, in Table 12.3-3, East Garrison MRA-Types of MEC Removed and Hazard Classification, where the same items are obviously listed as UXO, since there are no items classified as DMM found in the table. This table does, however, contain a nomenclature footnote explaining the reason for the apparent erroneous categorization of the MEC.

To avoid potential confusion as to the correct categories of the MEC items found in the cited burial pits, it would be advisable if a footnote or other explanatory text were provided at the initial mention of the buried MEC discovered in the two pits found on the MRS. Please make this correction at the noted locations and elsewhere in the Draft Group 4 RI/FS WP as deemed necessary.

SPECIFIC COMMENTS

1. **Glossary, Page vii:** The definition of Construction Support found here does not match that found in the Department of Defense Ammunition and Explosives Safety Standards (DoD 6055.09-STD). The correct definition is as follows:

Construction Support. Assistance provided by DoD explosive ordnance disposal (EOD) or UXO-qualified personnel and/or by personnel trained and qualified for operations involving CA, regardless of configuration, during intrusive construction activities on property known or suspected to contain UXO, other munitions that may

have experienced abnormal environments (e.g., DMM), munitions constituents in high enough concentrations to pose an explosive hazard, or CA, regardless of configuration, to ensure the safety of personnel or resources from any potential explosive or CA hazards.

In addition, the definition provided in the Glossary section of Volume 1 indicates that “qualified UXO personnel” may provide this support, which is not always the case. Care must be taken in the use of the terms “UXO Personnel,” “UXO Technicians,” “qualified UXO personnel,” and “UXO-Qualified Personnel,” as they are not necessarily interchangeable. In some instances, they appear to be used in a manner that may conflict with Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel). The following are the related definitions presented in that document:

- **UXO-Qualified Personnel:** Personnel who have performed successfully in military EOD positions, or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist or Senior UXO Supervisor.
- **UXO Technician:** Personnel who are qualified for and filling Department of Labor, Service Contract Act, Directory of Occupations, contractor positions of UXO Technician I, UXO Technician II, and UXO Technician III.

The term “UXO Sweep Personnel” is not formally defined, although the training and functions thereof are outlined in the DDESB Technical Paper 18. However, it is listed under the heading of “UXO Related Position Titles and Tasks” in that Technical Paper, as are the UXO Technician I, UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist and Senior UXO Supervisor. These positions are UXO personnel per the title of Technical Paper 18. The term “qualified UXO personnel” can mean any of these individuals that are qualified to perform their UXO-related functions (including UXO Technician I and UXO Sweep Personnel). However, the term “UXO-Qualified” does not include UXO Sweep Personnel or UXO Technician I by definition. Care must be exercised in the use of these terms to avoid the presentation of incorrect information by their misuse. This could result in individuals performing functions that they are not fully qualified to perform.

This issue is compounded by the use of the term “unexploded ordnance (UXO) personnel” in the definition of “Anomaly Avoidance” that is found in the Glossary. As this definition does not match that found in DoD 6055.09-STD, it should be replaced by the official definition, which does not use the term “unexploded ordnance (UXO) personnel.”

Please replace the noted definitions found in the Glossary Section with those found in the current version of DoD 6055.09-STD. Also, please review the use of the noted UXO Personnel terms in the remainder of the Draft GP 4 RI/FS WP and correct them as necessary to comply with the definitions found in DDESB Technical Paper 18.

2. **Section 3.0, Initial Evaluation, Page 3-2:** The first two paragraphs of this section on the cited page state that, “In total, the removal actions in the Future East Garrison MRA resulted in the removal of the following:

- 326 UXO items
- 10 Insufficient Data (ISD) items (material potentially presenting an explosive hazard [MPPEH] that could not be classified as UXO, DMM, or MD)
- 4,107 pounds of MD (includes MD [expended] and MD [fragmented] items if weights were documented)

According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury), 259 items had a hazard classification of 1 (MEC that will cause an injury or, in extreme cases, could cause major injury or death to an individual if functioned by an individual’s activities), one item had a hazard classification of 2 (MEC that will cause major injury or, in extreme cases, could cause death to an individual if functioned by an individual’s activities), and 74 items had a hazard classification of 3 (MEC that will kill an individual if detonated by an individual’s activities).”

There are some issues with the cited verbiage. These include:

- The 10 items categorized as “MPPEH” should not be classified as such if they are to be included in the 336 MEC items recovered, particularly since it is stated that they could be MD. If the intent is to state that these items were MEC of an undetermined category (see definition of MEC found in the Glossary section), then do not call them MPPEH. MEC by definition always presents an explosive hazard, not a potential one as MPPEH does by definition. List them as MEC items with insufficient data (ID) to place them in a subclass (i.e., UXO, DMM, or MC present in high enough concentrations to present an explosive hazard).
- The statement that, “According to the Fort Ord MMRP database, of the 336 MEC items, two items had a hazard classification of 0 (inert munitions item that will cause no injury),...” By definition, there is no such thing as inert MEC. MEC is explosive; therefore, it cannot be inert. This should be explained in the text or in a footnote, as is done in the previously cited Table 12.3-3 of Appendix A.

Please correct the cited text as noted.

3. **Appendix A, Future East Garrison MRA Conceptual Site Model, Page 12-19:** This CSM contains a Table 12.3-3, East Garrison MRA – Types of MEC Removed and Hazard Classification, which lists a “Flare, type unknown” as UXO and assigns a hazard class of 0 (zero). This cannot be correct, as an item classified as UXO cannot be inert by definition, and the hazard classification of 0 is reserved for inert items. Please review the cited table and correct the noted listing as necessary.

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SCB

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Response to:
Draft Group 4 Remedial Investigation/Feasibility Study Work Plan
FOR A ESCA Remediation Program, Former Fort Ord, Monterey County,
California

FOR THE ADMINISTRATIVE RECORD

December 11, 2009

Dear Mr. Cook and Ms. Youngblood,

The FOCAG has had the opportunity to read this work plan. With all due respect for what appears to be a large effort, the result, so far, is a rather pedantic exercise that is a rehash of selective older data. The rationale for dividing the Fort Ord Superfund Site into nine group areas, this report focusing on group 4, isn't clear. However, perhaps it has something to do with LFR's advertised "Wide Area Assessment Technology"? The area here is a stated 244 acres. It lies within the unincorporated area of Monterey County. We see no distribution of this document to the Monterey County Planning Department.

Data from previous site sampling from approximately the years 1996 to as late as the year 2000 (in some cases) is used as justification for your conclusion on page 5-1 that "...no additional field investigation activities are anticipated for the Future East Garrison MRA prior to conducting the RI/FS."

Old sampling, done with Schonstadt's, and some sample digging to respective depths of one foot and four feet, are apparently being considered adequate for anointing approximately 68 acres of the area as being ok for residential housing.

S

How dense this housing is to be, or the type of housing anticipated, is not disclosed.

The printed, anticipated project schedule, located at the back of this document is presumptuous for a "draft work plan". It's pre-determined, or, also known as reverse engineering.

Has the baseline risk assessment as required by CERCLA statute been completed for your Group 4 designated area?

How can an RI/FS process go forward without such essential information?

The areas of Group 4 are in the vicinity of the portion of Fort Ord first purchased by the Army in 1919. There is little information on training uses, and no maps at all are available that we are aware of, showing pre-1945 uses. Group 4 is just east of, and in proximity to listed Combat Ranges on a 1945 map we are including as an attachment.

We find the ordnance sampling done to be minimal, and used the sub-standard Schonstadt. There has been no investigation of deeply buried penetrating ordnance. Two burial pits are revealed as having been found in this draft work plan report. From my visits as a boy to former Fort Ord, when it was an active Army training base, burial pits were up to ten feet deep. Indeed they would often be dug about ten feet deep and the bulldozer would be left nearby, unmanned, until such time as the bulk of the most current training exercise was dumped or pushed into the burial pit, then it would be covered up and over with dirt. Some of these large burial pits I witnessed were about half filled, approximately five feet deep.

Regarding residual chemical contamination, aka, COC's Chemicals Of Concern:

Where is the risk assessment?

Of the approximately 200 potential constituents, what was looked for?

Where was it specifically looked for?

When was it looked for?

Who did the sampling?

The FOCAG is including, as an attachment, a copy of a letter from Dr. Gunnar Heuser dated May 9, 2002. It is as pertinent today as it was when he wrote it seven and a half years ago. He addresses:

Is Fort Ord Toxic?

Comments on Exposure Limits

Comments on Dose-Effect

Health Studies and Effects

Suggested Health Studies

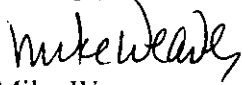
Conclusions

This Group 4 area is a proposed area to include residential housing based on the

Page 3

1997 Fort Ord Reuse Plan. The area contains dangerous former Army training ranges. The FOCAG is alarmed that a rehash of some previous sample data is being used as justification to go forward with a pre-determined schedule. We don't believe it to be a good plan. Community Support is an important part of the Superfund Clean Up Process. It is hard to find it here.

Sincerely,



Mike Weaver
Co-Chair, Fort Ord Community Advisory Group.
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c.c.

USEPA

DTSC

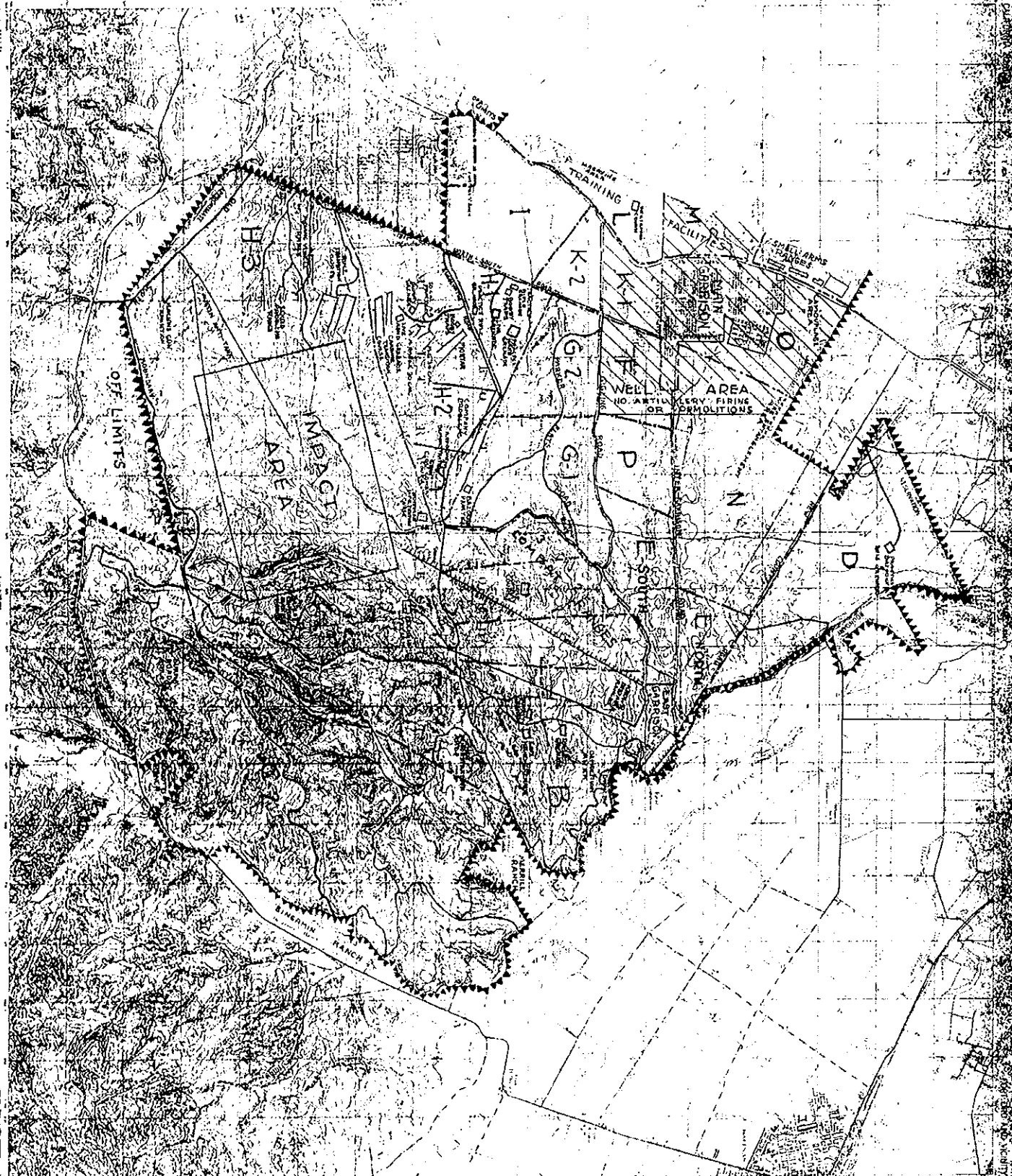
Federal, State, and County elected representatives with oversight of this National/State/County Superfund Site and its reuse.

Attachments:

1945 Fort Ord Training Facilities map

Letter from Dr. Gunnar Heuser regarding Fort Ord toxics, dated May 9, 2002 (23 pages)

ATTACHMENT 1



1945 MAP

Attachment 2

GUNNAR HEUSER, M.D., Ph.D., F.A.C.P., F.A.C.F.E., B.C.F.E.
NeuroMed and NeuroTox Associates
A Medical Group

Fellow, American College of Physicians
Fellow, American EEG Society

Diplomate (McGill University), Internal Medicine
Diplomate, American College of Forensic Examiners

NEUROTOXICOLOGY

IMMUNOTOXICOLOGY

May 9, 2002

RE: Review of the Army's Proposed Plan – Interim Action

To Whom It May Concern:

I was asked to function as a TA regarding health issues at Fort Ord. In preparation for my evaluation and for suggestions I reviewed more than twenty pounds of records, some of them consisting of the ones mentioned in the contract I signed on 5/4/02. Additional records were reviewed and are incorporated in my opinion.

I saw it as my first task to review reports which address the potential toxicity of materials above ground, in the ground, and in the water table below Fort Ord. Such an assessment would of course give one an idea as to whether or not Fort Ord is indeed toxic.

My second task was to assess the potential health effects of the toxicity and to comment on what if anything has been done to address these health effects.

I saw it as my third task to make suggestions as to how potential health effects can be addressed.

Is Fort Ord Toxic?

Multiple documents were reviewed and all show that potentially toxic chemicals have been and are still being found on Fort Ord grounds. It should be stressed that many of these potentially toxic compounds are known toxic metals. In addition, there is evidence that depleted uranium was used for training purposes. However, the extent of this use is not known at this time. Similarly, chemical warfare materials were found in the field on Fort Ord on the firing ranges.

Fort Ord was evaluated many times and in my opinion the toxicity present is well documented. It should be stressed that Fort Ord has been declared a Super Fund site by the EPA.

The Army suggested that the site be detoxified by burning the vegetation (mostly chaparral) and that ordnance be exploded. The Army contends that this type of cleanup would basically result in elimination of all potentially toxic compounds some of which would be evaporated into the air. The Army contends that it can direct the smoke high enough into the air to not bother local residents. The Army did not comment on the fact that smoke will pollute the air elsewhere if not locally.

The Army has looked at one single chemical compound or one single metal at a time and contends that they will not be generated in toxic amounts.

The Army did not consider the fact that a mix of toxic compounds can have unexpected health effects.

Comments on Exposure Limits

Regulatory agencies have suggested exposure limits for many potentially toxic chemicals.

It should be stressed that exposure limits apply to healthy adult males who are working an eight to twelve hour workday. Exposure limits are therefore not applicable to females, children, and nor to acutely or chronically ill individuals.

Exposure limits are suggestions only and not binding since even the regulatory agencies admit that some adult males are sensitive to exposure below the allowed limit.

None of the suggested exposure limits apply to mixes of chemicals. The problem of predicting the potentially toxic effects of mixes is addressed in a textbook which is referenced below.

It is quite accepted in the literature that mixes of chemicals can dramatically increase the toxic effects which one would have expected from just considering one chemical at a time.

Comments on Dose-Effect

A basic tenet of toxicology is the consideration of dose-effect. While there are exceptions, it is generally true that the higher the dose the more toxic a given compound can be.

It is often assumed that a chemical can have no toxic effects if it is present below the regulatory exposure limits. This is obviously not true if one considers females, children, and acutely or chronically ill adults.

If one considers the potential toxic effects of mixes, a given patient could become ill even if the individual compounds in a mix are present at levels which are less than the official exposure limit. In view of the above, a statement that the absence of toxic levels of a given chemical mix could not possibly be toxic to human beings is blatantly wrong.

In order to assess the dose-effect relationship, one also has to look at the effect. If the effect has all the hallmarks of toxicity, one must reach the conclusion that the dose was toxic.

Toxic exposure and it's effects can be shown to effect brain function, immune function, lung function, and many other body organs and systems.

I have enclosed a protocol paper of mine which suggests measurements needed to document toxic effects of chemicals.

It should be noted at this time that I am not aware of any studies done on human beings living or working near Fort Ord. While a newspaper article mentioned that students on the nearby campus reported ill effects, no documentation of these ill effects have to my knowledge been done.

I am also not aware of any epidemiological studies which would study nearby populations and possibly compare them with a non-exposed population.

In view of the above no statement can be made at this time as to what if any health effects resulted from exposure to toxic chemicals at Fort Ord.

Health Studies and Effects

After reviewing more than twenty pounds of documents, I had to conclude that no health study of any kind has been done by any representative of the Army or any other agency.

Studies of the health of the surrounding population, including the students at the college, have apparently been suggested many times, yet, none have been done. Worse, I am not aware of any planned studies of potential or real health effects in the surrounding population.

No health studies have been done right before and after a burn.

The incidence of cancer including leukemia in the nearby population has not been determined and compared with a control population, nor has the incidence of birth defects and miscarriages.

It is strange that no studies were done nor are they planned, apparently because the Army thinks that the toxic compounds are individually present in amounts too small to have any health effects.

Suggested Health Studies

Blood can be sampled and solvent panels can be done. These would tell us whether or not the students and nearby populations have unusual amounts of solvents in their blood.

A representative sample of the student population could be compared with a matched sample from the University of Santa Cruz students who live on campus. These could be matched by sex, age, and other criteria so that the two populations become as similar as at all possible.

The two student populations should also be examined by a knowledgeable physician and should fill in questionnaires regarding their health.

Rather simple and inexpensive tests are available to study brain function, immune function, pulmonary function, and others.

Brain function and pulmonary function can be measured on site with portable instrumentation. Blood samples can be taken on site and then sent to appropriate laboratories.

When the Army plans to burn and explode potentially toxic compounds at Fort Ord, a sample of the surrounding population could be examined in the above fashion before and after the burn and explosion.

An epidemiologist would ideally work with the physician in charge of the above evaluations.

An epidemiologist would definitely be needed to sample enough of the population so as to be able to conclude whether or not there are clusters of cancer, leukemia, and other

diseases in the nearby population. Populations would have to be compared with a controlled population elsewhere.

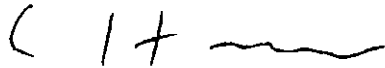
The evaluation outlined above could also benefit from studies already done in the Boston area at another toxic site.

Conclusions

Fort Ord is a toxic site which deserves to be a Super Fund site.

No health studies have been done at all. No individual evaluation of health effects have been documented nor any epidemiological study.

Epidemiological and health evaluations are mandatory. I will be glad to provide a detailed protocol.



Gunnar Heuser, M.D.

GH:cr

P.S. Statements and suggestions made in this report will be addressed in more detail and also be documented upon request.

DEFINING CHEMICAL INJURY: A DIAGNOSTIC PROTOCOL AND PROFILE OF CHEMICALLY INJURED CIVILIANS, INDUSTRIAL WORKERS AND GULF WAR VETERANS

G. Heuser, M.D., Ph.D., P. Axelrod, and S. Heuser, M.A.

Correspondence to: G. Heuser, M.D., Ph.D. 28240 W. Agoura Road, Suite #203, Agoura Hills, California 91301, Fax: (818) 865-8814, or P. Axelrod, 2601 N Street, No. 3, Sacramento, California 95816, (916) 441-4397.

INTRODUCTION

Chemical injury can cause severe, often disabling multi-system complaints which may persist for months and at times years after chemical exposure has ceased. Physicians who see chemically injured patients are frequently baffled when they face a patient with multiple complaints which do not fit into a known diagnostic disease category. Furthermore, regular laboratory tests (e.g. CBC, liver function tests, sedimentation rate, urinalysis) are often normal as is a cursory physical examination.

The diagnostic exploration of a chemically injured patient is a new field which is difficult for the inexperienced physician. Chemically injured patients often complain of impaired cognitive and memory functions, intermittent confusion and disorientation, changes in behavior and mood, word-finding problems, sleep disorders, decreased libido and potency. At times they complain of seizure-like events. They also often report recurrent flu-like symptoms, fatigue and exhaustion, malaise, headaches, and chronic pain. Skin rashes, gastrointestinal complaints, and other health effects may also be present. Different patients may react differently to a given chemical or group of chemicals.

Toxic effects cannot be objectively evaluated unless every involved system is studied with advanced and sophisticated methodology. Without benefit of that process, a chemically injured patient will be dismissed with a diagnosis of post-traumatic stress disorder, somatization disorder or other labels implying that "it's all in

their heads" [Davidoff, et al., 2000]. The largest patient population to have received such a diagnosis is that of the Persian Gulf War Veterans. As of the writing of this article, nine years after the armed conflict, several hundred thousand veterans still suffer from a host of symptoms called "Persian Gulf War Illness" which may in large part be due to chemical injury [Jamal, 1998; Everson et al., 1999].

The authors understand that war time in Iraq exposed people not only to chemicals but also to uranium 238, aka depleted uranium, electromagnetic radiation, experimental vaccines, pyridostigmine bromide, biological warfare agents, and diseases and parasites indigenous to the Middle East e.g. leishmaniasis and brucellosis. Any of these toxins and infectious agents, individually or in combination, may carry with it a host of health effects. The purpose of this paper is not to dismiss those impacts but rather to offer currently available diagnostic techniques which, if applied correctly, will help both patient and physician assess how a toxic environment alone may contribute to illness otherwise dismissed as psychosomatic.

In this paper we will guide the reader through a diagnostic protocol which the senior author has developed and used on thousands of his chemically injured patients. We propose tests and consultations (from experts in their respective fields) which from our experience and research are most helpful in documenting and at times the effects of toxic chemical exposure. In discussing our approach, we will take one organ system at a time, discuss and select

diagnostic tools and tests appropriate to the evaluation of a given system.

Single abnormalities in a single system can have many causes. Abnormalities in multiple systems can also have many etiologies. However, a careful differential diagnosis (using this suggested protocol) will arrive at a tenable diagnostic impression of chemical injury if multiple objective abnormalities are found and cannot be explained on any other basis. Thus, a diagnosis of chemical injury is arrived at in part by exclusion of other diseases which may have predated the toxic exposure in question.

In the experience of the authors there is no doubt that chemical exposure (solvents, pesticides, chemical weapons, others) occurred during the Gulf War. In this sense, Gulf War Veterans deserve the same careful evaluation which is indicated in patients who have been exposed to chemicals at home, at work, or elsewhere (e.g. commuting) here in the USA.

The protocol begins with an exhaustive case history, to be followed by a careful physical examination, laboratory tests, and specialty consultations. Patient and doctor should seek out consultants who display interest rather than indifference. Generally an enthusiastic, curious and interested consultant specialist will be a better member of the evaluation team and bring his or her methodology to bear when tackling the problem of diagnosing chemical injury.

The evaluation process ends with case definition and a better understanding of the patient's problems and needs. Most importantly, this process will lay the foundation for rational and compassionate treatment.

This paper does not address the experienced clinical toxicologist. Rather, it is meant to help the personal physician to follow a road map of investigation when facing a patient who presents with a history of chemical injury.

This paper is also meant to help the educated lay-person who has been chemically injured and is being told that nothing is wrong since nothing

abnormal can be found (on minimal testing only!).

In our experience, both the general physician and the educated patient need a guide to follow when trying to understand and evaluate a toxic situation. This paper is meant to function as such a guide.

The need for a road map is especially urgent since society is pressured by some of its segments to attach a psychiatric diagnosis to some patients and to then hospitalize them with that diagnosis.

HISTORY

The history as well as the physical examination are meant to guide the clinician into the process of a differential diagnosis in which certain conditions are tentatively accepted or rejected. Appropriate testing will then follow and rule in or out conditions and diseases in a given patient.

An individual and family history must be carefully obtained from the patient. Past and present conditions and diseases (incl. those of childhood and connected with occupation), as well as past and current occupational, incidental or accidental chemical exposures should be listed. Short-term memory loss is present in many patients and therefore at times makes them poor historians. Thus it is desirable to engage support from family members and significant others to participate in the history which may then be more correct and complete.

Patients should be encouraged to list what appear to be 'allergic' or 'sensitive' reactions to chemical substances which were previously not experienced as harmful. These include chemicals such as gasoline, fumes and perfumes, household cleaners and other chemicals in everyday use. Reactions to these chemicals may include skin rashes, hives, eye and throat irritations, sinus problems, nausea, dizziness, and flu-like symptoms. These may have developed during the initial chemical exposure but may also recur when a patient has become chemically sensitive and now reacts to

even low amounts of a given chemical or chemical mixture. This reaction to low level exposure is called Multiple Chemical Sensitivity (MCS) [Cullen, 1987]. If not carefully evaluated, MCS patients will easily be misdiagnosed as suffering from somatization disorder, post-traumatic stress disorder or other psychiatric labels.

Patients with a history of chemical injury may develop chronic fatigue [Behan, 1996; Bell et al, 1998; Buskila, 1999; Dunstan et al, 1995; Heuser, 1993; Tirelli, 1998] (incl. Chronic Fatigue Immune Dysfunction Syndrome (CFIDS), chronic pain (incl. headaches and fibromyalgia), intermittent dizziness and faintness (especially after prolonged standing), and other significant and at times disabling symptoms. A complete history should list all of the above and all additional problems the patient has.

Patients should also be asked to obtain all existing civilian and/or Department of Defense and Veteran Affairs medical records for review.

In the case of Persian Gulf or other veterans, special consideration should be given to wartime duties and experiences including known or suspected chemical exposures, number of sick bay calls in theater and out, number of times the veteran was ordered to don chemical protective gear, and number of unexplained sightings of dead animals or deceased humans.

PHYSICAL EXAMINATION

A chemically injured patient deserves a very careful physical and especially neurological examination.

The skin should be examined for rashes and scratch marks. Flushing (suggesting a mast cell disorder) should be noted if present during the physical examination. Submandibular lymph node swelling and parotid gland swelling should be noted.

Blood pressure should be examined for orthostatic hypotension, if possible after quiet standing for twenty to thirty minutes (while being attended by a competent observer).

A detailed comprehensive neurological exam should document balance and sway (often impaired), the rapidity and smoothness of rapidly alternating movements (often impaired), and coordination (also often impaired).

If abnormalities are suspected or actually found, the patient should be referred to a specialist for more objective tests.

CENTRAL NERVOUS SYSTEM

Neurotoxic chemicals can reach the brain via the blood following inhalation, ingestion, or through skin absorption. A different route of entry is via the nasal passages into the roof of the nose and then through the nerves in the cribriform plate into the olfactory bulb and beyond (e.g. limbic system, neuroendocrine system and others).

Every patient who complains of impaired cognitive, memory, and other central nervous system functions deserves a detailed neurological evaluation. So does the patient who complains of impaired balance, coordination, speech, and sensory and/or motor nerve function. Finally, a neurological evaluation is also indicated in patients who suffer from tremor, chronic headaches, chronic pain, and intermittent impairment of consciousness. It should be noted that some patients are unaware of their deficits. Therefore, every chemically injured patient deserves a comprehensive neurological and neuropsychological evaluation.

No single test, not even a neuropsychological evaluation, can tell the whole story. This is why one has to rely on history obtained from the patient and witnesses, record review, observation during office visits, a neurological examination, and evaluation of brain function with tests which are added to the neuropsychological evaluation. The choice of these additional tests (e.g. Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), evoked response studies) depends not only on the clinical indications but also on the availability of advanced technology and interested and knowledgeable expert physicians [Heuser, 1992].

Neurological and neuropsychological functions may fluctuate, making challenge tests desirable whenever possible. Trying to solve mathematical or other problems can constitute such a challenge.

Structural effect on the brain is assessed by Magnetic Resonance Imaging (MRI). In some cases (e.g. in suspected multiple sclerosis and brain and pituitary tumors) a more sensitive evaluation uses the MRI after injection of a contrast medium (e.g. gadolinium) which "lights up" the affected part of the brain.

Lesions resembling those seen in multiple sclerosis and vascular (ischemic) disease are often seen in patients after chemical injury.

MRI scanning of the brain should be done in every patient with neurological problems. MRI is preferable to Computed Tomography (CT) since an MRI sees soft tissue (e.g. brain) better than CT and also avoids exposure to radiation.

In our experience SPECT and/or PET are often abnormal while MRI is more often within normal limits. Certainly, functional impairment far exceeds structural impairment in chemically injured patients.

It is commonly assumed that brain function is symmetrically affected by chemical exposure. In our experience, this is not true. More often than not, abnormalities are asymmetrical in distribution [Heuser and Mena, 1998].

Function of the brain can be assessed by a variety of tests. The choice of these tests is often dictated by their availability in a given community and by VA, DOD or civilian insurance coverage.

A brief discussion of available functional tests follows:

A neuropsychological evaluation [Hartman, 1995] is mandatory in each patient after neurotoxic exposure. A competent neuropsychologist will also be able to test for malingering and for a psychiatric disorder. In addition he or she will be able to predict which areas of the brain are most

likely effected. This prediction can then be correlated with other function tests.

The EEG sees only activity of the cortical layers of the brain. Therefore, it is unable to detect abnormalities deep inside the brain. Recording time should be at least thirty minutes and may well have to extend to an hour or longer. Routinely, recording is done while the patient is alert, during spontaneous sleep, and before, during and after hyperventilation and photic stimulation. All these conditions and measures can bring out abnormalities which may not be seen during a resting EEG. While the tracing is subjectively "eyeballed" by the examiner, it is obtained over a considerable time interval and may therefore detect abnormalities which are not seen during other tests. A well executed EEG will give valuable information about left-right hemisphere differences, normal vs. abnormal frequencies, and episodic discharges (e.g. seizure activity). EEG abnormalities may be asymmetrical after chemical exposure which can cause slowing, dysrhythmia, and also occasionally seizure activity. Long-term effects were first described by Duffy et al. in 1979. If seizure activity is suspected, an EEG together with PET scanning is the optimal approach. The senior author has found hypermetabolism, raising the suggestion of seizure activity, in the deep subcortical (e.g. amygdala) areas of the brain after chemical exposure [Heuser, 1999; Heuser and Wu, 1999, 2000].

EEG, PET and also prolactin levels should be done as close (in time) as possible to an actual or suspected seizure. Prolactin levels have been described as being elevated shortly after a seizure [Bauer, 1996].

EEG studies during sleep are necessary if a sleep disorder (esp. sleep apnea) is suspected. This can occur after chemical exposure [Ulberg et al., 1997] and can cause elevation of blood pressure, chronic fatigue, headaches, and other symptoms.

A quantitative EEG (qEEG) analyses a short epoch of a given EEG tracing by computer. Very few investigators are properly trained in analyzing

a qEEG. Also, no published data are available after toxic exposure.

Evoked response studies measure the speed of electrical conduction of a given stimulus (e.g. a light flash or sound click or electrical stimulus) to the appropriate brain region. The resultant electrical activity in the target area of the brain builds itself into a wave form which has positive and negative peaks. These normally occur after a given number of milliseconds. Abnormalities can be seen after neurotoxic exposure when symmetrical or asymmetrical delay of peaks and change in wave forms can occur.

A different evoked response evaluation is the P300 study in which regularly occurring clicks are interrupted by a random click. The positive deviation of the curve - which normally occurs 300 milliseconds after the auditory click - then becomes a measure of central nervous system function. This is a well-studied response which is known to correlate with cognitive function. Dysfunction can be found after neurotoxic exposure [Morrow et al., 1992].

SPECT consists of inhalation and/or subsequent intravenous administration of a radioactive compound. As the compound circulates through the brain, the computer constructs a color image in which colors have been calibrated to represent varying blood flows (perfusion) through the region of interest. A typical finding after neurotoxic exposure may be hypoperfusion in the frontal, temporal and parietal areas of the brain, usually in an asymmetrical distribution [Heuser and Mena, 1998]. This finding in chemically injured patients is indicative of impaired blood flow and oxygen delivery to a given part of the brain. Hypoperfusion of the temporal lobes can be correlated with impairment of short-term memory which is known to be laid down in the temporal lobes. Of particular interest to Persian Gulf Veterans is the work of Dr. John Vento who found a high percentage of SPECT abnormalities amongst his memory and cognitively impaired Gulf War veteran population [Vento et al. 1997].

PET yields an additional measure of brain function. It provides color scale imaging of an

intravenously injected radioactive compound (commonly a glucose derivative). As the brain requires glucose for its activity, its accumulation in various parts of the brain is a measure of brain function. Decreased activity is often seen in the cortical areas while increased activity may be seen in the deep sub-cortical areas in chemically injured patients [Heuser, 1999; Heuser and Wu, 1999, 2000].

Magnetic Resonance Spectroscopy (MRS) is a procedure developed to display the presence of neurotransmitters in the brain [Ross et al., 1992]. This is an evolving specialty which has a lot of promise. Recently, yet unpublished definite abnormalities were described in Gulf War Veterans. [Haley et al., 2000]

Functional MRI (fMRI) is a research tool which does not require the administration of a radioactive compound. As yet, no data are available on the effects of neurotoxic exposure.

Prior to any functional testing, the patient should again be asked what drugs or other preparations he or she is on. Since they may affect the function tests, they should be discontinued if at all possible. Most investigators will be satisfied when a patient has not taken any nonessential drugs for one week. Ideally, the patient should be off all nonessential drugs for more than a month prior to any functional testing.

PERIPHERAL NERVOUS SYSTEM

Frequent complaints after neurotoxic exposure are numbness, tingling, burning and crawling sensations, weakness and pain.

The standard approach is to test peripheral nerve function by doing ElectroMyoGram (EMG) and nerve conduction studies. We have found however that Current Perception Threshold (CPT) studies constitute a more comprehensive approach. While the literature on the use of CPT after neurotoxic exposure is still sparse [Bleecker et al, 1997], CPT is well established as a test for peripheral sensory nerve function [Katims, 1998]. In our opinion, CPT is a more sensitive test of peripheral nerve function since it also examines

small (e.g. C) fibers which cannot be examined by nerve conduction velocity studies. The most recent CPT equipment employs a double blind approach and has therefore become increasingly objective.

Biopsy of the sural nerve may supply additional information.

AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system controls functions such as temperature, perspiration, vascular tone (including blood pressure), heart rate, smooth muscle tone (including intestinal and bladder) and others.

The hypothalamus (i.e. neuro-endocrine system) interacts with the autonomic nervous system. Both hypothalamic and autonomic nervous system functions can be impaired by chemicals.

Till table testing [Rowe and Calkins, 1998] is becoming a recognized test for assessment of autonomic nervous system function, especially in patients with CFIDS which often develops as a result of chemical injury.

EYES

An eye examination is recommended for every patient with a history of chemical injury.

Patients frequently complain of eye irritation after toxic chemical exposure. While this may simply be due to an inflammatory response to the irritating chemical, it can also be due to dryness.

Intermittently blurred vision is another frequent complaint which can be due to a dry eye syndrome. In our patient population, Sjogren's syndrome is very rare, while dry eye syndrome secondary to chemical exposure is frequent.

After studying (unpublished data) several hundred patients we have found that tear quantity and tear quality are impaired in more than one half of chemically injured patients.

Quality tears are produced by the goblet cells. Their quantity can be assessed by the Schirmer test, their quality by examining tear break-up time [Franck and Boge, 1993; Sommer et al., 1994; Bulbulia et al., 1995].

Goblet cell mucous secretions enhance tear quality by providing viscosity and eye lubrication independent of the lacrimal tear gland which provides tears for crying. Therefore, a patient can still cry copious tears even with a dry eye syndrome. It should be understood that in our experience (Sadun and Heuser, unpublished data) dry-eye syndrome may continue for years, may be life-long, and can best be relieved with the use of artificial tears. Chemically produced dry eye syndrome should not be confused with Sjogren's syndrome which also causes dry eyes and can be ruled out with appropriate tests [Bell et al., 1999; Manoussakis and Moutsopoulos, 1999; Rice, 1999].

A routine eye examination does not include a test for dry eye syndrome which therefore often goes undiagnosed. Typically, tear quantity is measured by the Schirmer test in which a filter paper is placed between the globe of the eye and the lower lid. A yellow liquid (fluorescein sodium and benoxinate hydrochloride ophthalmic solution) is dropped into the eye and its advance on the filter paper is measured after a five-minute interval. An advance of less than 10 millimeters indicates insufficient tear production.

Color vision is also often affected after chemical exposure. This however has to be tested by using the Lanthony D-15 [Mergler et al., 1987; Mergler, 1994] rather than the usual tests for color blindness.

Visual field defects, increased electric and sunlight sensitivity, accommodation inertia and other abnormalities have been described and other should therefore always be tested for.

EARS, NOSE, AND THROAT (ENT)

Patients frequently complain of intermittent nose bleeds, sore throats, dryness, change in sense of smell, congestion, intermittent cough, impairment

of voice (hoarseness), sinus problems, and other ENT symptoms. Vertigo and dizziness are also frequent complaints.

When complaints persist, a competent ENT evaluation is mandatory. Here again, some patients are unaware of their deficits. Thus, every patient should ideally be tested after toxic exposure. This will involve:

Inspection of the nasal mucosa which is often atrophic, brittle, dry, and shows a cobblestone pattern [Meggs et al., 1996].

A nasal smear, especially for eosinophils. These cells are typical of allergy and are not typically found after chemical exposure.

Biopsy of the mucosa of the middle turbinate. This will distinguish between a chemical and an allergic change. One change occasionally seen on nasal mucosal biopsy is the presence of squamous metaplasia. This is definitely not a sign of allergy but is a sign of chemical exposure. Patients with this finding deserve close follow-up since squamous metaplasia may potentially develop into cancer.

Videolaryngoscopy. This will examine vocal cord appearance and function. Both may be impaired from chemical exposure and/or reflux but also because of impaired function of the nerves supplying the vocal cords.

Platformography and other sophisticated tests to evaluate a patient for balance problems and vertigo.

ElectroNystagmoGram (ENG) and other specialized tests for evaluation of dizziness. Vestibular dysfunction was recently described [Roland et al., 2000] in Gulf War Syndrome.

CT scanning of the sinuses if sinusitis is suspected.

IgA content of saliva. One function of the inner lining of the nose, the throat, the lungs, the gut and the bladder is to defend the body against intruders. IgA (an immune antibody) is one of these defense mechanisms. A saliva specimen

is usually representative in the sense that IgA levels measured in the saliva may be assumed to be similar all the way through the mucosal system. Salivary IgA is often decreased after chemical exposure [Ewers et al., 1982]. This decrease may explain the low defense of a given individual against external intruders.

A saccharin test by which saccharin is placed inside the nose and beyond the middle turbinate. One then asks the patient when he or she first notices a sweet taste. The time elapsed between the placement of a small saccharin crystal and the sweet taste is an indicator of mucociliary function which is often impaired after chemical exposure [Andersen et al., 1974; Capellier et al., 1997; Schafer et al., 1999].

NASAL AND PULMONARY PASSAGES

Patients frequently complain of:

Shortness of breath and dyspnea on exertion which can be due to nasal congestion with a Reactive Upper Airway Dysfunction Syndrome (RUDS), Vocal Cord Dysfunction (VCD) with Reactive Laryngeal Dysfunction Syndrome (RLDS), and hyperreactive airways (incl. Reactive Airways Dysfunction Syndrome (RADS), and of course other conditions contributing to shortness of breath (e.g. anemia, heart disease, and others).

Cough (intermittent) which can also be due to RLDS, bronchitis, and asthma (including RADS) and other conditions. Here again a careful differential diagnosis is mandatory.

Pulmonary function may be impaired as a result of chemical exposure.

Hyperreactive airways with abnormalities suggestive of obstructive impairment are often found. The most sensitive indicator is the Forced Expiratory Flow (FEF) 25 -75% measurement which is part of a complete pulmonary function test. This measurement is often decreased after chemical irritant exposure and has the additional advantage of being generally independent of the

effort the patient makes. This indicator is of course only one measure of a necessary comprehensive pulmonary function test. A methacholine test will often help to diagnose hyperreactive airways.

Restrictive airways from impairment of the elasticity of the lungs leading to reduced ability to take a deep breath are also often found after chemical irritant exposure. Asbestosis is a disease which typically causes restrictive and also obstructive airways disease.

A chest x-ray will be part of the process of the differential diagnosis.

A CT scan of the lungs is indicated whenever restrictive disease is suspected.

In the 1980s a number of patients were described who had suffered from very short exposure to inhaled irritating chemicals and then developed an asthma-like condition for years thereafter. This has been termed RADS [Brooks et al., 1985; Brooks, 1995]. In some cases, RADS has been found to continue for more than ten years after short term exposure [Piirila et al., 1996].

When the upper nasal airways have become reactive from a previous chemical exposure, the term RUDS has been introduced [Meggs, 1994; Meggs et al., 1996].

When shortness of breath is caused by problems within the vocal cord area (vocal cord dysfunction), the term RLDS (Reactive Laryngeal Dysfunction Syndrome) applies. This term was introduced by the senior author [Heuser et al., 1998] to describe patients who have voice problems after an initial chemical irritant exposure and then continue, sometimes for years, to have voice problems whenever exposed to even small amounts of irritating chemicals. In addition, these patients may develop shortness of breath.

One of the functions of the lungs is exchange of oxygen. The resultant level of oxygen saturation in the blood can be measured by oximetry. This may be low when lung function is impaired (and also for other reasons). Therefore, oximetry is

routine in our office in all patients who have a history of toxic inhalation exposure.

GASTROINTESTINAL SYSTEM

Patients often have acid indigestion incl. GastroEsophageal Reflux Disease (GERD), irritable bowels incl. Irritable Bowel Syndrome (IBS), and food allergies. These conditions are frequently diagnosed but are not specific for chemical exposure.

Additional complaints include abdominal cramping, intermittent constipation and/or diarrhea, and also intermittent nausea and vomiting. Unfortunately, a given toxic chemical leaves no diagnostic signature in the gastrointestinal system. Therefore all the above complaints are usually considered as nonspecific. Nevertheless, the term Reactive Intestinal Dysfunction Syndrome (RIDS) has recently been introduced [Lieberman and Craven, 1998].

Malabsorption with weight loss may occur in some patients after chemical exposure. In this context, patients should be evaluated for non-tropical sprue [Murray, 1999].

Liver function tests should always be done on every patient who gives a history of past or ongoing chemical exposure. Here again, toxic chemicals do not usually leave a signature which is diagnostic of chemical exposure.

Low salivary IgA levels may be representative of an impaired mucosal intestinal defense mechanism after chemical exposure.

KIDNEYS AND URINARY SYSTEM

After chemical exposure patients often complain of urinary frequency and urinary discoloration. The former is not usually due to diabetes insipidus nor urinary infection and therefore remains unexplained at this time in these patients.

Chemicals can cause hematuria, often microscopic [Gun et al., 1998]. Kidney function can be affected after chemical exposure [Lauwerys and Bernard, 1987; Mutti et al. 1992;

Fowler, 1993; Hook and Goldstein, 1993) which in the extreme can cause kidney failure.

Creatinine clearance and twenty-four hour urine collections for protein (incl. globulin fractions) may become necessary to follow patients with significant impairment.

SKIN

Recurrent rashes (with or without itching), hives, welts, "blood blisters" and other skin changes (incl. visible flushing) are frequent complaints after chemical exposure and can continue for a long time after exposure has ceased.

Here again, inspection reveals no signature which would be specific for toxic exposure.

Many of our patients carry a diagnosis of rosacea. This is usually considered to be of unknown origin. If chemically induced or aggravated rosacea indeed exists it has no distinguishing characteristics from a diagnostic point of view.

Also of note is in our observation that chemical exposure of the skin appears to at times accelerate sun induced ageing of the exposed skin.

In addition to inspection our consulting dermatologists will also obtain a skin biopsy in unaffected areas. This frequently shows perivascular dermatitis and the presence of mast cells. The latter may be indicative of a mast cell disorder which can develop after chemical exposure and then explain allergies, sensitivities to chemicals, sun light and ultraviolet light, and other reactions (incl. flushing) which may all be found in our patient group [Heuser and Kent, 1996; Heuser, 2000].

Contact and other dermatitis should be evaluated with appropriate tests [Marks and DeLeo, 1997; O'Malley, 1997]. Dermal uptake of solvents was studied by Brooke et al. (1998) and others.

Very sophisticated dermatopathological changes after exposure were described by Prof.

Johansson's group [Gangi and Johansson, 1997; Liang et al, 1998; Rossi and Johansson, 1998].

IMMUNE FUNCTION

Sensitivity to allergens (incl. foods) and/or chemicals (incl. drugs) is a frequent complaint in our patient population. This can be further analyzed with appropriate tests. However, changes in immune function are often not clearly related to specific symptoms and signs and yet may be so profound that they should always be tested for.

When patients develop allergies after chemical exposure these should be evaluated by an allergist with skin testing and other appropriate tests.

We routinely order total IgE and check for eosinophils. If elevated in blood (IgE, eosinophils) and nasal smears and/or biopsy specimens (eosinophils), a diagnosis of allergy is justified.

The immune system consists of many cells which can be counted in a blood sample. Function of these cells (e.g. mitogenesis, natural killer cell function) can be tested only in specialized laboratories.

A rapid increase in TA1 (CD3+, CD26+) and T3 positive (CD3) cells can be a very sensitive indicator of chemical exposure. While increased TA1 cells can be seen in auto-immune disease (e.g. multiple sclerosis), they more frequently show a temporary increase after exposure, particularly if the patient is sensitive to chemicals [Heuser et al., 1992].

It should be stated at this time that different organ systems can have a different sensitivity to chemical exposure. For instance, the immune system may react much more than the brain and other organs (or vice versa).

Among immune function tests the test for natural killer cell function is particularly important. This function is measured by bringing live natural killer cells in contact with live human leukemia cells.

Normally aggressive natural killer cells will attach to these leukemia cells and dissolve them. The result is expressed in lytic units and often shows impairment of this function after chemical exposure. Long-term impairment increases cancer risk. This is why we routinely test for killer cell function. If impairment is found, it may be corrected with vitamin C [Heuser and Vojdani, 1997].

The immune system also releases certain cytokines and other factors which may become indicators of chemical exposure. In our experience and that of others [Blackwell, 1999; Luster et al., 1999; Scheumann and Tiegs, 1999] this is true of Tumor Necrosis Factor (TNF-alpha) which is elevated in many of our patients after toxic exposure.

When chemicals attach themselves to some of the body's proteins, the immune response may become confused and become an autoimmune response. This is frequently found after immunotoxic exposure [Bigazzi, 1997; Rich, 1996]. A positive ANA titer, positive rheumatoid factor, and positive tissue (e.g. thyroid, myelin, smooth muscle, parietal cells, and others) antibodies are examples of that response [Gard and Heuser, 1990; Heuser et al., 1992]. It is important to realize that auto-antibodies may appear after chemical exposure but may go away once the exposure has ceased (Heuser, unpublished data).

Interestingly, full-blown autoimmune disease (e.g. Systemic Lupus Erythematosus and Multiple Sclerosis) is rarely found in our patients after chemical exposure which however seems to push patients in the direction of such diseases.

After chemical exposure, gamma globulins may be low. This is why we often obtain IgG subclasses. If abnormal, the patient may benefit from i.v. gamma globulin infusions.

Typically the sedimentation rate (ESR) is normal or even low normal after chemical exposure unless infections or autoimmune disease are the result.

Antibodies to certain chemicals can also be looked for and may, if positive, constitute a lead as to what exposure has caused the immune system to react [Thrasher et al., 1987].

In our opinion, immune system testing and testing for auto-immunity should be routine in all patients after toxic exposure.

ENDOCRINE SYSTEM

Chemical exposure can cause significant, at times disabling, chronic fatigue. While these patients usually end up with a diagnosis of CFIDS, one should nevertheless consider other causes of chronic fatigue. In this context, hypothyroidism has to be ruled out with appropriate tests (e.g. TSH, thyroid antibodies) which may have to be repeated.

While hypothyroidism seems to be a relatively frequent occurrence after chemical exposure, adrenal insufficiency is rare. However, we have seen cases of chemical sensitivity which could in retrospect be explained on the basis of a well documented adrenal insufficiency. When this was adequately treated, the chemical sensitivity disappeared. An early morning cortisol level is a good screening test, so is a twenty-four hour urine collection for this compound. More detailed testing and consultations by endocrinologists will be necessary, particularly if the patient complains not only of severe fatigue and exhaustion and weakness but also allergies, nausea and headaches.

Women often complain of loss of sex drive and of irregular menstrual bleeding. The latter can sometimes be explained by the estrogen-like effects of many chemicals (solvents, pesticides) [Colborn et al., 1997; Barnard and Heuser, 1998].

DeHydro-Epi-Androsterone (DHEA) levels are frequently low in patients who suffer from chronic fatigue. This often responds to appropriate replacement therapy.

Men frequently complain of loss of libido and potency.

The most striking finding in our male population is a high percentage of abnormal shapes on examination of sperm in the ejaculate. Abnormal morphology is a more frequent finding than a low sperm count [Heuser and Marik, 1998]. A number of authors have addressed changes in sperm in this context [Auger et al., 1995; Bujan, 1998; Indulski and Sitarek, 1997; Tielemans et al., 1999; Var. authors, 1995].

Prolactin levels may be increased shortly after a seizure [Bauer, 1996]. They may also be chronically increased in some patients with pituitary tumors and hypothyroidism.

Most endocrine glands are governed by the pituitary master gland. This in turn depends on the hypothalamus for its function. The hypothalamus has connections to all other parts of the brain and therefore is subject to impaired function after neurotoxic exposure.

Nasal pathways transport a neurotoxic stimulus and/or chemical into the olfactory bulb and then on to the limbic system and hypothalamus resulting in neuroendocrine problems after neurotoxic exposure.

REGULAR LABORATORY STUDIES

An astute clinician will carefully select tests needed to go through a differential diagnosis of a patient's complaints. Of particular importance are conditions and diseases which can cause multi-system complaints similar to those of toxically exposed patients.

Some infections occur independent of toxic exposure (e.g. Lyme disease, HIV and others). Others (e.g. viral, fungal) have been postulated to be the result of chemical exposure as have mycoplasma infections [Baseman and Tully, 1997; Vojdani et al, 1998].

Anemia, diabetes mellitus, hepatitis, and other conditions can cause chronic fatigue.

Vitamin B12 deficiency can cause neurological problems.

While porphyria is very rare in our patient population, abnormalities of porphyrin metabolism [Downey, 1999] are relatively frequent but usually not severe enough to explain symptoms. A study of porphyrin metabolism is in our opinion more meaningful if it is done more than once and is timed in relation to exposure.

The above are just a few of the conditions and diseases which have to be considered and ruled out in order to arrive at a correct diagnosis. A comprehensive laboratory evaluation is a necessary part of the differential diagnosis and therefore mandatory in our patient population.

Laboratory technicians should be advised of possible allergic responses to alcohol, band-aid tape, metallic and/or rubbers materials employed in blood drawing and other techniques.

TOXICOLOGICAL CONSIDERATIONS

Route of entry. Chemicals can be absorbed by inhalation, swallowing, and via the skin. It should be stressed that chemicals can irritate and/or enter the brain via the intranasal route to the olfactory bulb and on to other structures including the limbic system and the hypothalamus.

Dose-response. Most pure toxicologists stress the dose while we, as clinicians, stress the response part of the dose-response curve. Regulatory agencies (e.g. OSHA) suggest certain limits of exposure. These limits apply to healthy adult males who work an average eight-hour day for five days a week. They do not apply to females, children, the elderly, and any already impaired individuals. Nor do they apply to individuals who spend most of their days and all night at home where they might be exposed.

In view of the above, a low dose (even below government suggested limits) exposure can cause significant health affects in some people.

When there is ongoing toxic chemical exposure, blood, urine or fat tissue measurements of suspected chemicals or their metabolites are in order. Once time has passed, these measurements may lose their significance.

Certainly, long term disabling conditions can develop and continue after the triggering chemical has long disappeared from body fluids and tissues.

Chemical sensitivity (incl. MCS) and intolerance are defined as a recurrent temporary impairment of function after exposure to a low concentration of chemicals (so low that it does not effect the normal population).

Sensitization and kindling. Some chemicals are known sensitizers and thus become damaging in even very small doses. Neurophysiological research has shown that pain pathways can be sensitized [Willis and Westlund, 1997]. As a result, a patient can perceive pain even when the stimulus is very small.

Kindling [Bell et al. 1997] refers to the fact that repeated stimulation with subthreshold electrical current can eventually bring about a seizure disorder in animal models. Certain chemicals can result in similar effects when repeatedly administered into the extended amygdala region of experimental animals in subthreshold doses [Albertson et al., 1985; Gilbert, 1995]. Our PET findings may support a kindling mechanism [Heuser and Wu, 1999, 2000] and also explain the emotional changes found in patients after chemical injury [Aggleton, 1992]. Considering these findings, one should be much more careful to diagnose functional disorders [Barsky and Borus, 1999] in chemically injured patients. Furthermore, cytokines are released after chemical exposure and may in turn cause behavior changes [Anisman and Merali, 1999].

The above are but a few examples of the fact that low dose exposure can cause significant health effects in some patients. These patients deserve the full protocol even if the dose has remained ill defined or was considered to be too low to have caused health effects.

Chemical injury versus chemical sensitivity. In our experience almost all patients who claim MCS have objective evidence of chemical injury in one or more organ systems. This is why our protocol will usually detect objective abnormalities in these patients.

Chemical injury is defined as a long lasting impairment of a given function during and/or after toxic exposure.

While MCS needs to be documented by using challenge tests, evidence of chemical injury is almost always present in these patients and can therefore be documented at any time by using the protocol developed by the senior author.

Chemical mixtures. In real life situations most patients are exposed to mixtures of chemicals rather than a single chemical. In this case guidelines given by OSHA, NIOSH and other agencies may not apply since interaction between chemicals in the chemical mixture may have unexpected or exaggerated effects [Feldman et al.; 1999, Pollak, 1993; Yang 1994].

CONCLUSIONS

Patients who have suffered a chemical insult may develop long-lasting, at times disabling conditions. If the examination is limited and cursory, a chemically injured patient will be mislabeled as suffering from a somatization disorder, conversion reaction, psychosomatic or psychiatric illness. This then is a tragic mistake and misdiagnosis.

Frequently, patients with a history of toxic exposure and continuing symptoms develop multi-system impairment. It is the resulting constellation of symptoms and impairment which in the opinion of the senior author is typical of toxic exposure (incl. Persian Gulf War Illness).

A diagnosis of toxic chemical injury can be made if:

Impairment developed during or after toxic exposure(s).

A typical constellation of multi-system impairment is established with objective tests. Rarely (e.g. in RADS) only one system is effected.

Other diseases and conditions which are known to cause multi-system impairment have been ruled out.

The protocol presented in this paper, using a comprehensive evaluation, will prove or disprove, with objective and recognized tests, the presence of physical injury after toxic chemical exposure.

SUMMARY

In this paper a comprehensive protocol for the clinical evaluation of a chemically injured patient is described.

It is noted that an in depth evaluation often shows objective evidence of physical injury while a limited cursory examination may not.

It is stressed that exposure to toxic chemicals can cause severe functional impairment in many organ systems while the organ structure may remain intact. This impairment may continue for months or years after exposure has ceased.

ACKNOWLEDGMENTS

We acknowledge all patients (incl. Persian Gulf War Veterans) whose illness has contributed to the writing of this paper.

We also acknowledge Dr. O. Aguilera and Dr. Heuser's devoted office staff: Carol Rogowski, Karen Amoun, and Diane Rodelander.

Finally, we thank Air Force Reserve Captain Jerry Kromrey of the State of California Reserve Officers Association, Committee on Persian Gulf War Illness, for his unfailing encouragement.

ABBREVIATIONS

ALS	Amyotrophic Lateral Sclerosis
ANA	Anti-Nuclear Antibody
CBC	Complete Blood Count
CFIDS	Chronic Fatigue Immune Dysfunction Syndrome
CPT	Current Perception Threshold
CT	Computed Tomography
DHEA	DeHydro-Epi-Androsterone
EEG	ElectroEncephaloGram
EKG	ElectroKardioGram
EMG	ElectroMyoGram
ENG	ElectroNystagmoGram
ENT	Ears, Nose, Throat

EEG	Quantitative ElectroEncephaloGram
FSH	Follicle Stimulating Hormone
GERD	GastroEsophageal Reflux Disease
IBS	Irritable Bowel Syndrome
IgA	Immunoglobulin A
LH	Luteinizing Hormone
MCS	Multiple Chemical Sensitivity
MRI	Magnetic Resonance Imaging
fMRI	Functional Magnetic Resonance Imaging
MRS	Magnetic Resonance Spectroscopy
MS	Multiple Sclerosis
OSHA	Occupational Safety and Health Administration
PET	Positron Emission Tomography
RADS	Reactive Airways Dysfunction Syndrome
RIDS	Reactive Intestinal Dysfunction Syndrome
RLDS	Reactive Laryngeal Dysfunction Syndrome
RUDS	Reactive Upper airway Dysfunction Syndrome
SLE	Systemic Lupus Erythematosus
SPECT	Single Photon Emission Computed Tomography
TNF	Tumor Necrosis Factor
TSH	Thyroid Stimulating Hormone
VCD	Vocal Cord Dysfunction

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ABOUT THE AUTHORS

Dr. Heuser practices clinical toxicology. He has seen thousands of patients after toxic chemical exposure and over time developed and used a diagnostic protocol which objectively documents chemical injury and impairment.

Heuser has published many peer reviewed articles, contributed book chapters, and has been internationally recognized in his field. He has been invited to present his diagnostic protocol in Australia, before the German government (Bundestag) in Bonn, at the Karolinska Institute in Stockholm (Sweden), and before the Annual Conference of the National Gulf War Resource Center.

Patricia Axelrod directs The Desert Storm Think Tank and Veterans Advocate which is an ad-hoc association of active duty, reserve and retired soldiers, scientists, and researchers working together to assess the impacts and consequences of war in general with a specific emphasis on The Persian Gulf War. Axelrod's work has assisted in American, German and United Kingdom governmental investigation and reform. Her work has received a Project Censored Award from the Sonoma State University, Sonoma, California. She is also the recipient of a 1990-91 John D. and Catherine T. MacArthur Foundation Research and Writing Grant which helped seed The Desert Storm Think Tank. Her 1993 ground breaking article, "Research Guide for Desert Storm Syndrome (International Perspectives in Public Health Vol. 10, 1994) has been entered into the records of a number of U.S. funded committees for the investigation of Persian Gulf War illness, including those conducted by Senator Donald Reagle, the National Institutes of Health, and the Presidential Advisory and Oversight Committees. In preparation for this article Axelrod traveled to and from post-war Baghdad, Iraq. In addition she has interviewed and debriefed hundreds of Persian Gulf Veterans.

Both Heuser and Axelrod are founding members of the State of California, Reserve Officer Association committee on Persian Gulf War Illness.

Sylvia Heuser is president of EMRIC (Environmental Medical Research and Information Center) which is based in Dr. Heuser's office and supports all his research and writing projects with ideas, literature search, and review of patient files.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
FORT ORD OFFICE, ARMY BASE REALIGNMENT AND CLOSURE
P.O. BOX 5008, BUILDING # 103 GIGLING ROAD
MONTEREY, CALIFORNIA 93944-5008

SC
LB



Fort Ord BRAC Field Office

Stan Cook
ESCA Remediation Program Manager
Fort Ord Reuse Authority
100 12th Street, Building 2880
Marina, CA 93933

Subject: *Draft Final Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)*, dated August 11, 2010.

Dear Mr. Cook:

Thank you for an opportunity to review and comment on the subject document. The Army's comments are enclosed. Please note our comments are focused on "big picture" issues such as the consistency with documents previously produced under the Army's cleanup program. A copy of this letter will be furnished to U.S. Environmental Protection Agency (Judy Huang) and California Department of Toxic Substances Control (Roman Racca).

Sincerely,

Gail Youngblood
BRAC Environmental Coordinator

Enclosure

9

DRAFT FINAL Group 4 Remedial Investigation/Feasibility Study (RI/FS) Work Plan, Future East Garrison Munitions Response Area (MRA)

Dated August 11, 2010

Army Comments:

Volume 2 – Sampling and Analysis Plan

1. P.2-3, Section 2.2.1 Future East Garrison MRA Remedial Investigation Areas. Rationale for selecting Grids 1 and 2 for investigation. The text suggests that these grids were located to the south of an area identified by the Army as a potential practice mortar range. However, no such area was previously identified in the suggested location. A suspected stokes mortar range was identified “to the east of MRS-42” and “between Barloy Canyon Road and Crescent Bluff Road” in *Final Site Assessment East Garrison Area 4 Site Report* (Administrative Record number: OE-0556J) based on the finding of expended MKI practice Stokes trench mortars (munitions debris [MD]). Therefore, it is suggested to replace text “to the south of” with “in the vicinity of” to avoid potential confusion.
2. p.2-8, Section 2.3.2 Analog Investigation. The fourth paragraph includes a sentence “MD will be collected and an estimated weight of material per grid will be recorded by the UXO Technicians.” The statement is followed by paragraphs that provide for collection of additional data on MD that may be recovered during intrusive investigation. The text is currently unclear as to what information will be recorded for recovered MD. Please clarify.
3. p.2-11, Section 2.4.2 DGM Surveys. In this section, the use of EM61-MK2 mounted on FORA ESCA Sled is proposed as the instrument of choice in the event that digital geophysical investigation is desired in a portion of the investigation areas. Previous uses of the FORA ESCA Sled in other MRAs within the ESCA required extensive site preparation, such as vegetation removal to the extent beyond what would be typically conducted to support analog investigation. Please provide a brief description of additional site preparation that may be expected to be required if the FORA ESCA Sled were to be used as part of the investigation in the Future East Garrison MRA.
4. p.2-13, Section 2.4.6 Soil Screening Operations. This section describes that, in the event that soil containing high density of small metallic debris or other sources that cause noise interference for the digital geophysical investigation is encountered, intrusive investigation would utilize soil excavation in 3-inch lifts and soil screening. Soil screening in habitat reserve areas will require preparation of a habitat restoration and monitoring plan to ensure the success criteria outlined in the Installation-wide Multispecies Habitat Management Plan (HMP) will be met. Please include this information in appropriate section(s) of the document.
5. p. 12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds. The second numbered paragraph. The listed requirement is based on the Site 39 habitat restoration plan. Please revise the first sentence to read “In habitat reserve parcels, excavated areas will....”
6. P.12-5, Section 12.3.5.3 Site Restoration and Monitoring for Invasive Weeds. The third numbered paragraph states that excavations that result in steep-sided depressions in vicinity of potential California tiger salamander breeding sites will be filled with soil. Please note that regrading is preferred, and that no fill soil is required.

APPENDIX J

Distribution List

Print	CD	Name	Organization	Address	City and State	Zip
1	1	Stan Cook	Fort Ord Reuse Authority	100 12 th Street, Bldg. 2880	Marina, CA	93933
1	1	Michael Houlemard	Fort Ord Reuse Authority	100 12 th Street, Bldg. 2880	Marina, CA	93933
1	1	Judy Huang	U.S. Environmental Protection Agency	75 Hawthorne Street, Mail SFD-8-3	San Francisco, CA	94105
1	1	Tom Hall	TechLaw, Inc.	7 Shore Point Road	North Little Rock, AR	72116
1	1	Roman Racca	California Department of Toxic Substances Control	8800 California Center Drive	Sacramento, CA	95826
2	2	Gail Youngblood	Department of the Army	BRAC, Bldg. #4463 Gigling Road	Seaside, CA	93955
1	1	Lindsay Alexander	Fort Ord Administrative Record	BRAC, Bldg. #4463 Gigling Road	Seaside, CA	93955
1	1	LeVonne Stone	Fort Ord Environmental Justice Network	P.O. Box 361	Marina, CA	93933
1	1	Mike Weaver	Fort Ord Community Advisory Group	52 Corral de Tierra Road	Salinas, CA	93908
1	1	Richard Bailey	Fort Ord Community Advisory Group	440 Ramona Avenue, Apt 16	Monterey, CA	93940
1	1	Nancy Amadeo	Marina in Motion	P.O. Box 1641	Marina, CA	93933
1	1	Linda Millerick	Save Our Air Resources (SOAR)	751 Monterey - Salinas Highway	Salinas, CA	93908
1	1	Nick Nichols	Monterey County, Resources Management Agency Office of Housing & Redevelopment	168 West Alisal Street, Third Floor	Salinas, CA	93901
1	1	Project File	LFR Inc. Attention: Jennifer Johnson	1900 Powell Street, 12 th Floor	Emeryville, CA	94608
1	1	Project Library	LFR / Weston Project Office	100 12 th Street, Bldg. 2903	Marina, CA	93933

Approved:



Christopher G. Spill, P.G.
ESCA Technical Project Manager
LFR Inc.